DOCUMENT RESUME

ED 059 146 SP 005 121

AUTHOR	Wright, William R., Ed.
TITLE	The Wabash Valley Education Center, Final Report.
INSTITUTION	Wabash Valley Education Center, West Lafayette, Ind.
SPONS AGENCY	Bureau of Elementary and Secondary Education (DHEW/OE), Washington, D.C.
REPORT NO	OE-Proj-67-03337-1
PUB DATE	[70]
NOTE	446p.; An ESEA Title III project
EDRS PRICE	MF-$0.65 HC-$16.45
DESCRIPTORS	*Curriculum Development; *Curriculum Study Centers; *Demonstration Centers; *Inservice Teacher Education; *Resource Centers; Resource Materials

ABSTRACT

The Wabash Valley Education Center serves a 13-county area in north-central and northwest Indiana. The Center has two goals: 1) to assist local school systems in devising and developing curricular innovations and aiding in the development of teaching procedures and teaching materials and 2) to serve as a demonstration center. Two main services are offered 1) specialists in several fields work with individual teachers and schools in the region to improve various content areas and 2) a wide variety of materials and resources are available for loan to teachers and schools. The detailed information provided in the document includes 1) meetings, conferences, and workshops funded by the administrative budget 1967-1970; 2) report of special studies commissioned by the Center; 3) a survey to determine the over-all impact of the Center 1967-1970; 4) inservice program planning and implementation; 5) instructional materials center; 6) language arts project; 7) special education project; 8) secondary science project; 9) social studies program; and 10) elementary science project. (MBM)

ED 059146

FINAL REPORT FOR

PROJECT NUMBER 67-03337-1

Under Title III, P.L. 89-10

The Wabash Valley Education Center

WABASH VALLEY EDUCATION CENTER
University Square
500 By Pass 52 West
West Lafayette, Indiana 47906
317-463-1589

Serving 30 School Corporations within a
Twelve-County Area of West-Central Indiana

Director: William Floyd

P005121

ACKNOWLEDGEMENTS

Completion of this report would not have been possible without the cooperation, diligent efforts and hard work of the professional staff members of the Center. Various staff members were responsible for writing and putting together the respective sections of the report. Credit should be given where credit is due. Thus, the following recognitions are given:

Instructional Material Center Report - Constance Hayman and Charles Bryan

Elementary Science Project Report - Howard Poole, Camille Cardoza, Lola Washburn and Kristin Grigsby

Secondary Science Report - Lowell Knoop

Language Arts Report - William Floyd

Social Studies Report - Emma Lou Gist

Special Education Report - James Taylor and Doris Housh

Inservice Program Planning and Implementation Section Report - William R. Wright and Harry O. Leader

Special Reports - William R. Wright and Harry O. Leader

Special recognition goes to that group of people who are often missed when recognition and praise are given - the secretaries and typists. Thus, to Barbara Brown, Sue Harner and Judy Brookbank goes a special word of thanks for their skillful translation of some very rough copy of the report into a readable one.

William R. Wright
Final Report Editor

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PART I

ESEA TITLE III
STATISTICAL DATA AND FORMS
(OE 4381 - 4382)

OE 4381 (REV 2/67)

DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
OFFICE OF EDUCATION
WASHINGTON D.C. 20202

BUDGET BUREAU NO. 51-R600
APPROVAL EXPIRES 6/30/68

ESEA TITLE III STATISTICAL DATA

Elementary and Secondary Education Act of 1965 (P.L. 89-10)

THIS SPACE FOR U.S.O.E. USE ONLY →	PROJECT NUMBER	VENDOR CODE	COUNTY CODE	REGION CODE	STATE ALLOTMENT

SECTION A - PROJECT INFORMATION

1. REASON FOR SUBMISSION OF THIS FORM *(Check one)*
   - A [ ] INITIAL APPLICATION FOR TITLE III GRANT
   - B [ ] RESUBMISSION
   - C [ ] APPLICATION FOR CONTINUATION GRANT
   - D [X] END OF BUDGET PERIOD REPORT

2. IN ALL CASES EXCEPT INITIAL APPLICATION. GIVE OE ASSIGNED PROJECT NUMBER: 67-03337-1

3. MAJOR DESCRIPTION OF PROJECT: *(Check one only)*
   - A [X] INNOVATIVE
   - B [ ] EXEMPLARY
   - C [ ] ADAPTIVE

4. TYPE(S) OF ACTIVITY *(Check one or more)*
   - A [ ] PLANNING OF PROGRAM
   - B [ ] PLANNING OF CONSTRUCTION
   - C [X] CONDUCTING PILOT ACTIVITIES
   - D [X] OPERATION OF PROGRAM
   - E [ ] CONSTRUCTING
   - F [ ] REMODELING

5. PROJECT TITLE *(5 Words or Less)*

   Wabash Valley Education Center

6. BRIEFLY SUMMARIZE THE PURPOSE OF THE PROPOSED PROJECT AND GIVE THE ITEM NUMBER OF THE AREA OF MAJOR EMPHASIS AS LISTED IN SEC. 303, P.L. 89-10. *(See instructions)*

   The central purpose of the project reported herein was: (1) to develop imaginative solutions to educational problems; (2) to more effectively utilize research findings; and, (3) to make intelligent use of supplementary materials and services.

   ITEM NUMBER 3

7. NAME OF APPLICANT *(Local Education Agency)*	8. ADDRESS *(Number, Street, City, State, Zip Code)*
West Lafayette Community School Corporation	141 Andrew Place West Lafayette, Indiana 47906

9. NAME OF COUNTY	10. CONGRESSIONAL DISTRICT
Tippecanoe	Indiana - Second

11. NAME OF PROJECT DIRECTOR	12. ADDRESS *(Number, Street, City, State, Zip Code)*	PHONE NUMBER / AREA CODE
William Floyd	University Square 500 By Pass 52 West West Lafayette, Indiana 47906	463-1589 Area code 317

13. NAME OF PERSON AUTHORIZED TO RECEIVE GRANT *(Please type)*	14. ADDRESS *(Number, Street, City, State, Zip Code)*	PHONE NUMBER / AREA CODE
Bruce Moore	141 Andrew Place West Lafayette, Indiana 47906	743-9631 Area code 317

15. POSITION OR TITLE

    Superintendent

SIGNATURE OF PERSON AUTHORIZED TO RECEIVE GRANT	DATE SUBMITTED

SECTION A – Continued

16. LIST THE NUMBER OF EACH CONGRESSIONAL DISTRICT SERVED	17A. TOTAL NUMBER OF COUNTIES SERVED	12	18. LATEST AVERAGE PER PUPIL ADA EXPENDITURE OF LOCAL EDUCATION AGENCIES SERVED
2, 6, and 7	B. TOTAL NUMBER OF LEA'S SERVED	30	$ 535.87
	C. TOTAL ESTIMATED POPULATION IN GEOGRAPHIC AREA SERVED	310,000	Excludes: textbooks, cafeteria, joint services, lease rental, debt service, capital outlay, Kg. & Transp

SECTION B – TITLE III BUDGET SUMMARY FOR PROJECT (Include amount from item 2c below)

1.		PREVIOUS OE GRANT NUMBER	BEGINNING DATE (Month, Year)	ENDING DATE (Month, Year)	FUNDS REQUESTED
A.	Initial Application or Resubmission		6-29-67	6-28-68	$ 685,313
B.	Application for First Continuation Grant		6-29-68	6-28-69	$ 585,000
C.	Application for Second Continuation Grant		6-29-69	6-28-70	$ 325,000
D.	Total Title III Funds				$1,595,313
E.	End of Budget Period Report				

2. *Complete the following items only if this project includes construction, acquisition, remodeling, or leasing of facilities for which Title III funds are requested. Leave blank if not appropriate.*

A *Type of function (Check applicable boxes)*

1 ☐ REMODELING OF FACILITIES 2 ☒ LEASING OF FACILITIES 3 ☐ ACQUISITION OF FACILITIES

4 ☐ CONSTRUCTION OF FACILITIES 5 ☐ ACQUISITION OF BUILT-IN EQUIPMENT

B	1. TOTAL SQUARE FEET IN THE PROPOSED FACILITY	2. TOTAL SQUARE FEET IN THE FACILITY TO BE USED FOR TITLE III PROGRAMS	C	AMOUNT OF TITLE III FUNDS REQUESTED FOR FACILITY
	7350	7350		$ 25,728

SECTION C – SCHOOL ENROLLMENT, PROJECT PARTICIPATION DATA AND STAFF MEMBERS ENGAGED

1.			PRE-KINDERGARTEN	KINDERGARTEN	GRADES 1-6	GRADES 7-12	ADULT	OTHER	TOTALS	STAFF MEMBERS ENGAGED IN IN-SERVICE TRAINING FOR PROJECT
A	School Enrollment in Geographic Area Served	(1) Public	-	3,618	41,278	30,839	2,000	-	77,735	
		(2) Non-public	-	67	2,792	1,324	-	-	4,183	
B	Persons Served by Project	(1) Public	-	3,618	41,278	30,839	2,000	-	77,735	600
		(2) Non-public	-	67	2,792	1,324	-	-	4,183	50
		(3) Not Enrolled	-	-	-	-	-	-	-	
C	Additional Persons Needing Service	(1) Public	-	-	-	-	2,000	-	2,000	-
		(2) Non-public	-	-	-	-	-	-	-	-
		(3) Not Enrolled	-	-	-	-	-	-	-	

2.	TOTAL NUMBER OF PARTICIPANTS BY RACE *(Applicable to figures given in item 1B above)*	WHITE	NEGRO	AMERICAN INDIAN	OTHER NON-WHITE	TOTAL
		80,606	1,312	--	--	81,918

SECTION C - continued

3. RURAL/URBAN DISTRIBUTION OF PARTICIPANTS SERVED OR TO BE SERVED BY PROJECT

PARTICIPANTS	RURAL		METROPOLITAN AREA		
	FARM	NON-FARM	CENTRAL-CITY	NON-CENTRAL CITY	OTHER URBAN
PERCENT OF TOTAL NUMBER SERVED	6.6%	45.9%	--	--	47.5%

SECTION D - PERSONNEL FOR ADMINISTRATION AND IMPLEMENTATION OF PROJECT

1. PERSONNEL PAID BY TITLE III FUNDS

TYPE OF PAID PERSONNEL	REGULAR STAFF ASSIGNED TO PROJECT			NEW STAFF HIRED FOR PROJECT		
	FULL-TIME 1	PART-TIME 2	FULL-TIME EQUIVALENT 3	FULL-TIME 4	PART-TIME 5	FULL-TIME EQUIVALENT 6
A. ADMINISTRATION/ SUPERVISION	1	-	1			
B. TEACHER: (1) PRE-KINDERGARTEN	-	-	-			
(2) KINDERGARTEN	-	-	-			
(3) GRADES 1-6	-	-	-			
(4) GRADES 7-12	-	-	-			
(5) OTHER	-	-	-			
C. PUPIL PERSONNEL SERVICES	-	-	-			
D. OTHER PROFESSIONAL	7	3	8.5			
E. ALL NON-PROFSSIONAL	11	2	12.0			

F. FOR ALL CONSULTANTS PAID BY TITLE III FUNDS → (1.) TOTAL NUMBER RETAINED 175 (2.) TOTAL CALENDAR DAYS RETAINED 150

2. PERSONNEL NOT PAID BY TITLE III FUNDS N/A

TYPE OF UNPAID PERSONNEL	REGULAR STAFF ASSIGNED TO PROJECT			NEW STAFF HIRED FOR PROJECT		
	FULL-TIME 1	PART-TIME 2	FULL-TIME EQUIVALENT 3	FULL-TIME 4	PART-TIME 5	FULL-TIME EQUIVALENT 6
A. ADMINISTRATION/ SUPERVISION						
B. TEACHER: (1) PRE-KINDERGARTEN						
(2) KINDERGARTEN						
(3) GRADES 1 TO 6						
(4) GRADES 7-12						
(5) OTHER						
C. PUPIL PERSONNEL SERVICES						
D. OTHER PROFESSIONAL						
E. ALL NON-PROFESSIONAL						

F. FOR ALL CONSULTANTS NOT PAID BY TITLE III FUNDS → (1.) TOTAL NUMBER RETAINED ______ (2.) TOTAL CALENDAR DAYS RETAINED ______

SECTION E - NUMBER OF PERSONS SERVED OR TO BE SERVED AND ESTIMATED COST DISTRIBUTION

	MAJOR PROGRAM OR SERVICES	TOTAL NUMBER SERVED OR TO BE SERVED PRE-K (1)	K (2)	1-6 (3)	7-12 (4)	ADULT (5)	OTHER (6)	NONPUBLIC SCHOOL PUPILS INCLUDED (7)	ESTIMATED COST (8)
1.	EVALUATIVE PROGRAMS								
A	Deficiency Survey (Area Needs)								
B	Curriculum Requirements Study (Including Planning for Future Need)								
C	Resource Availability and Utilization Studies								
2.	INSTRUCTION AND/OR ENRICHMENT								
A	Arts (Music, Theater, Graphics, Etc.)								
B	Foreign Languages								
C	Language Arts (English Improvement)		3,685	44,070	32,163	2,000		4,183	78,729
D	Remedial Reading								
E	Mathematics		3,685	44,070	32,163	2,000		4,183	750
F	Science		3,685	44,070	32,163	2,000		4,183	163,814
G	Social Studies/Humanities		3,685	44,070	32,163	2,000		4,183	100,828
H	Physical Fitness/Recreation								
I	Vocational/Industrial Arts								
J	Special-Physically Handicapped			8					
K	Special-Mentally Retarded	20	10	170	450				38,000
L	Special-Disturbed (Incl. Delinquent)			35	30		5		
M	Special-Dropout								
N	Special-Minority Groups								
3.	INSTRUCTION ADDENDA								
A	Educational TV/Radio								
B	Audio-Visual Aids		3,685	44,070	32,163	2,000		4,183	371,500
C	Demonstration/Learning Centers		3,685	44,070	32,163	2,000		4,183	75,000
D	Library Facilities		3,685	44,070	32,163	2,000		4,183	25,000
E	Material and/or Service Centers		3,685	44,070	32,163	2,000		4,183	75,000
F	Data Processing								
4.	PERSONAL SERVICES								
A	Medical/Dental N/A								
B	Social/Psychological								
5.	OTHER Fixed Charges								143,265

1,071,986

OE 4382 (11-00)

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF EDUCATION
WASHINGTON, D.C. 20202

BUDGET BUREAU NO. 51-R601
APPROVAL EXPIRES 6-30-68

PART II—NARRATIVE REPORT

☐ Application For Continuation Grant
OR
☒ End of Budget Period Report

Elementary and Secondary Education Act of 1965, Title III, P.L. 89-10, as amended

INSTRUCTIONS - *Identify this project by the following: Name and Address of Agency, Project Number, Grant Number, State, and Budget period (month, day, year).* West Lafayette Community School Corporation, 141 Andrew Place, West Lafayette, Indiana 47906; Project No. 67-03337; Indiana; 6-29-67 through 6-28-70

1. (a) For operational activities, discuss the effect of the project on the clientele by briefly stating the major objectives of the project and the techniques used in evaluating the extent to which these objectives were achieved. PACE project applicants are required to provide project evaluations. Please attach one copy of the results of this evaluation with supporting materials. Estimate the cost of the evaluation.

   (b) For planning activities, attach one copy of the results of the planning.

2. Briefly describe project endeavors in which the anticipated results have exceeded expectations, and those in which results have not measured up to expectations.

3. Report the effect of the project on the educational institution or agency by discussing what you consider to be the greatest change resulting from the project.

4. Report the effect of the project on the co-operating agencies by (1) listing all the community agencies that co-operated in the project; (2) discussing the results of such co-operation; and (3) listing local educational agencies and counties which were served by the project and indicate any changes since the initial application.

5. Discuss how project information was disseminated. Include such information as (1) the number of unsolicited requests for information; (2) the number of visitors from outside the project area; and (3) the estimated costs of such dissemination.

6. Describe the methods and procedures being developed to carry the project forward without Federal support after the designated approval period.

7. List costs for budget period this narrative report covers:

$ 1,682,515 Total cost.

$ 87,202 Total non-Federal support.

$ 1,595,313 Total Federal support under Title III, P.L. 89-10.

$ -0- Total Federal support other than Title III, P.L. 89-10.

SECTION I

PART II

NARRATIVE

Background and History

of the

Wabash Valley Education Center

I. The Community

A. Estimated Population

The geographical area served by this project was a 13-county area of approximately 4,600 square miles in north-central and northwest Indiana. In the total area there are 316,000 inhabitants of which approximately 80,000 are students. This compares to the state population of approximately 4,700,000 in 92 counties. According to the standard population descriptive classifications, it should be noted that 52.5 per cent of the participants served are classified as rural, of which 6.6 per cent are classified as farm and 45.9 per cent as nonfarm. The remaining 47.5 per cent of the participants reside in small urban centers, the largest being Lafayette, which has an approximate population of 45,000.

B. Location of Educational Agencies Served

The educational agencies involved in the project by counties are as follows:

Benton County

*Benton Community School Corporation

Boone County

Lebanon Community School Corporation
*Western Boone County Community School District

Carroll County

*Carroll Consolidated School Corporation
*Delphi Community School Corporation

Cass County

*Logansport Community School Corporation
**Southeastern School Corporation

* Contributing School Corporation
** Became Members in 1968-69

Clinton County

Clinton Central School Corporation
*Clinton Prairie School Corporation
Frankfort Community Schools
*Rossville Consolidated School District

Fountain County

*Attica Consolidated School Corporation
Covington Community School Corporation
Southeast Fountain School Corporation

Howard County

***Northwestern School Corporation

Montgomery County

*Crawfordsville Community School Corporation
*North Montgomery Community School Corporation
South Montgomery Community School Corporation

Newton County

*South Newton School Corporation

Tippecanoe County

Lafayette School Corporation
*Tippecanoe School Corporation
*West Lafayette Community School Corporation

Tipton County

**Northern Community Schools of Tipton County

Warren County

*Warren Central Consolidation
*Warren Community Schools

White County

*Frontier School Corporation
North-White School Corporation
*Tri-County School Corporation
*Twin Lakes School Corporation

* Contributing School Corporation
** Became members in 1968-69
*** Became member in 1969-70

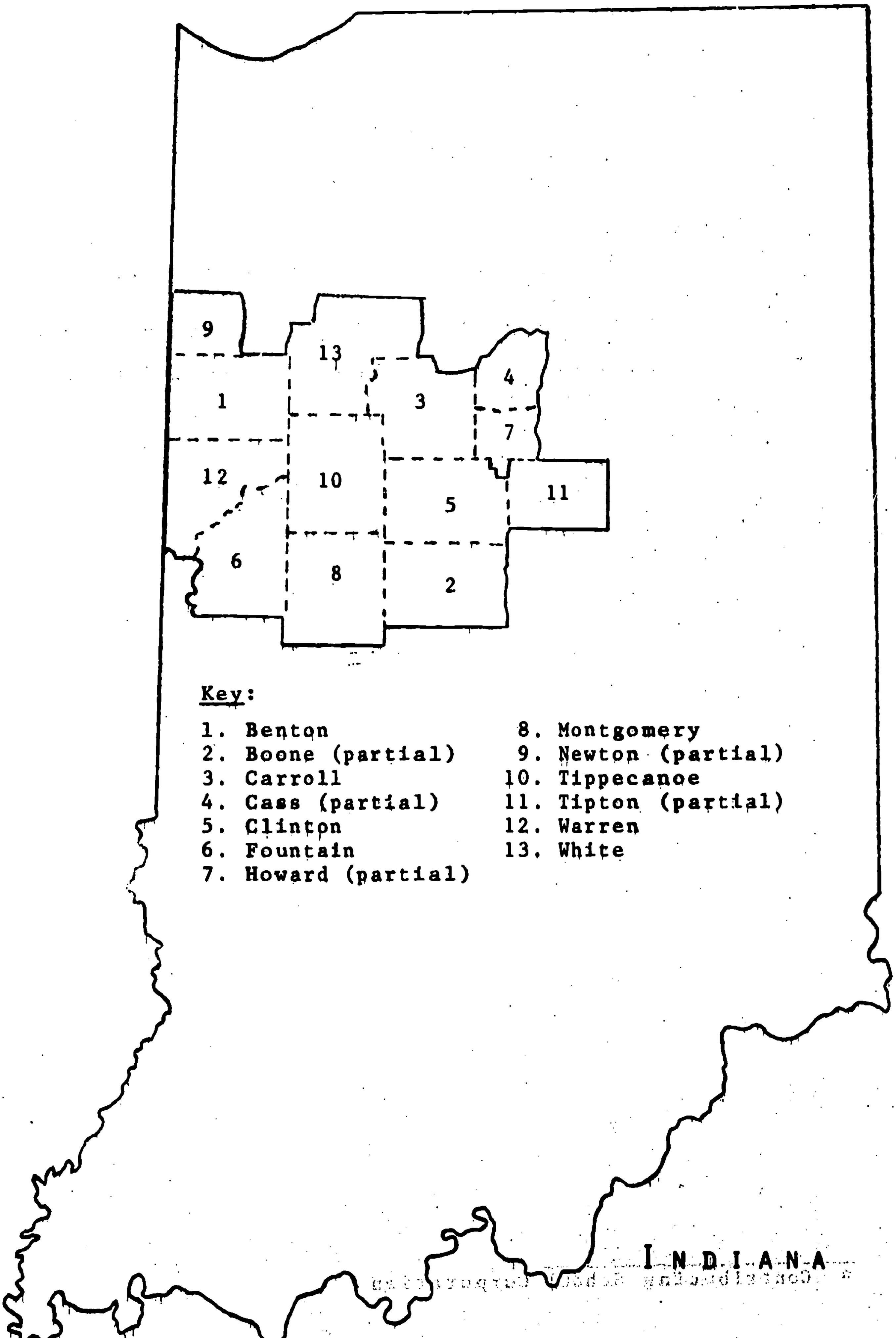
Parochial Schools

*Catholic Diocese of Lafayette
Frankfort Pilgrim High School
Lafayette Christian School
St. James Lutheran School

Private Schools

Wabash Center Retarded Children's School, Lafayette
Longcliff School, Logansport State Hospital, Logansport
Comprehensive Association for Retarded Children, Monticello

* Contributing School Corporation


9
13
1
3
4
7
12
10
5
11
6
8
2
Key:
1. Benton
2. Boone (partial)
3. Carroll
4. Cass (partial)
5. Clinton
6. Fountain
7. Howard (partial)
8. Montgomery
9. Newton (partial)
10. Tippecanoe
11. Tipton (partial)
12. Warren
13. White
INDIANA

C. Cooperating Agencies

Many agencies in the 13-county area are listed as cooperating bodies. They have been of invaluable service in public relations, the dissemination of information, and in providing resource persons to assist the Center in certain aspects of its program. They include the following:

Purdue University
Wabash College
Lafayette Art Center
Lafayette Symphony Society
Lafayette Journal & Courier
Lafayette Leader
Indianapolis Star & News Agency
Benton Review
Crawfordsville Journal & Review
Frankfort Morning Times
Lebanon Reporter
Pharos-Tribune & Press (Logansport)
The Monticello Herald Journal
Attica Ledger-Tribune
Journal-Citizen (Delphi)
Danville Commercial News (Danville, Ill.)
Radio WASK
Radio WAZY
Radio WBAA
Radio WSAL
Radio WILO
Radio WCVL
WLFI-TV

II. Goals and Objectives

The Wabash Valley Education Center operated, as it had during its first year, with two goals in mind: (1) to assist local school systems to devise and develop curricular innovations and aid in the development of teaching procedures and teaching materials; and (2) to serve as a demonstration center exhibiting instructional models and demonstrating innovative concepts showing how a center may be developed and how it may function in other regions of the state and nation.

To achieve these goals, the Center offered two main services: (1) specialists in several fields work with individual teachers and schools in the region to improve various content areas; (2) a wide variety of materials and resources are available for loan to teachers and schools.

Needs and Priorities

Justification for the support of this project was based on three major factors. First, the educational requirements emerging from the dramatic civilization developing around us are very demanding. Second, the apparent need for a newly devised type of intermediate educational unit exists. And third, there is a need for giving attention to the educational concerns of a pupil population that is drawn from a setting that is neither highly urban nor basically rural,

Priorities during the 1967-70 project period were assigned variously to the following items:

Assistance with curricular development and improvement.

Assistance with experimental programs,

Assistance with in-service training for the improvement of teaching and administrative methodology,

Assistance in the utilization of teaching equipment and materials.

Assistance with evaluation of the total school program.

Assistance with special education for the exceptional child.

III. Specific Objectives

In considering the objectives identified through a planning survey which was conducted prior to the opening of the Center in 1966-67, the Center took cognizance of the rural and urban characteristics of the area it was to serve in order to overcome the gap between educational practices and what research indicates should be done. Full operational attention was given to the ten objectives, derived to meet this need. They were;

1. To design a service-oriented center with optimal services to improve the learning opportunities of students.

2. To encourage the employment of teaching techniques and programs which require students to actively participate in a variety of experiences.

3. To involve the teacher in the application of research findings concerning theories of learning as a means of research orientation.

4. To utilize a variety of materials and media as tools to bridge the learning gap that too often occurs between the teacher and the learner.

5. To provide communication channels as a means of interaction between the personnel of the Center, classroom teachers and school administrators concerning the function of the Wabash Valley Education Center.

6. To provide, through the Center, appropriate materials and media necessary for the implementation of programs and services which will result in an improved education program for students.

7. To provide means to assist in the improvement of administrative services within individual school corporations.

8. To develop and assist in the implementation of techniques and procedures for evaluating the learner's progress.

9. To design and implement a program serving exceptional children (special education).

10. To develop a procedure for evaluating the effectiveness of the Center.

A. Areas of Specific Involvement

In order to facilitate the meeting of the objectives listed, seven areas of specific involvement were delineated and objectives in each area were set which would: (1) provide the Wabash Valley Education Center with realistic means by which programs could be planned to meet the stated Center objectives; and (2) provide project directors with a set of criteria for evaluative purposes as the projects evolved.

The emphasis in curricular improvement and innovation was on developing and encouraging the development of programs designed to improve the learning environment and to meet the instructional needs of children through individualized instruction. It was also to encourage programs that require the student to learn concepts and generalization rather than memorizing isolated facts and to encourage programs designed to promote independent study by students.

In the area of in-service training the objectives were concerned with being of direct assistance to teachers in helping them make their service more effective. By acquainting teachers with known learning theories, assisting them to develop an awareness and understanding of latest research findings and innovative programs, and aiding teachers in applying new methodology that has been developed and tested, the Center provided a unique service for the local school systems. Other objectives were to improve competency of teachers in their subject matter areas; to assist the teacher in evaluating pupil progress; and to create an awareness, and encourage the use of, materials to enrich and augment the curriculum. The Center was also involved in aiding the teacher in developing an understanding of the characteristics and needs of the gifted, culturally deprived, emotionally disturbed, and the mentally retarded child; help in using audio-visual aids was given.

Consultant service was determined to be an area of great importance. The objectives listed in the original proposal ranged from providing competent consultants in the major curriculum areas of literature, language arts, social studies, science, mathematics, modern foreign language, and the fine arts to providing consultants to assist in designing and executing research projects. They included providing consultants competent in measurement and evaluation of student achievement, consultants to demonstrate current learning theories, consultants to assist in the improvement of competency in methodology and utilization of audio-visual materials and equipment. The securing of consultants to assist in the improvement of administrative practices and those expert in public relations to create public awareness of outstanding educational practices were Center objectives.

Special education provided consultants whose job it was to aid in the development of a program construction of new materials or adapt existing materials and media to assist teachers of special education classes. Needs in this area were identified in a study conducted in 1967; every attempt was made to begin to meet them during 1968-69.

Recognition of the necessity for a smooth, effective communications system was explicated in five objectives: to provide a method for (1) an exchange of information between and among teachers, administrators, and Center personnel; (2) distribution of materials and equipment to all school systems involved; (3) demonstration of innovations and exemplary programs; (4) effective public relations; and (5) keeping the general public aware and supportive of the Wabash Valley Education Center.

Because the Center is cooperative in every sense of the word, the personnel work closely with each other and with the clientele. Areas of specific involvement and the objectives stated in each area apply to all consultants and their activities equally.

B. Recommended Areas of Emphasis

In the following paragraphs certain operational emphases of the Wabash Valley Education Center are discussed. These areas of operational emphasis were derived from the data secured according to the criteria developed for and used in the preliminary survey.

Comprehensive Instructional Materials Center. To undergird and support any of the proposed services, a materials resource center was ascertained to be of primary need. The data gathered for the study indicated that success of proposed activities of the center resided in the availability of an abundance of services to schools with substantial support in the form of materials. Materials for classroom usage as well as professional developmental materials for the professional school personnel form integral parts of the materials center. Thus, the expansive materials resource center has been of great importance for the Wabash Valley Education Center.

Programs involved in instructional improvement have been greatly enhanced by a wide range of both unique and basic samples of educational materials that have been provided by the Center and oriented toward this purpose. These include books, filmstrips, films, transparencies, programmed instruction, records, tapes, maps, globes, models, enrichment materials, and other highly illustrative materials, etc.

Assistance with Curricular Development and Improvement. Staff members employed by the Center assisted teachers and school administrators in curriculum development, curriculum modification, and subject matter revision. Special consultants were retained for specific anticipated needs. Services and efforts of other agencies such as universities, the state department of education, and the Title IV Research Laboratory were used in a coordinated attempt to assist in a given situation. Units of subject area teaching materials were prepared for usage along with audio-visual equipment and materials which some local schools did not believe feasible for them to purchase. The preparation of specific curriculum materials upon request was included as an added service.

Assistance with In-Service Training for Improvement of Teaching and Administrative Methodology and Techniques. The Center provided many types of helpful in-service training programs for teachers, supervisors, principals, and other school personnel. Staff members were employed full and part-time by the Center to assist local school personnel and to coordinate efforts for improving teaching techniques in the various subject matter fields. The Center staff facilitated the process of sharing innovative ideas and methods among personnel in the Wabash Valley Education Center area. Special outside consultants were used where a need for given expertise was desired. An instructional and administrative methodology improvement service, to be effective, necessitates a quantity of supplementary equipment and materials associated with exemplary and innovative teaching and administrative techniques. Demonstration materials and equipment, preparation facilities, and bulletin board displays were fundamental to this service area. It was assumed that an expansive professional library had much to contribute to the success of the activities in this category.

Assistance with Action Research. Implicit in this assistance are the research advice and facilitative services which were tendered to individual teachers and administrators and to their respective school corporations. A staff member as a consultant with the ability to communicate sound statistical practices, to advise on applied research design, and to manage and perform data processing operations is necessary. The facilitative services included, in addition to standard mechanical data processing procedures such as key punching, sorting, etc., those interpretative and feedback functions continually desirable in the organization and conduct of action research. Not all of these facilitative services were used.

Implementation of this priority item provided the vehicle for a suggested close relationship between the Title III Center and the Title IV Cooperative Educational Research Laboratory, Inc. (CERLI) headquartered in Northfield, Illinois. A relationship was established and made functional during the period of parallel funding of WVEC and CERLI.

<u>Assistance in the Utilization of Teaching Equipment and Materials</u>. The assistance involved in this service revolved around in-service training to improve and extend usage of recent and current teaching aids, equipment and materials. This service was tendered through deliberate exposure to such materials and equipment collected and displayed in the Instructional Materials Center. An employee of the Center, well versed in materials usage and equipment technology, conducted sessions both in the schools of the participating corporations and at the Center to improve the skills of the teachers in their utilization of teaching equipment and materials. There was an emphasis on those supplementary equipment and materials necessary to aid teachers in moving from traditional to innovative methods of teaching. An essential aspect of such a service was the adequate audio-visual materials section of the Instructional Materials Center which focused on equipment not justifiably purchasable in a single school, or in some instances, in a single school corporation.

<u>Assistance with Experimental Programs</u>. As a part of an emphasis on innovative programs and processes, provisions were made for the conduct of experimental programs. One of the major reasons schools have not conducted more experimental programs relates to the absence of professional experience in the area. This kind of assistance was supplied through the Center. Member schools, each having some uniqueness, had an opportunity to establish programs in order to examine aspects of problems which could be associated with such uniqueness. But there was also need for experimental programs concerned with common problems of several of the member schools. Resources of the Center were provided here as well. More specifically, a comprehensive list of consultants competent to assist in any of the experimental areas identified by member schools was maintained at the Center. The Center (1) helped obtain the services of these consultants, (2) provided on-going liaison and coordination work with the member schools involved through permanent Center staff personnel, and (3) disseminated the findings of experimental programs to all member schools.

Assistance with Administrative Duties of Mechanical and Operational Nature. The Center examined the feasibility of using computer accounting equipment to assist in certain administrative functions as class scheduling, long-term collections of data on student achievement, attendance, grade reporting, dropouts, checkwriting services, payroll accounting, and cost statistics for budgets. Suggestions were made that schools could be helped in these areas by providing microfilm equipment to assist them with the problem of record storage; developing a substitute teacher bureau to help school officials fill vacancies when regular teachers are absent; and other activities of a mechanical and operational nature such as collection and organization of data for reports to be facilitated through the Center.

Assistance with Evaluation of Total School Program. The Center provided staff or special consultants to assist schools and school corporations in undertaking evaluation programs. This service required specialized library facilities, provision for stocking various data-gathering forms and such equipment necessary to tabulate and analyze the data gathered.

Assistance with Programs Focusing on Exceptionalities of Children. Exceptionality was interpreted here as including gifted, retarded, physically and mentally handicapped, and emotionally and socially handicapped children. The term, educationally deprived, may well cross any or all of the above areas and was included as children's needs were not in all cases met in the local school or school system through the Title I provisions of the Elementary and Secondary Education Act. It is suggested that programs of this type provide assistance and consultant service for teachers; tender psychological, psychometric, psychiatric, therapeutic, and social services for children, as well as coordinate special education personnel of the schools actively involved in the project. The Center provided many kinds of equipment and materials designed for dealing with the exceptionalities that an individual corporation was not able to purchase. A professional library well supplied with current research was assumed as basic for the success of such a service, as are certain professionally trained personnel to perform the services in the areas of exceptional education. These were provided by the Center during the second and third year operational grants.

C. Evaluation

For purposes of clarity and to facilitate comparison between this document and the original proposal for the grant, a similar outline is followed. Evaluative techniques and the results of the evaluations will be included in the discussion of each project.

Any evaluation of the Wabash Valley Education Center must rest on thorough evaluation of its programs. Only by examining them carefully can the success or failure of the Center be considered. The Center was its programs, its curriculum activities, the involvement of its teachers, and its materials and services. Through the evaluation of each program, the Center is evaluated.

Briefly, however, one other important fact about the Center must be discussed. It is the circumstances of its present and future financing.

The three years of first federal and then state financing terminated at the end of fiscal 1969-70. After this period the Center will be on its own financially. In compliance with suggestions from the federal and state governments and clearly in line with the intent of Title III ESEA discussed earlier, efforts have been made to secure sound continuing financing.

With the support of most area schools, a part of the financial underpinnings for the Center will be supplied. Other areas which have been and will be explored for further financing include the federal bureaus of Education for the Handicapped, Library Programs, Elementary and Secondary Education, Higher Education, Educational Personnel Development, Research, and Vocational Education.

Further, explorations have been made and will continue to be made into the ways in which the Center or certain aspects of it mesh with other programs of the state of Indiana. It is hoped that the Center, as a cooperative, can be as helpful to the state as the state has been to the Center, for regional cooperatives can enhance the state in which they operate.

Foundation grants will be explored to see if there is interest in the Center and its programs. Business and industry, ever more interested in diversification for the public good, will also be tested to determine possible funding.

With the beginnings of a financial base demonstrated by 30 corporations in the Center area, prospects are good for a strong and vital organization on a long-term basis.

On July 1, 1969, the state of Indiana assumed management of the Wabash Valley Education Center, in keeping with amendments to Public Law 89-10, the Elementary and Secondary Education Act of 1965. The Center was evaluated by officials of the Office of the Superintendent of Public Instruction in December 1968 and March 1970. Many of their recommendations have been incorporated into the programs described on the following pages. That early cooperative effort paved the way for the close ties which existed during the period since July 1, 1969.

IV. General Center Activities

Rationale

If a key word can be found to describe the efforts of the Wabash Valley Education Center to be of service to the local school communities, that word is individualization. The Center was aware that in the area it serves, no one answer will be found to apply equally to all 30 school corporations. So, as the schools strive to provide individualized instruction for their children, the Center seeks for individualized answers for each local situation within the area.

Individualized answers to the problems of teachers, students, and school administrators were put into practice by Center consultants working in the areas of social science, language arts, elementary science, and high school physics during various segments of the three-year period of federal funding.

V. Responsiveness to Expressed Needs

A. Rationale

A very important area of general Center activities, in terms of its lasting impact upon the quality of education in the Center sphere and on the continuing effectiveness of the Center in insuring that improvement, was the responsiveness of the Wabash Valley Education Center to implicitly and explicitly expressed needs of the pupils, teachers, and administrators served. A very important part of this is dealt with in the section on dissemination of information. But another, equally important aspect is revealed only by looking at Center organizational structure and analyzing how certain felt needs were willed through a process of sensitizing staff and the various managing boards to these needs.

B. Mathematics Organization

When the Bureau of Special Services of Purdue University held public meetings to discuss the scope and direction of Wabash Valley Education Center, suggestions by mathematics teachers present indicated a strong interest in exchange of information with their colleagues and assistance in improving teaching quality.

During the 1967-1968 grant period, with assistance from Center personnel, a formal organization of teachers of mathematics grades 7-12 was formed. The organization met monthly to hear authorities in the field, and to discuss means of improving the quality of mathematics teaching.

C. Science Teachers Association

An organization similar in purpose to the one discussed above, but for science teachers, was organized for one year. It was intended to give teachers of science on all grade levels, but primarily secondary, a forum for exchange of ideas and an opportunity to hear experts in the field discuss new methods or discoveries, etc.

D. Advisory Committee for Curriculum Development

The Curriculum Advisory Committee was organized as a means of sensitizing the local school administrators in a direct way. The Committee functioned in two ways: (1) as a channel through which planners could feed information about proposed curriculum development programs; and (2) by discussing local needs and thus, in a circular process, sensitize Center planners to needs in each corporation.

The stated purposes of the group were: (1) to hear proposals, (2) to initiate proposals, and (3) to advise the Governing Board of the Wabash Valley Education Center. Because it is made up of teachers, principals, assistant superintendents, and other specialists in the field, it serves not only as an advisory group but also as an integral part of the communication network which operates between and among different levels of Center clientele.

This is perhaps the greatest change which has been a direct result of the project. The Center as a whole and each group which works with it, have grown increasingly aware of the problems of their colleagues and have become concerned with and have strived to achieve the goal of educational improvement in the Center area particularly but also in the field as a whole.

SUBSECTION A

Meetings, Conferences and Workshops Funded by the Administrative Budget 1967-1970

The following list of meetings, conferences or workshops were funded through account 100 of the W.V.E.C. Account 100 earmarks funds for expenditure under the classification Administration. It is not to be construed that the following were the only meetings, conferences or workshops sponsored by the administration section. Rather, they are those for which encumbrances were made in excess of the regular expenditures of the administration section; e.g., salaries, travel, etc.

The administration section sponsored many meetings, conferences and workshops that were lead by various Center personnel that did not require special funding. Because the list would be lengthy and rather meaningless without an explanation of each item on the list, it will not be given. Suffice it to say that the meetings, conferences and workshops sponsored by the administration section that did not require special funding covered a variety of topics and were for a variety of educational personnel in the area served by the W.V.E.C.

SECTION II

85 29

Date(s): August 31, 1967

Program Title: Audio-Visual Workshop

Program Purpose(s): Demonstrate a variety of A-V materials and equipment

Attendees (Type): Teachers

Attendees (Number): 100

Program Held at: W.V.E.C., Demonstration Room

Date(s): October 26, 1967

Program Title: A Visit to an Intermediate School Unit

Program Purpose(s): To familiarize Superintendents with organization, programs and services of an intermediate school unit as an example of an educational cooperative.

Attendees (Type): Superintendents

Attendees (Number): 30

Program Held at: Oakland Schools, Pontiac, Michigan

Date(s): December 6, 1967 (2 hours)

Program Title: Teaching Computer Science in the Junior High School

Program Purpose(s): Discuss the applicability of teaching computer science in the Junior High

Attendees (Type): Junior and Senior High School Math Teachers

Attendees (Number): 40

Program Held at: Cumberland School, West Lafayette, W.L.C.S.C.

Date(s): January 10, 1968

Program Title: Iteration

Program Purpose(s): To demonstrate the application of iteration in the solution of the quadratic equation

Attendees (Type): Junior and Senior High School Teachers (Math)

Attendees (Number): 21

Program Held at: W.V.E.C.

Date(s): February 14, 1968

Program Title: W.V. Math Association

Program Purpose(s): To hear a lecture on "Utilizing Science in the Teaching of Math"

Attendees (Type): Junior and Senior High School Math Teachers

Attendees (Number): 15

Program Held at; W.V.E.C. Demonstration Room

Date(s): February 21, 1968 (6 hours)

Program Title: Curriculum Advisory Committee Workshop

Program Purpose(s): To bring about instructional improvement

Attendees (Type): Curriculum Directors, Principals, Assistant Superintendents

Attendees (Number): 25

Program Held at: W.V.E.C.

Date(s): March 14 and 15, 1968

Program Title: Needs Assessment

Program Purpose(s): An in-service program for W.V.E.C. professional staff

Attendees (Type): W.V.E.C. Professional Staff

Attendees (Number): 10

Program Held at: W.V.E.C.

Date(s): April 25, 1968

Program Title: South Montgomery Community School Corporation In-Service Workshop

Program Purpose(s): To enable participants to discuss educational problems facing the corporation and to develop and propose possible solutions to the problems.

Attendees (Type): Elementary and Secondary Teachers and Administrative

Attendees (Number): 108

Program Held at: South Montgomery Junior and Senior High School

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Date(s): June 10, 1968 (3 hours)

Program Title: Conference for Junior and Senior High School Science Teachers

Program Purpose(s): To provide participants with information on teaching, flexible scheduling and individualized instruction in the Junior and Senior High School.

Attendees (Type): Teachers

Attendees (Number): 30

Program Held at: W.V.E.C.

Date(s): June 13, 1968 (6 hours)

Program Title: Administrators Conference - New Directions - Educational Change

Program Purpose(s): To provide attendees with information on uses of V.T.R. for in-service training; to provide attendees with information on individualization of instruction.

Attendees (Type): Superintendents and Principals (Elementary, Junior High and Senior High)

Attendees (Number): 20

Program Held at: W.V.E.C.

Date(s): June 14, 1968 (6 hours)

Program Title: Remedial Reading Conference

Program Purpose(s): To enable attendees to hear about and discuss the problems of teaching remedial reading as appropriate to the regular classroom teacher.

Attendees (Type): Teachers

Attendees (Number): 50

Program Held at: Memorial Center, Purdue University

Date(s): December 4, 1968 (6 hours)

Program Title: Data Processing Workshop

Program Purpose(s): To assess the applicability of computer systems to school financial accounting.

Attendees (Type): Superintendents

Attendees (Number): 15

Program Held at: W.V.E.C.

Date(s): December 11, 1968

Program Title: Data Processing Workshop

Program Purpose(s): To assess the applicability of computer systems to pupil accounting, grade reporting, scheduling, and other records.

Attendees (Type): Superintendents and Principals

Attendees (Number): 25

Program Held at: W.V.E.C.

Date(s): March 11, 1969 (6 hours)

Program Title: Administrators Meeting

Program Purpose(s): To discuss and analyze the role of the principal.

Attendees (Type): Elementary and Secondary School Principals

Attendees (Number): 25

Program Held at: Memorial Center, Purdue University

Date(s): March 13, 1969 (2 hours)

Program Title: A Sequential Science Program - Emphasizing Physical and Biological Science

Program Purpose(s): To examine a sequential science program for the Junior High (Florida State Program).

Attendees (Type): Junior and Senior High School Teachers

Attendees (Number): 25

Program Held at: West Lafayette Junior High School, W.L.C.S.C.

Date(s): March 19, 1969

Program Title: Review of the Wabash Valley Education Center

Program Purpose(s): To review for O.E. officials, officials of other government agencies and other interested individuals the program of W.V.E.C. in order to gain financial support.

Attendees (Type): Federal government officials; school administrators and representatives from commercial agencies.

Attendees (Number): 70

Program Held at: Management Review Center, U.S.O.E., Washington D.C.

Date(s): April 9, 1969 (6 hours)

Program Title: Human Relations Laboratory

Program Purpose(s): To present school counselors and/or pupil personnel workers with new insights into personal-interpersonal learnings; to increase participants' awareness and understanding of small group processes.

Attendees (Type): School Counselors and Pupil Personnel Workers

Attendees (Number): 25

Program Held at: Memorial Center, Purdue University

Date(s): April 16, 1969

Program Title: Wabash Valley Association Meeting

Program Purpose(s): To give attendees an understanding of the activities and work going on in the area of "The Readability of Mathematical English."

Attendees (Type): Junior and Senior High School Math Teachers

Attendees (Number): 10

Program Held at: W.V.E.C. Demonstration Room

Date(s): May 15, 1969 (2 hours)

Program Title: Teachers Symposium: Science

Program Purpose(s): To examine new curriculum organization in the teaching of secondary science oriented toward laboratory effectiveness.

Attendees (Type): Junior and Senior High School Science Teachers

Attendees (Number): 25

Program Held at: W.V.E.C. Demonstration Room

Date(s): June 9-13, 1969 (6 hours each day)

Program Title: Professional Negotiations

Program Purpose(s): To discuss approach to professional negotiations through systems analysis.

Attendees (Type): Superintendents

Attendees (Number): 8

Program Held at: Memorial Center, Purdue University

Date(s): December 3, 1969

Program Title: Wabash Valley Math Association Meeting

Program Purpose(s): To disseminate information on how to write instructional objectives.

Attendees (Type): Junior and Senior High School Math Teachers

Attendees (Number): 15

Program Held at: Crawfordsville High School, Crawfordsville, Indiana

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SUBSECTION B

Report of Special Studies:

Studies For and Commissioned By The Wabash Valley Education Center

During the three year grant period several special studies were commissioned by the Wabash Valley Education Center. The studies that were commissioned dealt with two areas of concern -- evaluation and the feasibility of selected cooperative activities.

In the area of evaluation, Dr. Alex C. Moody, Indiana State University, Terre Haute, was commissioned by the Wabash Valley Education Center to undertake a study to determine teacher and principal opinion of the current availability of services offered by the Wabash Valley Education Center. The purpose of the study was to determine the impact made by the Center during its first year of operation with additional materials and services to teachers. This study was a follow-up study of one phase of an extensive study conducted by the Bureau of Special Services of Purdue University during the 1966-1967 academic year. The Purdue study was funded through the Wabash Valley Education Center planning grant and undertaken to determine what supplementary materials and services school personnel from member school corporations thought desirable and necessary for improved instruction that were not readily or in some cases remotely available to them. The Purdue study in part attempted to assess teacher opinion of services and materials available prior to the operational phase of the Center. In contrast, the Moody study attempted to assess teacher opinion of materials and services available after one year of operation by the Wabash Valley Education Center.

Moody used research techniques and data gathering instruments similar to those used in the Purdue study in his study. This was done so that the two sets of data would be comparable. Among the various findings reported by Moody, the most significant was that in the opinion of the respondents many materials and services were more available than they had been the previous year.

A second evaluation project funded by the Wabash Valley Education Center was conducted by Mr. Harry O. Leader, Program Specialist for the Center. This research project was an evaluation of the Instructional Materials Center, a major division of the Center. Most of the information obtained through this study is reported in this Report in the section describing the Instructional Materials Center. Thus, only an over-all summary of the research will be presented here.

During the past three years the Instructional Materials Center has provided the teachers served by the Wabash Valley Educational Center with a variety of instructional materials, including 16mm films, filmstrips, kits, models, professional books, periodicals, artifacts, slides, maps, charts and realia. The materials used most extensively by the teachers have been 16mm films. For instance, 20,000 16mm film showings were made during the first year of operation. The second year this number was increased to 40,000, and during the third year, utilization should be in excess of 50,000 films. In addition, a media staff has provided consulting services, a production service, and in-service training for teachers in mediated instruction.

During the second year of operation a questionnaire was developed by the media staff and sent to a large sample (approximately one-third) of the teachers served by the Center. The questionnaire assessed the utilization of selected services (primarily 16mm films) and solicited information and responses to questions describing certain situational and personal variables of teachers that might be related to the use of the Instructional Materials Center by teachers. The responses were analyzed by the analysis of variance statistical procedure, an F-test of significance, and the Scheffé technique.

A feasibility study regarding the possibility of providing regional data processing services was commissioned by the Wabash Valley Education Center during the second half of the 1967-1968 grant year. Three consultants from Purdue University were contracted to do the study who are expert in the field of education as well as data processing applications to education. The purpose of the study was to determine the feasibility of establishing a data processing center to serve Center member school corporations. The feasibility study had six dimensions: (1) assessment of need and identification of services; (2) operational considerations; (3) resources requirements; (4) fiscal considerations; (5) time considerations; and, (6) a payroll pilot study.

The result of the study indicated that the school corporations participating in the Wabash Valley Education Center had sufficient student population base to warrant a data processing center that could be effective, efficient and economical.

The report of the feasibility study regarding the formation of a Wabash Valley Education Center data processing center has been submitted to the U.S. Office of Education as well as to the Department of Public Instruction, State of Indiana. Thus, as in the case of the study previously noted, it will not be included in this report.

The Wabash Valley Education Center commissioned Mr. R. D. Knoll, systems analyst, to prepare a systems design for pupil and property accounting that would be applicable and usable by the school corporations served by the Center. The systems design was supplemental to the feasibility study described above.

The report submitted by Mr. Knoll described systems which were not completely detailed because at the time of preparation of the report no specific computer configuration had been chosen.

In that the recommendations included in the feasibility study were not acted upon by the Wabash Valley Education Center as the mediator for the cooperating school corporations, it does not appear appropriate at this point to include Mr. Knoll's report in this report.

SUBSECTION C

A SURVEY TO DETERMINE THE OVER-ALL IMPACT OF THE WABASH VALLEY EDUCATION CENTER 1967-1970

Final Report

Wabash Valley Education Center
500 By-Pass 52 West
University Square
West Lafayette, Indiana 47906
William Floyd, Director

May 1970

Project Staff:

William R. Wright, Program Specialist
Harry O. Leader, Program Specialist

The work presented or reported herein was performed pursuant to a Grant from the U.S. Office of Education, Department of Health, Education, and Welfare. However, the opinions expressed herein do not necessarily reflect the position or policy of the U.S. Office of Education, and no official endorsement by the U.S. Office of Education should be inferred.

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Introduction

Effective educational program planning always includes attention to what impact the program will have on the individuals or groups for whom the program was developed. Lack of concern for assessing the impact of programs has hindered educational improvement throughout the country. It has resulted in many potentially beneficial programs going by the wayside, never again to be looked at. Lack of concern for assessing the impact of programs has resulted in duplication of program efforts and expenditures. It has also resulted in an educational lag where improvements and needed change in the local schools, directly related to teachers and pupils, takes fifty years to evolve.

Purpose of the Survey

The purpose of this survey is to determine the impact made by the Wabash Valley Education Center during three years of operation funded by the federal government. The survey is all encompassing in terms of the various programs and services offered by the Center. This is in contrast to the survey conducted by Moody which assessed teacher-principal opinion of the availability of services and materials offered by the Center after one year of operation. No study, similar to the Moody study or the one being reported herein, was conducted at the end of the second year of operation.

Results of this study should provide substantial input to answering the question - did the Wabash Valley Education Center and its programs and services have any impact on education in the geographical area it served?

Population Used for the Survey

The population of the study is all of the teachers in the public and parochial school corporations served by the Wabash Valley Education Center with the following exceptions:

1) those schools that did not participate in the **services of the Wabash Valley Education Center** from its inception through the third year of operation. The schools that were excluded from consideration in the population did not participate in the Center until late in the second year of operation or were closed after the first year of operation.

2) these schools with fewer than four teachers. The staff of the Wabash Valley Education Center had proposed to conduct several studies, one of which was a study on leadership behavior in which Halpin's Leader Behavior Description Questionnaire (LBDQ) was to be employed. Since the present study utilizes same sampling procedures as those studies mentioned, Halpin's sampling rationale for the LBDQ was accepted. Halpin's rationale states that "a minimum of four respondents per leader (school) is desirable, and additional respondents beyond ten do not increase significantly the stability of the index scores."

3) one additional school corporation whose officials indicated a reluctance to supply data for the study noted in point 2.

Sampling Procedure

Based upon Halpin's rationale, in schools with four to ten teachers all teachers were used in the sample, while in schools with ten or more teachers only ten were drawn in the sample. For the latter all teachers in the corresponding school were assigned a number and then, by use of a table of random numbers ten were selected for the sample. Non-teaching administrators, school nurses, and non-certified personnel were not included in the study. These procedures resulted in a sample size of 1306 from a total population of 2848. From this original sample of 1306, 100 individuals were selected for this study.

The original sample of 1306 individuals each had a code number assigned to them. So, to obtain a random sample of these 1036 individuals for this study, the investigators placed each code number on a slip of paper, put the slips of paper in a box and then drew out 100 slips. These 100 slips then identified the 100 individuals to whom opinionnaires would be sent.

A list of the schools used in the survey as well as the number of possible respondents from each school (that is, the number of individuals selected to respond to the opinionnaire, not the actual number of respondents) is given in Table 1. In Table 2 are listed the school corporations from which data were gathered. Again, it should not be construed that data were gathered from all the school corporations listed. Figure 1 is a "scattergram" which shows the dispersement of schools included in the survey over the geographical area served by the Wabash Valley Education Center.

Table 1

Schools Used in the Survey

School	Number of Individuals Selected to Respond to Opinionnaire
Attica High School, Attica	1
Benton Central Jr. - Sr. High School, Oxford R.R.	1
Boswell Elementary School, Boswell	1
Fowler Elementary School, Fowler	1
Otterbein Elementary School, Otterbein	1
Oxford Elementary School, Oxford	1
Flora Jr. High School & Elementary School, Flora	1
Clinton Central High School, Michigantown	1
Scircleville Elementary School, Scircleville	1
Jefferson Elementary School, Jefferson	1
Covington Elementary School, Covington	1
Crawfordsville High School, Crawfordsville	1
Laura Hose Elementary School, Crawfordsville	1
Mollie B. Hoover Elementary School, Crawfordsville	1
Hillcrest Elementary School, Delphi	1
St. Bernards, Crawfordsville	2
St. Joseph, Lebanon	3
St. Mary Cathedral, Lafayette	1
Frankfort Sr. High School, Frankfort	1
South Side Elementary School, Frankfort	1
Frontier Elementary School, Brookston	1
Harney Elementary School, Lebanon	1
Lebanon Jr. High School, Lebanon	1
Stokes Elementary School, Lebanon	2
Columbia Jr. High School, Logansport	2
Daniel Webster Elementary School, Logansport	3
Fairview Jr. High & Elementary School, Logansport	2
Franklin Elementary School, Logansport	1
Logansport High School, Logansport	2
Coal Creek High School, New Richmond R.R.	1

cont'd.

Table 1 (cont'd.)

School	Number of Individuals Selected to Respond to Opinionnaire
Linden High School, Linden	1
Mt. Zion Elementary School, Crawfordsville R.R.	1
Buffalo Elementary School, Buffalo	1
North White High School, Monon R.R.	3
Waveland Elementary. Jr. and High School, Waveland	1
Kentland Elementary School, Kentland	1
South Newton Jr. - Sr. High School, Kentland R.R.	1
Kingman Elementary School, Kingman	1
Richland Elementary School, Newton	1
Battle Ground Elementary School, Battle Ground	1
Dayton Elementary & Jr. High School, Dayton	1
East Tipp High School, Lafayette R.R.	2
Klondike Elementary School, West Lafayette R.R.	2
Klondike High School, West Lafayette R.R.	1
Montonye Elementary School, Lafayette R.R.	1
Southwestern Jr. High School, Lafayette R.R.	4
Wainwright High School, Lafayette R.R.	2
Wea Elementary & Jr. High School, Lafayette R.R.	2
West Point School, West Point	2
Gilboa Elementary School, Gilboa	1
Remington Elementary School, Remington	1
Round Grove Elementary School, Brookston R.R.	2
Wolcott Elementary & Jr. - Sr. High, Wolcott	1
Eastlawn Elementary School, Burnettsville	2
East Twin Lakes Jr. High, Burnettsville	1
Lincoln Jr. High School, Monticello	4
Meadowlawn Elementary School, Monticello	1
Twin Lakes High School, Monticello	2
Woodlawn School, Monticello	1
Yeoman School, Yeoman	1
Warren Central Elementary, West Lebanon	1
Pine Village School, Pine Village	1

cont'd

Table 1 (cont'd.)

School	Number of Individuals Selected to Respond to Opinionnaire
Rainsville Elementary School, Attica R.R.	2
Williamsport School, Williamsport	1
Cumberland Elementary School, West Lafayette	1
Morton Elementary School, West Lafayette	1
West Lafayette Sr. High, West Lafayette	2
Dover School, Thorntown R.R.	1
Thorntown High School, Thorntown	2
Washington Township School, Lebanon R.R.	1
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Table 2

School Corporations Included in the Survey

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Attica Consolidated School Corporation
Benton Community School Corporation
Carroll Consolidated School Corporation
Clinton Central School Corporation
Clinton Prairie School Corporation
Covington Community School Corporation
Crawfordsville Community School Corporation
Catholic Schools of Lafayette Diocese
Delphi Community School Corporation
Frankfort Community Schools
Frontier School Corporation
Lebanon Community School Corporation
Logansport Community School Corporation
North Montgomery Community School Corporation
North White School Corporation
South Montgomery Community School Corporation
South Newton School Corporation
Southeast Fountain School Corporation
Tippecanoe School Corporation
Tri-County School Corporation
Twin Lakes School Corporation
Warren Central Consolidated School Corporation
Warren Community School Corporation
West Lafayette Community School Corporation
Western Boone Community School Corporation

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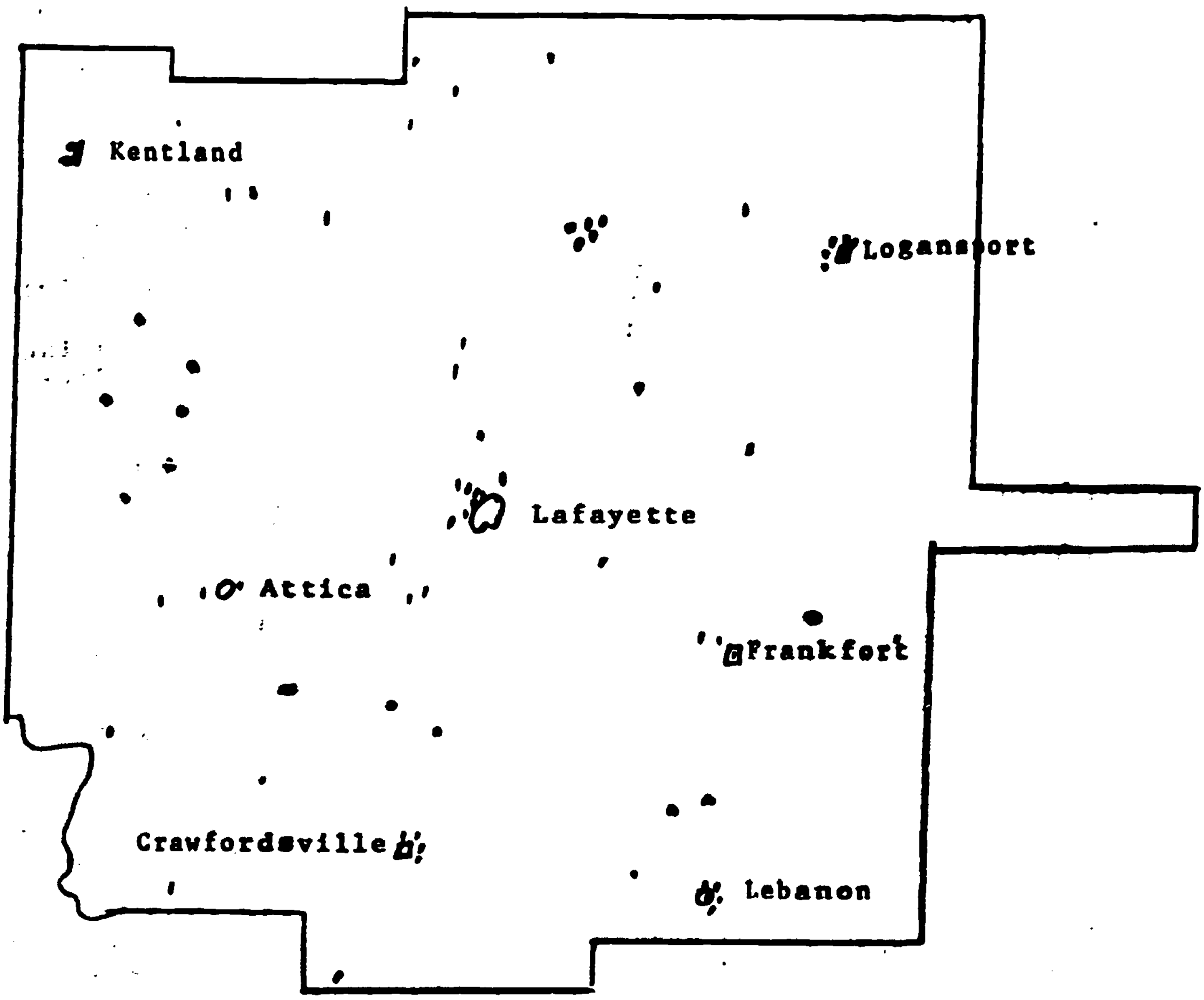
Figure 1



Scattergram of Schools Included
in the Survey

(Note: The boundry lines enclosed the geographical area served by the Wabash Valley Education Center. Each dot represents a school in which teachers who responded to the opinionnaire are located.)

Procedures Used in Data Collection

One hundred teachers were randomly selected from a roll of all teachers served by the WVEC during its first year of operation to respond to the WVECO. Each individual selected to respond to the WVECO was sent a letter which explained the purposes of the study and asked the individual to respond to the opinionnaire enclosed with the letter. A sample copy of the letter and the opinionnaire appears in Appendix A.

The letters and opinionnaires were mailed to the respondents at their respective school addresses. The material was posted on a Friday (April 10, 1970) and was expected to be in the respondent's hands by the following Monday (April 13, 1970). Each respondent was asked to complete the opinionnaire and return it to the WVEC via its delivery service or by mail using the postage paid envelope attached to the opinionnaire by Friday (April 17, 1970) of the same week.

In order to obtain a maximum return rate the opinionnaire ~~was brief.~~ It was constructed so that it could be easily responded to in five minutes.

On the Monday (April 20, 1970) following the Friday deadline for the return of the opinionnaires it was decided to send a follow-up card to each individual in the sample reminding them to return the completed opinionnaire if they had not already done so. No time limit was stated on the follow-up card but the investigators arbitrarily set May 1, 1970, as the last day returns would be counted in the analysis. This decision to send a reminder was made because by April 20 only 54 of the 100 respondents had returned the opinionnaire and the investigators felt more responses were necessary in order to draw appropriate inferences.

The follow-up notice generated 13 additional responses and provided a total response of 67. During the period between April 20 and May 1, 1970, the investigators were notified that four of the individuals selected to respond to the opinionnaire no longer taught at the schools where the opinionnaires had been sent. These individuals were unable to be traced and consequently were dropped from the sample. Other teachers from the population were not selected to replace these individuals. Thus, to the best knowledge of the investigators there were 96 possible respondents. Information for the study is based then on a 70 percent return of opinionnaires by respondents.

Instrument Used to Collect Data

One instrument was used to gather data for analysis. It was the Wabash Valley Education Center Opinionnaire (WVECO).

The WVECO was developed by three members of the WVEC staff -- the Director and two Program Specialists. The opinionnaire is not a published or copywrited instrument. It was developed specifically for this study and designed to elicit feelings or beliefs about the programs and services of the WVEC from individuals served by it. The WVECO is intended to be used to describe the impact made by the WVEC.

The opinionnaire contains 13 Likert-type response items and one "yes-no" response item. Each item asks a question about one or more phases of the WVEC. The respondent is asked to decide which of the responses best approximates his or her opinion regarding the question.

The items of the WVECO were developed through careful consideration of all programs, activities, materials and services of the WVEC. Once the questions were formulated and edited they were submitted to the professional staff of the WVEC for critique. The staff was asked to check to see if each question was clearly and succinctly stated and that it was unambiguous. They were also asked to see if the over-all opinionnaire would query potential respondents to an extent sufficient to determine the impact of the WVEC. The discharge of these requests by the staff resulted in the opinionnaire mailed to respondents.

Data Analysis Techniques

Data collected for this study via the Wabash Valley Education Center Opinionnaire (WVECO) was analyzed by simple nonparametric statistics. The nonparametric statistics appropriate for analyzing data collected from an opinionnaire are frequencies, percentage and means.

As the completed opinionnaires were received responses to each item were tallied to determine frequencies. When the tallying was completed the percentage of response for each choice or response option for each item was calculated. Percentages were calculated by dividing the number of responses per item choice or option by the number of total responses to the item. Percentages were calculated for all items on the opinionnaire.

Mean responses were calculated for those items which were amenable to this type of treatment. Twelve of the 14 itemss on the opinionnaire were of the type for which means could be determined. Those items for which means were not calculated were of the type which elicited a yes or no response or a qualitative response.

Respondents had a six choice response set for those opinionnaire items for which means were calculated. The response set was: Yes, definitely; yes, moderately; yes, somewhat; no, generally; no, definitely; and, no opinion.

To calculate a mean response for each item of the opinionnaire for which this response set was used, the choices were weighted. The choice "yes, definitely" was weighted 5, the "yes, moderately", 4 and so on to a weight of 1 for the choice "no, definitely". The choice "no opinion" was not assigned a weight because this response is not scalable in the same manner as the other responses. A "no opinion" response is a discrete response.

The technique used to calculate the mean item response was simply to multiply the choice weight by the number of responses to the choice, add the products and then divide that sum by the total number of responses to the weighted choices.

Findings

As noted in the Data Analysis Techniques section of this report, data collected were analyzed by means of frequencies, percentage and means. The number of respondents to the WVECO totaled 67. Not all 67 respondents responded to each of the items on the opinionnaire. Six of the 14 items were responded to by all respondents, the remaining items responded to by 66 of the individuals who returned the opinionnaire (see Table 3).

Table 4 shows the summary of responses to the opinionnaire in terms of frequencies (number of responses) and percentage. Each WVECO item is given separately followed by the response set, the number of responses to each category in the response set and the percentage for each response category.

Table 5 shows the mean responses to selected opinionnaire items. Twelve of the 14 items were amenable to calculation of means when weights were assigned to the various categories in the response set. The means range on a 5 to 1 point scale from 4.4393 for item 1 as a high to 2.5303 for item 5 as a low.

Table 3

Number of Responses to Opinionnaire
by Item

Item	Number of Responses	Item	Number of Responses
1	67	8	66
2	66	9	67
3	66	10	67
4	67	11	66
5	66	12	67
6	66	13	66
7	67	14	66

Table 4

Summary of Responses to Opinionnaire:
Frequencies and Percentages
N = 67

1. Do you think that the programs, activities, materials and services of the Wabash Valley Education Center make any positive difference in the education of the children you teach?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes, definitely	41	61.19	Generally no	2	2.98
Yes, moderately	17	25.37	Definitely no	1	1.49
Yes, somewhat	5	7.46	No opinion	1	1.49

2. Do you feel that motion picture films are a valuable instructional tool for your classroom?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes, definitely	47	71.21	Generally no	4	6.06
Yes, moderately	7	10.60	Definitely no	0	0.00
Yes, somewhat	7	10.60	No opinion	1	1.51

3. Do you feel that multi-media kits which include a variety of instructional resources and a topic guide are a valuable asset in the instructional processes of your classroom?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes, definitely	20	30.30	Generally no	4	6.06
Yes, moderately	17	25.75	Definitely no	2	3.03
Yes, somewhat	10	15.15	No opinion	13	19.69

4. Have you used any of the following A-V materials or equipment that is available from the Center: filmstrips, records, posters, audio-tapes, video-tapes, video tape recorders, projectors, cameras or equipment for production of transparencies for the overhead projector?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes	45	67.16	No	22	32.83

5. To what extent have you used the materials or equipment that are listed in item 4?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Very extensively	1	1.51	Seldom	11	16.66
Extensively	10	15.15	Never	16	24.24
Moderately	28	42.42			

6. Do you think that having the A-V materials and equipment, as listed in item 4, readily available for your use from the WVEC, enhances your instructional procedures or techniques and thereby affects the education of the children you instruct?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes, definitely	18	27.27	Generally no	3	4.54
Yes, moderately	15	22.72	Definitely no	2	3.03
Yes, somewhat	21	31.81	No opinion	7	10.60

Table 4 (cont'd.)

7. Have any of the seminars, workshops, conferences or meetings sponsored by the Center or led by its personnel caused you to change, modify or alter your instructional methodology to the degree that noticeable attitudinal change or better understanding evolved on the part of the students you instruct?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes definitely	6	8.95	Generally no	11	16.41
Yes, moderately	7	10.44	Definitely no	4	5.97
Yes, somewhat	21	31.34	No opinion	18	26.86

8. Did you work with any of the Center curriculum consultants, on a one-to-one basis, to help you resolve any instructional problems you faced in your classroom?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes, many times	3	4.54	Yes, 3 or 4 times	2	3.03
Yes, once	5	7.57	No	57	86.36

9. Do you feel, or have you noticed, any attitudinal change on the part of other teachers in your building regarding the availability of a wide range of supplementary instructional materials and services and their potential for making your and their jobs easier, more viable and allowing you to have greater educational impact on your students?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes, definitely	20	29.85	Generally no	7	10.44
Yes, moderately	16	23.88	Definitely no	1	1.49
Yes, somewhat	12	17.91	No opinion	11	16.41

10. Do you feel that the materials and services of the Center have significantly contributed to the improvement of learning and/or motivation for learning of the students you instruct?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes, definitely	31	46.26	Generally no	3	4.47
Yes, moderately	11	16.41	Definitely no	4	5.97
Yes, somewhat	15	22.38	No opinion	3	4.47

11. Have Center activities in the various curriculum areas been of any help to you personally in becoming a better informed, a more creative or innovative, or an improved classroom teacher?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes, definitely	11	16.66	Generally no	9	13.63
Yes, moderately	14	21.21	Definitely no	6	9.09
Yes, somewhat	23	34.84	No opinion	3	4.54

12. Do you think that the Center has demonstrated that it has made or shows potential for making a significant contribution toward improving education in the schools it serves to justify the expenditure of local tax money, to perpetuate it?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes, definitely	41	61.19	Generally no	4	5.97
Yes, moderately	12	17.91	Definitely no	2	2.98
Yes, somewhat	5	7.46	No opinion	3	4.47

Table 4 (cont'd.)

13. Do you think that your school corporation would be justified in expending funds for the use of materials and to obtain services that they possibly cannot provide for themselves and which could be shared with other school corporations?

Response Set	No. Responses	Percentage	Response Set	No. Responses	Percentage
Yes, definitely	42	63.63	Generally no	3	4.54
Yes, moderately	10	15.15	Definitely no	2	3.03
Yes, somewhat	6	9.09	No opinion	3	4.54

14. Do you feel that your school corporation should financially support the Center to the extent that the Center could maintain curriculum consultants who would provide leadership and assistance in in-service training and be of assistance to teachers in helping them resolve instructional problems?

Yes, definitely	17	25.75	Generally no	12	18.18
Yes, moderately	18	27.27	Definitely no	5	7.57
Yes, somewhat	10	15.15	No opinion	4	6.06

Table 5

Mean Responses to Selected
Opinionnaire Items (Weighted)

Item	Yes Definitely 5	Yes Moderately 4	Yes Somewhat 3	No Generally 2	No Definitely 1	Mean Response
1		x				4.4393
2		x				4.3538
3		x				3.9245
5				x		2.5303
6		x				3.7457
7			x			3.0000
9		x				3.8392
10		x				3.9687
11			x			3.2380
12		x				4.3437
13		x				4.3809
14			x			3.4838

Summary and Conslusions

The followingsix points are a summary of the data collected via the WVECO.

1. Ninety-four per cent of the teachers surveyed felt that the Wabash Valley Education Center made a positive difference in the education of the children they taught.

2. Ninety-two per cent of the teachers surveyed felt films were a valuable classroom instructional tool.

3. Sixty-seven per cent of the teachers surveyed have used A-V materials and equipment available from the Wabash Valley Education Center and feel that they were definitely beneficial to their instruction.

4. Most all of the teachers surveyed believed that the Wabash Valley Education Center has had significant impact in causing them to improve their instructional methodology, make them better teachers and consequently improve the learning environment for the children they instruct.

5. Eighty-six percent of the teachers feel that the Wabash Valley Education Center has been of significant help to them and that tax monies should be provided to maintain it.

6. Over two-thirds of the teachers surveyed believed that the curriculum consultants have been of significant help to them and that the consultants should be maintained by the Wabash Valley Education Center and supported financially by the schools.

As a result of the investigation it may be concluded that the Wabash Valley Education Center has made a definite impact in the are that it serves both through its instructional materials center and with its curriculum improvement services. The results indicate also that an overwhelming number of teachers believe that local tax monies should be provided to maintain the Center. This is followed by an indication of significant support by the respondents for the notion that schools should expend some of their funds to perpetuate the Center.

No implications are drawn or recommendations made for the reader. The reader is asked to do this for himself. Implications were not drawn or recommendations made because the project staff conducted the survey as an in-house excercise. It was not commissioned necessarily by the Governing Board or the Executive Committee. In the final analysis, maybe the implications and recommendations are best left to these groups.

APPENDIX

WABASH VALLEY EDUCATION CENTER
500 By Pass 52 West - University Square
West Lafayette, Indiana 47906

April 10, 1970

Dear Teacher:

The Wabash Valley Education Center is conducting a survey to determine the impact of its services and programs. You have been randomly selected from some 4,000 teachers throughout the area served by the WVEC to respond to the enclosed opinionnaire.

The information gleaned from the returned opinionnaires will be used as part of a final report prepared by the Center to be submitted to the U. S. Office of Education and the State Department of Public Instruction. Such a report is required of all federally funded projects upon termination of federal funding. No individual, school or school corporation will be identified in the report of this survey. The essential and fundamental purpose of the survey is to determine the perception of impact that the Center had by teachers who have had the opportunity to be served by it.

The opinionnaire only takes a few minutes to complete. So, won't you take those few minutes <u>now</u>? You are requested not to sign your name or write your school and corporation number on the opinionnaire. However, if you wish to make a statement about the programs and services of the Center or any other comments over items not covered in the opinionaire, please feel free to do so. If you do, please use a separate sheet of paper.

The enclosed opinionnaire is to be <u>completed</u> <u>and</u> <u>returned</u> to the Center <u>by Friday</u>, <u>April 17, 1970</u>. Please use the enclosed postage paid envelope to return the opinionnaire either through the Center's delivery system or via the U.S. mail.

Your help and cooperation in the conduct of this survey is greatly appreciated. Only through your efforts and others like you, can the survey be a success.

Sincerely

/s/Harry O. Leader /s/William R. Wright

Harry O. Leader
Program Specialist

William R. Wright
Program Specialist

bb
enclosures

Appendix A

WABASH VALLEY EDUCATION CENTER

OPINIONNAIRE

DIRECTIONS: For each of the following questions, place an X on the line before the answer that best approximates your opinion regarding the question. Be sure to respond to all items.

1. Do you think that the programs, activities, materials and services of the Wabash Valley Education Center make any **positive difference** in the education of the children you teach?

_____Yes, definitely _____Yes, moderately _____Yes, somewhat

_____Generally no _____Definitely no _____No opinion

2. Do you feel that motion picture films are a valuable instructional tool for your classroom?

_____Yes, definitely _____Yes, moderately _____Yes, somewhat

_____Generally no _____Definitely no _____No opinion

3. Do you feel that multi-media kits which include a variety of instructional resources and a topic guide are a valuable asset in the instructional processes of your classroom?

_____Yes, definitely _____Yes, moderately _____Yes, somewhat

_____Generally no _____Definitely no _____No opinion

4. Have you used any of the following A-V materials or equipment that is available from the Center: filmstrips, records, posters, audio-tapes, video-tapes, video tape recorders, projectors, cameras or equipment for production of transparencies for the overhead projector?

_____Yes, definitely _____Yes, moderately _____Yes, somewhat

_____Generally no _____Definitely no _____No opinion

5. To what extent have you used the materials or equipment that are listed in item 4?

_____Very extensively _____Extensively _____Moderately

_____Seldom _____Never

6. Do you think that having the A-V materials and equipment, as listed in item 4, readily available for your use from the WVEC, enhances your instructional procedures or techniques and thereby affects the education of the children you instruct?

_____Yes, definitely _____Yes, moderately _____Yes, somewhat

_____Generally no _____Definitely no _____No opinion

7. Have any of the seminars, workshops, conferences or meetings sponsored by the Center or led by its personnel caused you to change, modify or alter your instructional methodology to the degree that noticeable attitudinal change or better understanding evolved on the part of the students you instruct?

____Yes, definitely ____Yes, moderately ____Yes, somewhat

____Generally no ____Definitely no ____No opinion

8. Did you work with any of the Center curriculum consultants, on a one-to-one basis, to help you resolve any instructional problems you faced in your classroom?

____Yes, many times ____Yes, 3 or 4 times ____Yes, once ____No

9. Do you feel, or have you noticed, any attitudinal change on the part of other teachers in your building regarding the availability of a wide range of supplementary instructional materials and services and their potential for making your and their jobs easier, more viable and allowing you to have greater educational impact on your students?

____Yes, definitely ____Yes, moderately ____Yes, somewhat

____Generally no ____Definitely no ____No opinion

10. Do you feel that the materials and services of the Center have significantly contributed to the improvement of learning and/or motivation for learning of the students you instruct?

____Yes, definitely ____Yes, moderately ____Yes, somewhat

____Generally no ____ Definitely no ____No opinion

11. Have center activities in the various curriculum areas been of any help to you personally in becoming a better informed, a more creative or innovative, or an improved classroom teacher?

____Yes, definitely ____Yes, moderately ____Yes, somewhat

____Generally no ____Definitely no ____No opinion

12. Do you think that the Center has demonstrated that it has made or shows potential for making a significant contribution toward improving education in the schools it serves to justify the expenditure of local tax money to perpetuate it?

____Yes, definitely ____Yes, moderately ____Yes, somewhat

____Generally no ____Definitely no ____No opinion

13. Do you think that your school corporation would be justified in expending funds for the use of materials and to obtain services that they possibly cannot provide for themselves and which could be shared with other school corporations?

____Yes, definitely ____Yes, moderately ____Yes, somewhat

____Generally no ____Definitely no ____No opinion

14. Do you feel that your school corporation should financially support the Center to the extent that the Center could maintain curriculum consultan[ts] who would provide leadership and assistance in in-service training and be of assistance to teachers in helping them resolve instructional problems?

____Yes, definitely ____Yes, moderately ____Yes, somewhat

____Generally no ____Definitely no ____No opinion

HAVE YOU ANSWERED ALL QUESTIONS?

NOTE: Please use the enclosed envelope to return this opinionnaire to the Wabash Valley Education Center through the Center's delivery system or by U.S. mail. Your cooperation and assistance is sincerely appreciated.

Please return by April 17, 1970

SECTION III

SUBSECTION A

Inservice Program Planning and Implementation Section

Program Specialists: William R. Wright
Harry O. Leader

Rationale and Objectives of the IPPI Section

The IPPI section was an addition to the Wabash Valley Education Center during the Center's third year of operation. It was instituted during the closing months of the 1969 fiscal year and was made operational at the outset of the 1970 fiscal year. The IPPI section was created to help fill a void in the current elementary and secondary educational structure in the area served by the Center that was readily apparent to the professional staff members of the Center. The perceptions of the problem held by the staff were verified and substantiated by a majority of the members of the Center's Governing Board. The void seen by both groups was the general lack of planned and coordinated in-service training programs for teachers.

Taking a lead from the Indiana State Plan, Title III, the staff of the Center developed an organizational structure and formulated operational plans for the IPPI. Basic to these were the notion that the staff of the section would work to motivate the formulation of programs at the local education agency level that would translate the identified needs of the agency into viable, and hopefully, ongoing in-service programs.

IPPI Section Organizational Structure

During its operational year the section was staffed by two professionals and a clerk-typist who was shared with the Social Studies Consultant. In the hierarchical administrative structure of the Wabash Valley Education Center, the two professionals in the section, titled Program Specialists, are in staff positions. The two positions were similar in all respects with regard to the hierarchical structure of the Center. They differed only in the special and exceptional talents of the individuals who staff the positions.

<u>Functions</u>

The IPPI provided leadership and stimulation in in-service program planning and coordination. The staff of the section worked closely with the superintendents, principals, and teachers of cooperating school corporations to assist the respective person or groups to plan, carry out or conduct in-service programs structured to meet specific needs in a school corporation.

For the IPPI, leadership was tied to planning. The IPPI worked closely with the other sections, departments and divisions of the Center in order to be completely informed about the services they provided and the activities they sponsored or directed. This close liaison with the professional staff of the Center allowed the IPPI to offer appropriate suggestions during in-service program planning sessions that stimulate the use of all Center services by cooperating school corporations. In a similar fashion, but to a lesser extent, the IPPI had liaison with the personnel of the Curriculum Division of the Office of the State Superintendent of Public Instruction.

As leadership was tied to planning in the IPPI, so stimulation was tied to coordination. The staff of the IPPI systematically visited the cooperating school corporations and through such visits attempted to stimulate in-service programming. With the stimulation went the offer to coordinate and to help organize the program.

Activities

The following is a list of the activities of the IPPI section. Two of the major activities of the section were special projects. One was the coordination and supervision of the preparation of a PERT report for the Wabash Valley Education Center and the other was the coordination and supervision of the preparation of this report. Since the PERT for the Center has been submitted, it will not be included in this report. But, to provide the reader with a sample of the type of PERT designed for the Center, the chart for the IPPI section is included in this report. The PERT chart and associated explanation sheets for the IPPI section follow.

A major activity in the research area that was undertaken by the IPPI section was the conduct of a study regarding the personal and situational variables of teachers as related to teacher utilization of films obtainable from the Instructional Materials Center of the Wabash Valley Education Center. The results of the study are detailed in other segments of this report and consequently will not be detailed here. (See comments in the following sections of this report: <u>Studies Commissioned by the Wabash Valley Education Center</u> and <u>Instructional Materials Center</u>.)

The IPPI surveyed the current literature in education and conducted research. These activities were vital and necessary if the IPPI section was to achieve any measure of success in the services it offered. The IPPI section also handled several special projects. These projects are included in the listing of activities.

Completed IPPI Activities (From July 1, 1969 to February 1, 1970)

(Note: Only major activities that have been undertaken and completed will be listed. The incidental, specific or preparatory activities related to any of the major activities as either prerequisites or follow-up will not be mentioned.)

1. The IPPI worked with the staff of the respective Center sections, divisions or departments in preparing and developing project PERT charts. The IPPI coordinated and supervised the preparation of the final PERT report which was submitted to the State Title III ESEA office. Work period: September 1, 1969 - November 1, 1969.

2. The staff of the IPPI visited all school corporations cooperating in the Center to explain and offer Center services and to assess and stimulate in-service programming. The visits included, in all cases, meetings with the superintendent and in some cases the meetings were also attended by other corporation administrators and/or teachers. Work periods: July 1, 1969 - September 30, 1969 and January 1, 1970 - March 31, 1970.

3. The staff of the IPPI conducted five in-service training programs on the topic of Writing Instructional Objectives in an equivalent number of school corporations.

Location	Date	No. of Attendees
Western Boone Corp.	Oct. 23, 1969	10
North White H.S.	Jan. 23, 1970	30
Attica Elem. School	Jan. 28, 1970	3
South Newton Corp.	Feb. 20, 1970	100
Stokes Elem. Sch.(Lebanon)	Mar. 17, 1970	18

4. The staff of the IPPI applied the first step in Systems Analysis (i.e., Needs Assessment) in four school corporations for a number of different groups in each corporation.

Location	Date	No. of Attendees
Western Boone Corp.	Sep. 15, 1969 (Adm.)	6
	Sep. 25, 1969 (Curr. Comm.)	12
Benton Comm. Corp.	Oct. 13, 1969 (Adm.)	10
Tri-County Corp.	Oct. 14, 1969 (Adm.)	6
	Nov. 11, 1969 (Curr. Comm.)	10
Waynetown School (N. Montgomery Corp.)	Mar. 16, 1970	21

5. The IPPI conducted three seminars on the "Role of The Principal" in three school corporations.

Location	Date	No. of Attendees
N. Montgomery Corp.	Nov. 19, 1969	9
Twin Lakes Corp.	Nov. 20, 1969	10
W. Lafayette Comm. Corp.	Apr. 6, 1970	6

6. The IPPI served as consultants for four school corporations to assist them in planning and organizing for curriculum improvement. These four school corporations were: Carroll Consolidated, West Lafayette, South Newton and Northwestern.

7. The IPPI assisted in the planning and did the coordinating for the Wabash Valley Mathematics Association meetings. During the year three meetings were held. They were as follows:

1. Date: October 29, 1969
   Program: The Role of Rigor in Presenting Mathematics
   No. of Attendees: 15
   Location: WVEC

2. Date: December 4, 1969
   Program: Preparing Instructional Objectives
   No. of Attendees: 25
   Location: Crawfordsville High School

3. Date: February 4, 1970
Program: Discussion of State Mathematics Guidelines. Preview math texts of adoption list.
No. of Attendees: 75
Location: Jefferson High School, Lafayette

8. The IPPI planned and provided the program for one school corporation's teacher-school board meeting. The meeting was at the Clinton-Prairie High School on October 28, 1969 and was attended by 90 individuals.

9. The IPPI planned and coordinated two rather extensive workshops. The first one listed below lasted one-half of a working day and the second listed below was an all-day workshop. Both of the workshops were on released time.

1. Date: February 11, 1970
Program: Annual Workshop, Logansport Association for Childhood Education: Mathematics
No. of Attendees: 200
Location: Franklin Elementary School, Logansport

2. Date: February 20, 1970
Program: South Newton Professional Growth Day
No. of Attendees: 110
Location: South Newton High School, Kentland

10. The IPPI section planned, coordinated and arranged meetings for principals, curriculum coordinators and other special interest groups to hear about Center programs and services. These meetings were held on a one shot basis throughout the year.

Assessment of the IPPI Section

The extent of the success or failure of the IPPI Section over-all, can only be discussed subjectively because of the limited time the section has been in operation. A period of one year is hardly ample time to make any stringent evaluations. Many things need to be considered before one can say that an activity has been successful or that it has been a failure. (Here activity is used in the context of its broadest meaning.) These things need to be studied carefully and subjected to rigorous tests. Due to the limited staff in the section and its responsibilities to the programs and services of the section, no stringent self-evaluation was undertaken. What can be said about the section's success or failure is limited to the staff's reflections about the subject. These reflections are presented below.

The IPPI Section has been both a success and a failure. Its success can readily be judged by a perusal of the list of the activities that have been successfully completed. The staff worked directly and indirectly in the field with many teachers and administrators. It provided assistance to schools that they would not have had had the section not been part of the WVEC. The IPPI staff conducted research for the WVEC that probably would not have been done had the section not been made part of the Center. Of course, the research conducted for the Center by the IPPI could have been contracted to an outside agency. But, this would have been expensive and the job might not have been done as satisfactorily as the IPPI staff did the job.

Comments made by the teachers and administrators about the programs and services of the IPPI Section were always very favorable and in a number of incidents even embarrassingly laudable. Thus, over-all the staff of the IPPI believe that the section has been successful in what it was able to do during its brief tenure.

It was noted that the IPPI Section was a failure. In a sense it was -- not because of the section *per se*, its staff or programs and services but because of time. There just wasn't enough time to do the things that needed to be done. The staff of the IPPI section would like to have worked with more schools but there wasn't enough time. They would have liked to have done more research but there wasn't enough time. They would like to have worked on more special projects but there wasn't enough time. How much time would have been needed? That is hard to say. Let it suffice to say that change in education takes years. Most authorities say 50 years.

Evaluation of IPPI Activities

It would be difficult to statistically evaluate the IPPI because of the nature of the type of service it provides. As was noted above in the section "Assessment of the IPPI Section", really only subjective evaluation can be made. For a number of activities, the Final Report for one, evaluation *per se* is inappropriate.

Evaluation of the IPPI Section activities when and where feasible, were done very simply. One of two approaches was used. Where the activity involved working with a group of people, they were asked to either give an oral report of their impression of the activity or asked to complete a "Post Meeting Response Sheet".

The typical response when either approach was used to gather an evaluation response was that the participants believed the activity was well managed, effectively done and worthwhile. Post Meeting Response Sheets were not distributed at the conclusion of each activity. For some activities it was an inappropriate way to obtain feedback.

A sample of the evaluation responses for some of the IPPI Section activities are included in Appendix A of this report.

Recommendations

The essential purpose for the origin of the IPPI Section was to fill a void in an area of services offered by a school corporation for its teachers; namely, in-service education programming and coordination. This void appears in most school corporations save possibly the very large metropolitan ones. For the rural type school corporation like those served by the WVEC the need for in-service programming and coordination is particularly evident. Thus, it is strongly recommended that the IPPI Section or a service like it, be continued.

The most obvious approach to continued funding of the type of services offered by the IPPI Section is through cooperative financing by the participating school corporations. For a minimal expenditure by each corporation the IPPI Section or something similar to it could be funded. The WVEC is a nucleus about which cooperation for funding the IPPI could be maintained and advanced.

SUBSECTION B

Instructional Materials Center

I. Philosophy

The changing nature of modern society and the continually changing role of the schools have caused educators to reevaluate contemporary educational goals. One of the results of this reevaluation is the emphasis on the instructional materials center concept. This concept has been emphasized by numerous experts as one answer to the challenge of modern communications development and services.

The fundamental purpose of general education is to teach students to think -- to make wise judgments based upon accurate facts, clear reasoning, and understanding. The educational responsibility now placed on more and more students for self-direction, self-learning, and self-evaluation clearly makes the services of an instructional materials center almost imperative. Newer modes of teacher and student deployment, with new roles for each, in the learning process are becoming common characteristics of up-to-date and viable schools.

Teachers and material specialists have worked together and are deeply involved in reviewing and evaluating modes of teaching and learning in all content areas. For example, curriculum content studies, like Project Social Studies, have developed a core of materials for classroom use. Among the materials are such things as films, filmstrips, books, tapes, and laboratory materials which have been made available for national distribution and consideration by materials specialists. A number of the publishing companies have provided examination copies for evaluation by the Center. These resources are used by the curriculum specialists and classroom teachers for the improvement of instruction in the various curricular areas.

The philosophy of the Instructional Materials Center (IMC) of the Wabash Valley Education Center is to support "Recommendation 28" of NEA's Projection on Instruction which suggests:

> In each school system there should be one or more well-planned instructional materials and resource centers, consisting of at least a library and an audio-visual center... These

centers should be staffed by persons who are adequately prepared in curriculum and instruction, in library service, and in audio-visual education.

This philosophy has been accepted by school people and communities in the area served by the WVEC and is reflected in many of the new schools in the area.

II. Rationale

The rationale for the establishment and perpetuation of professional services from an instructional materials center include three kinds of professional responsibility in educational media service:

(1) To place at the disposal of the teaching faculty all media technology, services, and systems which will enhance the effective communication of ideas in a pre-programmed phase of learning;

(2) to place at the disposal of the curriculum specialists in the schools and Center staff all media technology, services and systems which will enhance the effective communication of ideas in a self-programmed phase of learning; and

(3) to reinforce the importance of quality education for each child by showing the need for establishing and improving the materials centers in each of the schools of the area.

III. Objectives

On the basis of this rationale, as proposed initially in the operational proposal, the IMC serves the objectives of the total educational program of the cooperating schools of the area by:

1. locating, gathering, organizing, coordinating, providing, and distributing a rich variety of quality learning resources for use by teachers and students as individuals and in groups in support of the special curriculum projects as illustrative of a total materials program;

2. offering leadership in motivation, utilization, and experimentation in the best arrangements of materials for teaching and learning;

3. making available facilities, services, and equipment necessary for selection, organization, management, and use of learning resources;

4. furnishing facilities for, and assistance in, the production of instructional materials, displays, and demonstrations;

5. counseling and guiding teachers and curriculum specialists in terms of the best media or arrangement of media for the particular situation;

6. supporting the programs of the curriculum division of the Center with media materials, and audio-visual services;

7. encouraging and assisting schools to develop a more comprehensive resource center.

IV. Uses of the Instructional Materials Center

The IMC has been used by the schools cooperating with the Center to accomplish a number of things. They are: to provide complete media service where needed; to provide specialized equipment and materials needed to support the curriculum programs and goals of the Center; to produce and distribute charts, pictures, transparencies, slides, films, tapes, models, and realia; and, to locate, gather, organize, coordinate, and distribute the materials needed by teachers and pupils for the special curriculum programs.

During all or part of the three years of the Center's programs, the professional staff of the IMC has included the following personnel: a division chief; a media specialist; a graphics specialist; a research librarian; and an administrative librarian. They have selected, developed and provided those materials, equipment, and services needed to support the instructional programs of the schools. The non-professional staff (secretaries, clerk-typists, and transportational personnel) required to support the professional staff was also provided.

V. Recommendations

Justification for the existence of regional resource centers has been accentuated by the release of the new standards established by the joint efforts of AASL and DAVI. The new standards suggest that a working relationship be instituted between a regional center and individual schools to satisfy the following recommendations for a basic collection in schools of 250 students or over:

1. ready and unlimited access to a minimum of 3,000 titles of 16mm films;

2. 2,000 transparencies and transparency masters;

3. 200 - 1,000 titles in a professional collection; and

4. 40 - 50 professional magazines and journals.

Considering the cost and the large number of films recommended, no one school corporation, with the exception of large urban areas, can afford the recommended film library. The materials alone would require an investment of over a half million dollars. In addition, most corporations do not have the capability of selecting, processing, scheduling, repairing, and maintaining such a library. Having access to a regional library which includes the above items would provide the availability of these necessary resources. Frequency of use is limited only by the number of materials and the demand of other participating schools.

Experience over the past few years has demonstrated that teachers realize the value of a variety of media and materials. Teachers have indicated that the proper use of a 16mm film augments and supplements the learning process in that it:

1. inspires involvement in discussions and inquiry;

2. improves the depth of a child's perception, feelings, and expression;

3. motivates creative responses;

4. appeals to visual and auditory senses;

5. allows the child to experience the geography and cultures of other countries; and,

6. provides the opportunity to witness scientific experiments and procedures which would otherwise be impossible.

A regional center provides an unparalleled opportunity to coordinate curriculum and materials and to encourage the proper use of supplementary materials. In addition, the training of teachers in the preparation of instructional materials for classroom use and in techniques of media utilization and operation of equipment can be implemented.

VI. Summary of Major IMC Activities

1. Using the new media guidelines, the IMC provided a team of consultants to assist schools in developing a comprehensive local resource center. The primary objective of this assistance was to enable school resource people to more effectively support teachers in their present curriculum program as well as to provide assistance to teachers in stimulating innovative approaches to

instruction. In addition, assistance was provided in several limited areas: selection of materials and equipment; arrangement of facilities; procedures for circulation of materials; and evaluation of existing media programs.

2. To more effectively define and solve this task, schools were introduced to an emerging process of program improvement. Individuals in the field of education are becoming increasingly aware that a systematic approach to problem solving is most essential. This "systems approach" employs the procedures utilized in business and industry. A team of qualified specialists trained and assisted administrators and teachers in the implementation of this approach.

3. The IMC supplied materials and services that were not readily accessible or available through the local resource centers. The services included a preview center for newly published library books, filmstrips, and other materials; a distribution system for supplementary materials; a production center for audio-visual materials not locally accessible; and, a training program designed to aid teachers in the production and utilization of materials.

4. The IMC encouraged and promoted better working relationships between teachers and their own local resource centers. Assistance was also provided for the development of resource kits, production audio-visual materials, and programs, materials, and facilities for individualized instruction.

5. An awareness of the value and cost of a regional resource center is essential among participating school corporations and their administrators, school boards, and school patrons. The increased demand for materials, particularly films, required them to determine the method and extent of support for continued operation. The IMC assisted the director to stress the need for local support of a regional resource center. Without adequate financial support, the present level of operation cannot be maintained.

6. During the three year operational period several of the schools developed new or remodeled library facilities. As a result, requests were made for IMC staff to tour the facilities and then discuss any problems which might have been encountered. From these visits came suggestions for more efficient utilization of facilities as well as ideas to resolve problems encountered by the school library staff.

Such visitations were made to Benton Central, Hershey, Lebanon Junior High, Morton, Fountain Central, Remington, and Jefferson High School.

Another visitation was held in relation to the regional librarian's meeting held at the Kingston school. The IMC was asked to provide specific materials for this meeting and also to provide information on both the physical (displays) and structural aspects of this meeting.

7. With the release of the new DAVI/AASL Standards for School Librarie attention has been focused on both facilities and materials for school media centers. Both school IMC personnel and administrators have expressed concern over the interpretation of these standards in relation to their respective programs.

As a result, the Center IMC personnel constructed an IMC survey form. This survey was designed to allow Center IMC staff to obtain information pertaining to the facilities, programs and services of school media centers. From this information a report containing suggestions for capitalizing on strengths and improving weaknesses was prepared and submitted to the superintendent, principals and school media staff. In addition, charts comparing individual school media center figures to state and national figures in the areas of staff, facilities, materials and expenditures were supplied.

Such surveys were compiled for four corporations: Lebanon, Benton, West Lafayette, and Covington.

In conjunction with this, several requests were received for information on the construction or remodeling of school media centers. As a result, a design and facilities portfolio was compiled which provided: actual blueprints and/or floorplans of model IMC's; information on services and programs to be incorporated; handbooks of exemplary IMC's; and, information on facilities and design. This portfolio was circulated five times.

8. During the three years, an IMC Committee, which was comprised of one representative from each school corporation, met once each month. The representatives were either media personnel or those interested in media. The original purpose of the committee was to aid in the formulation of policies and procedures for the IMC. It was decided that during the third year the function of the committee would be altered. Since the

IMC was operational, the committee turned its attention to common problems faced by the individual school media centers. These problems were discussed via panels and/or guest speakers. Fourteen meetings were held with a total attendance of 181.

9. In organizing any library it is apparent that several tasks are basic and essential. The IMC library was no exception and thus the following routine activities were performed.

   a. Selection Policy -- includes the philosophy of selection for WVEC and procedures for selection.
   b. Censorship Form -- designed to ascertain the specific complaint. Removal of material denied without this form. This and the selection policy were circulated four times as models for schools preparing their own such forms.
   c. Publishers and Equipment Catalog File -- designed to fulfill requests (both staff and school) pertaining to the need for up-to-date information on materials and equipment.
   d. Procedure Manual -- prepared in order that all routine activities would be performed identically regardless of the personnel involved. The manual includes information on the organization of all IMC activities and outlines the procedures to be followed on each activity (scheduling, processing, inspection, cataloging, etc.)
   e. Union Card Catalog -- organized for staff members, for teachers visiting the Center and as a complete record of the IMC holdings. Subject, author and title cards are interfiled. The cards are color keyed by media type to allow the user to ascertain what types of media are available on any given topic.

10. For some teachers, using the card catalog at the Center each time they needed something was impossible. Thus, to facilitate utilization of Center materials catalogs and supplements listing the materials and their numbers were issued to each teacher.

    During the first year, three supplements were issued listing the films procured during that period. At the end of the first year and into the summer a catalog listing all materials housed in the IMC was prepared and then issued in the fall of the second year.

During the third year two IMC supplements were prepared and distributed to teachers along with a special supplement for language arts materials.

Since several supplements to the first year catalog have been prepared and issued, a new general catalog of IMC materials is being prepared and will be issued mid-summer after the third year.

11. To fulfill requests from teachers and administrators for information on specific topics, numerous bibliographies were prepared. The bibliographies were of two types: (1) listings of materials obtainable from the WVEC; and (2) listings of materials commercially available.

12. The following numbers of materials were catalogued during the three year period:

Films	1839
Books	972
Curriculum Guides	200
Audio Tapes	182
Transparency Masters	350 sets
Diazo Transparency Master Books	19
Study Prints	85 sets
Models	23
Commercial Kits	50
Maps or Charts	25
Multi-media Kits	29
Video Tapes	15
Filmstrips	24
Educational Games	5
Records	5
Slide Sets	8 (479 slides)
Special Education Materials	89 items
Consignment Films (some of these were purchased and are therefore included in the 1839 total owned film titles catalogued)	1292

VII. Evaluation of Instructional Materials Center Activities

The activities of the personnel of the IMC were directed toward providing materials, services, and workshops for cooperating schools. The evaluation of the most significant activities are as follows:

1. The largest single activity of the IMC was the selection, procurement, cataloging and distribution of instructional 16mm films. The IMC now contains a film library of approximately 2,500 films of which 1,900 are owned by the Center. Approximately 2,100 films were loaned to the WVEC by Bailey-Film Associates, Coronet, Encyclopaedia Britannica, McGraw-Hill, Sterling and Universal during the three years of Center operation. The films loaned by the companies listed were to be used by teachers and subsequently evaluated by them so that the good ones could be acquired by the Center when further funds became available.

During the first year of operation (1967-68) there were a total of 29,014 requests for films. The IMC was able to schedule 20,491 of these requests for delivery which represented a 70 per cent request satisfaction. Based on reports by other regional film centers this percentage of utilization represents a high degree of success. However, during the second year (1968-69) of operation the IMC attempted to increase its first year percentage by obtaining selected duplicates of films and by improving the efficiency of the scheduling and delivery service. Results of the increased efforts were rewarding; during the second year 81.9 per cent of 49,883 requests were fulfilled. That is, the films were used 40,858 times during the second year. In comparison, through January of the third year 32,324 films were requested of which 26,231 were delivered, for a 81.2 per cent utilization rate. Complete utilization figures will not be available until the fall of 1970.

On the basis of information available through January 1969, a rough estimate of film usage may be made. Assuming that the average class size is 25-30 pupils, a child in the average classroom has been shown a minimum of six films during the first semester if each film has been shown only one time. However, teacher response has indicated that a film scheduled to an individual school may be shared by more than one teacher. In addition, many teachers, particularly in secondary schools, may show the film to several sections.

2. To facilitate the selection and purchase of filmstrips by the individual cooperating schools, the major producers of filmstrips -- Bailey Films, Encyclopaedia Britannica, Jam Handy, and McGraw-Hill -- loaned the Center their complete collections of filmstrips. These filmstrips were

available for viewing and evaluation by the classroom teachers. In the 1967-68 school year, 682 sets of filmstrips were previewed. A conservative estimate of four strips per set would result in 2,728 total filmstrips previewed. In contrast, during the second year (1968-69) 1,229 sets, or 4,916 filmstrips, were previewed. At the beginning of the third year the filmstrip companies, noted above, felt that sufficient time had elapsed for the majority of teachers to preview filmstrips that they had loaned to the Center and thus recalled all of their filmstrips. The McGraw-Hill filmstrips, however, remained as a permanent section of the Center by virtue of a purchase-bonus. As a result, utilization figures are supplied for September-December only of the third year (315 sets/1260 strips). The IMC realizes that a majority of these were viewed with no intent of purchase; however, a study on a random sample conducted at the end of the 1967-68 year indicated 16 per cent of the schools had increased the size of their filmstrip library as a result of the WVEC preview library.

3. The professional library of the IMC has grown each year to the point that it now has approximately 2,500 books, monographs, and pamphlets. Additional volumes and monographs were available from the Curriculum Division. The professional library was designed to supplement the Curriculum Division's activities and to promote the professional growth of teachers and administrators. Since only a few teachers were aware of the professional library during the first year of operation, no records of use were kept or reported. During the second operational year (1968-69), 699 volumes were circulated to schools. Through December 1969 of the third year 288 volumes were used.

4. During the first year of operation of the IMC, a research librarian developed 28 resource kits. The kits were developed and initiated from special requests by teachers. The kits not only provided a bibliography of available materials from a variety of sources, but also contain outstanding films, filmstrips, pictures, pamphlets, books, and realia for classroom use. During the summer and fall semesters these kits were requested a total of 156 times. Since the kits circulate for extended periods of time, this represents almost continuous use. During the second year they were utilized 218 times and, in comparison, 98 times through December of 1969,

5. From the beginning of the second year of operation of the IMC, sets of transparency masters, science models, and study print sets were requested 869, 232, and 233 times, respectively. In comparison, during the first part of the third year (1969-70) these figures were 120, 130, and 294. Since most of these items were purchased after the first year, no usage figures can be supplied for that period.

6. A variety of other media services have been performed for schools when these services were not available at the individual schools.

   Through April 1970 these were:

a.	Film inspection for school-owned films	217
b.	Audio-tape duplication	1256
c.	Days of VTR utilization (53 occasions)	112
d.	Miscellaneous media items (production)	1741
e.	Video-taped lessons and educational programs (production)	5
f.	Programmed self-instruction kits (production)	3
g.	Slide-tape lessons (production)	9

7. The professional staff of the IMC was available upon request for consultant services and for workshops at the schools. Since the beginning of the operation, a total of 84 workshops have been conducted and a total of 2,960 teachers have been served in these workshops. The nature of these workshops varied from techniques of media production and utilization to demonstration and selection of materials for classroom use.

8. An independent study analyzing the relationships between certain situational and personal variables of teachers and the utilization of 16mm films was conducted. A summary of the results and the implications can be found in the appendix.

   Another kind of workshop demonstrated how educators can use the video tape recorder to observe classrooms. Basic elements of interaction analysis were practiced. Subsequently, teachers, with or without supervision, employed the technique for self-improvement of their classroom performance.

Summary

Some general statements can be made of the Instructional Materials Center's accomplishments and deficiencies.

1. As a result of loans of media from the IMC, pupils in the area have profited from an expansion of the multi-media approach to instruction.

2. Teachers, principals, and superintendents have been up-dated concerning (1) instructional materials and devices currently available throughout the country; (2) the proper role of the instructional materials center in the school program; (3) the process of keying media usage to curricular content and to individual behavioral objectives for the pupil. As a result of interest created, the number of IMC's in schools served by the WVEC has been expanded.

3. Teachers have been stimulated to teach more creatively. This has been due to the direct efforts both by the staff and also through the common sharing of ideas by teachers engaging in joint enterprises sponsored by the Wabash Valley Education Center's IMC.

4. Schools have been assisted in thorough evaluations of their media programs. Likewise, teachers have been encouraged to gauge the results of their instruction against a criterion of behavioral objectives.

5. Some clients have been disappointed because the IMC has not attempted to purchase and circulate items such as audio-tapes, filmstrips, and records. This was, however, a deliberate omission. It was decided not to supply inexpensive items that might better be purchased by the individual schools. Items in these categories were included in the IMC library, minimally, for demonstration and preview purposes. Some teachers were disappointed that certain types of equipment, such as carousel slide projectors, were not available for loan. Not having the equipment available for loan was a matter of practicality and priority -- cost would have been prohibitive.

6. A longer loan period was sometimes needed so that the borrowed item would fit nicely into a teacher's lesson plan. To meet this need, double loan periods were approved when requested. If the loan period had been extended for all items the

percentage of satisfied requests would have decreased sharply. The reason for the decrease is obvious -- the number of duplicate copies held by the IMC would have been insufficient to meet requests.

7. As funds allocated for the maintenance and operation of the IMC were reduced, the professional and secretarial staff was reduced correspondingly, making impossible the completion of a series of multi-media kits and topical bibliographies. In addition, there was insufficient staff to counsel within all of the schools that requested such a service.

8. The great distance of the residences of some teachers from the Center made their visitations to the Center relatively impossible during the Center's regular hours. Thus, to be of help to these teachers Center hours were extended to 6:00-10:00 p.m. on Thursday evenings and 8:00-12:00 noon on Saturday mornings. This greatly alleviated the problem but did not eliminate it. In spite of teacher satisfaction with the extended hours, the reduction of funds caused the extension of hours to be ceased.

In spite of these shortcomings, it is the observation of the IMC staff that the aforementioned programs and services have been highly successful in meeting the stated objectives.

SUBSECTION C

LANGUAGE ARTS PROJECT

Rationale and Objectives

The changes in society require changes in the education of the individual. In recent years there has been a trend toward using the inductive teaching approach rather than establishing rules and procedures for students to follow in order to find "the answer" to a problem situation. Such terms as learning by discovery, inquiry, structure of knowledge, and "learning to think" are becoming more to more prevalent in the professional literature of today.

Through the use of the inductive approach, teachers and administrators need a better understanding of numerous basic underlying principles. First, the inductive, discovery approach requires that (1) the student must be an active participant in the learning experience rather than a passive recipient of another person's knowledge; (2) the teacher becomes one of the leaders of the group by guilding the learning experience through questioning, suggesting, and clarifying rather than dictating rules or procedures to follow; and (3) all people in education must be willing to look at the objectives of what they are attempting to teach and to evaluate student growth in terms of the established objectives. This indicates a need for changing the emphasis from content-centered objectives to student-centered objectives and a realization that the content per se is not an educational end, but is a means to an end such as "more effective communications." Facts are necessary but the organization and application of the generalizations are of greater importance. The educational goal is to assist the student in acquiring an operational concept of language arts as a functioning tool for all communication.

In the integrated language approach the major objective is to assist students to increase their ability to communicate both in written and oral form. In past years the language arts program has been split into a number of separate teaching areas as grammar, composition, speech, creative writing, reading, spelling, English, and listening.

The research that has been conducted in the language arts field has indicated that will all the training that students receive in the separate subject matter approach their ability to communicate orally, or in written form, does not greatly improve after several years of study. The transfer from factual knowledge to the application of communication skills is almost non-existent.

Business, industry, education, and other professional fields have in recent years again and again stated their need for people with improved ability to communicate with people. It appears that our present education system is not providing the personnel to meet the needs of present day society.

The integrated language arts program is an attempt to assist students to acquire skills in communication by teaching English, literature, and rhetoric (oral and written composition) is an integrated, functional, discovery approach. There is to be an attempt to help students acquire an understanding of the appropriateness of the language used in various situations. The emphasis is upon functional communication rather than a deductive "rule to follow" approach to the case of language.

This approach might mean a change in attitude on the part of teachers, curriculum directors, and administrators. Although many of the present objectives of the language arts are adequate, the approach to reaching the objectives are somewhat faulty. This necessitates in-service training to assist educators in accepting this change of attitude and approach to teaching.

SUMMARY OF MAJOR LANGUAGE ARTS PROJECT ACTIVITIES

Throughout the two school years the Language Arts project was funded, selected pilot teachers and met in monthly seminar sessions to assess new teaching techniques, discuss problems of implementation, suggest curriculum revisions, and exchange ideas. On certain occasions, well-known subject matter specialists were enlisted as consultants to brief teachers on recent trends in the field.

During the seminars much emphasis was placed on curriculum development utilizing the Nebraska Curriculum as a model. Not wishing to ignore other worthwhile contributions to the improvement of Lauguage Arts teaching, a number of others exemplary materials were also studied. Among these were certain materials developed by other Project English centers, such as the Euclid Center materials developed by Western Reserve University, the Project English materials developed at Purdue University, the University of Minnesota materials, the Carnegie materials, those from Northwestern, and others now extant and soon to become available. There were also certain well-planned commercial materials that were studied. Some of these were made available to the seminar participants for use on a trial basis, and numbers of them were stocked so that the teachers and schools which could not be included in the pilot program could check out items for examination.

A workshop was held for 60 teachers during the last 3 weeks of June 1968. Problem solving and inquiry techniques were utilized. The later portions of the workshop provided the participants with opportunities to implement the process models demonstrated and with time to work with pertinent materials.

The first week of the program was devoted to group process and sensitivity training. The groupings were random. It consisted of leadership training and presentation of models for inquiry activities and problem solving which could be emulated in the classroom or in professional meetings.

The last two weeks of the program was devoted to the discipline of English. Some consultant presentations of a general nature were made to joint sessions with all participants present.

Much of the second two weeks was devoted to small group activity for special interest groups. In them, teachers were given the opportunity to examine new curriculum materials and to select and revise portions which they wish to implement during the following year. Some of these groups were formed on the basis of the level at which the participants teach. Others devoted time to specific aspects of the integrated curriculum; for example, how to implement some aspects of modern linguistic theory into the present course of study. These small groups worked under the direction of the English consultant at the Center and an administrative assistant. The intention was to have all teachers taking part in the summer program actively employ some portions of the new materials in their classrooms next year.

LANGUAGE ARTS

Conferences, Workshops, and Seminars

Date(s):	September 7, 1968
Program Title:	Regional Language Arts Conference
Program Purpose(s):	To provide new methods of teaching to upgrade the teachers' classroom capabilities
Attendees (Type):	Teachers and Administrators
Attendees (Number):	33
Program Held At:	Attica High School

Date(s):	September 14, 1968
Program Title:	Regional Language Arts Conference
Program Purpose (s):	To provide new methods of teaching to upgrade the teachers' classroom capabilities
Attendees (Type):	Teachers and Administrators
Attendees (Number):	22
Program Held At:	Delphi High School

Date(s):	September 21, 1968
Program Title:	Regional Language Arts Conference
Program Purpose(s):	To provide new methods of teaching to upgrade the teachers' classroom capabilities
Attendees (Type):	Teachers and Administrators
Attendees (Number):	25
Program Held At:	Hershey Elementary School

Date(s):	September 28, 1968
Program Title:	Regional Language Arts Conference
Program Purpose(s):	To provide new methods of teaching to upgrade the teachers' classroom capabilities
Attendees (Type):	Teachers and Administrators
Attendees (Number):	26
Program Held At:	Laura Hose School

Date(s):	October 19, 1968
Program Title:	Language Arts Seminar--Secondary
Program Purpose(s):	Planning session for the Saturday seminars
Attendees (Type):	Teachers and Administrators
Attendees (Number):	14
Program Held At:	WVEC -- Lux Building

Date(s):	October 5, 1968
Program Title:	Regional Language Arts Conference
Program Purpose(s):	To provide new methods of teaching to upgrade the teachers' classroom capabilities
Attendees (Type):	Teachers and Administrators
Attendees (Number):	21
Program Held At:	Lebanon High School

Date(s):	October 12, 1968
Program Title:	Regional Language Arts Conference
Program Purpose(s):	To provide new methods of teaching to upgrade the teachers' classroom capabilities
Attendees (Type):	Teachers and Administrators
Attendees (Number):	19
Program Held At:	Benton Central High School

Date(s):	Bi-monthly November, 1968 - February 1969
Program Title:	Language Arts Seminar - Secondary
Program Purpose(s):	To acquaint teachers with Language Arts Curriculum materials available for their use and implementation
Attendees (Type):	Teachers and Administrators
Attendees (Number):	20 per session
Program Held At:	WVEC - Demonstration Room

Date(s):	Bi-monthly January-April 1969
Program Title:	Language Arts Seminar - Elementary
Program Purpose(s):	To acquaint teachers with Language Arts Curriculum materials available for their use and implementation
Attendees (Type):	Teachers and Administrators
Attendees (Number):	20 per session
Program Held At:	WVEC - Demonstration Room

LANGUAGE ARTS SUMMER WORKSHOP

Objectives Summers 1968 and 1969

1. Providing opportunity to increase background knowledge for teaching the three major strands of the Language Arts: i.e., Language, Composition, and Literature.

2. Providing opportunity for exploring and researching local or individual problems indentified by each participant or team.

   a. Participants should produce a useable instructional product which they will use in their classrooms during the forth-coming year.
   b. Participants should share this product in some way with the other members of this workshop.

3. Sensitivity Training

   a. Developing awareness of typical communications patterns.
   b. Developing skills for more effective interpersonal communication.
   c. Developing awareness of ways others perceive us, and awareness of the effects of these perceptions on children and co-workers.
   d. Developing an openness to feedback from others--teachers, students and others.

      1) skills in collecting feedback.
      2) skills in giving feedback.
      3) ability to "hear" or accept feedback.

4. Locating promising individuals who would be willing to serve as resource persons for further in-service training activities at the Center or in nearby areas.

5. Identifying model classrooms for the forthcoming year.

6. Building a reference file of materials developed by practicing teachers to meet actual teaching problems in the Language Arts.

Date(s): June 3-21, 1968; June 9-27, 1969

Program Title: Language Arts Summer Workshop

Program Purpose(s): See Above

Attendees (Type): Teachers

Attendees (Number): 42

Program Held At: Cumberland Elementary School (WLSC) - 1968
Purdue University - 1969

The Language Arts program as described in the preceding narrative was carried out during a two year period, 1967 to 1969. Every indicator used to gauge success or failure of the Language Arts project pointed to positive success of the program. Some of the indicators used were:

Participation by teachers in conferences, workshops and seminars;

Request from teachers, principals and superintendents for services related to the Language Arts; and

Response to questions e.g. Post Meeting Response Sheets.

The Language Arts project staff conducted a number of evaluation activities. Summaries from two of these activities can be found in Appendix B of this report.

Questionaires were completed before and after some programs to measure both teacher attitude and teacher performance. The information garnered from the questionaires indicated that the teachers gave a preponderance of positive responses to training programs in both the area of attitude change and performance change.

In summary, we have concluded that the objectives of the program were carried out during the two years that the program was funded. There was strong interest in the program by teachers and administrators at the time the funding was withheld.

Recommendations for the Language Arts project are as follows:

1. consider joint or cooperative funding of high level leadership in the field of Language Arts (consultants to work with teachers);

2. cooperative funding of multi-media for use by teachers in the thirty school corporations now served by the Center; and

3. the continuation of modest programs of research and development in the Language Arts.

SUBSECTION D

Special Education Project Report

I. Statement of Project Objectives

A. Assist special education teachers and therapists through recommendations for improving teaching techniques, managing classes, etc.

B. Conduct in-service education programs for regular and special class teachers and therapists, relating to special methodologies and curricula.

C. Work cooperatively with local and state department consultants and related personnel to develop instructional materials relative to the education of the handicapped and learning disabled children.

D. Assist in developing appropriate screening and referral procedures for children possibly needing special services.

E. Disseminate information to educators concerning new and promising approaches for teaching exceptional children.

F. Establish guidelines to develop appropriate materials concerning specific approaches to instruction.

G. Recommend promising programs and projects leading toward improved curriculum practices in the 12 counties served by the Wabash Valley Education Center.

H. Evaluate programs and services on a continual basis with appropriate recommendations for improvement.

I. Inform administrators of the availability of state and federal aid and assist in initiating proposals to secure funds for program development.

J. To supply information and guidance to those school administrators and boards who are interested in doing "something about special education" in their school systems but do not know where to begin or how to proceed.

K. For school corporations to cooperate in the operation of special classes (such as in the area of the trainable mentally retarded or the emotionally disturbed, where numbers in any given area are small) and in other special services (such as directors and psychologists or psychometrists).

L. To provide consultation for the mechanics of setting up the above-mentioned classes.

M. To help to determine how best to provide for the proper supervision of such a program as stated above.

N. To study the problems connected with setting up special classes, especially in those areas where the numbers of children are comparatively small. The problem-solving technique, force field analysis, might be most appropriate for this problem.

O. To increase the use of films, kits, and instructional aids by special educators.

P. To utilize to a greater extent the Regional Instruction Materials Center in Michigan. This will assist teachers and therapists in the operation of programs in the regular as well as in special classrooms.

II. Project Rationale

Particular Needs

Studies conducted in the Wabash Valley Education Center area indicate that many of the schools participating in the services of the Wabash Valley Education Center do not adequately serve the exceptional child. These surveys and the Purdue survey brought to light several particular needs of the 29 school corporations in the 12 counties now served by the Wabash Valley Education Center. In summary these particular needs are listed as follows:

A division of Special Education was felt to be a very high priority item for the Wabash Valley Education Center due to the fact that there were no other agencies to serve the schools in this field.

Particular Needs: There is need for the following programs:

A. A survey to determine the actual number ages and levels of physically and/or mentally handicapped children in many communities and the need to determine the kinds of special services necessary to provide adequate programs for them;

B. To consult and assist teachers and supervisory school personnel in the creation or adaptation of certain materials for use with handicapped children and youth.

C. To provide teachers with direction in designing, preparing, and utilizing materials in varied approaches for most effective classroom instruction.

D. To acquire, catalog, and disseminate information concerning the availability, nature, use, and cost of materials to teachers and therapists.

E. To conduct workshops and in-service education programs for special teachers and therapists, by demonstrating the use of new materials, and sharing teacher ideas, etc.

F. To observe and consult with teachers and therapists in the classroom and to make appropriate recommendations as to specific material and media in that setting.

G. To serve as liaison between school personnel and the State Department Consultant for Instructional Materials and other services such as the ERIC Center for Educational Information on the Handicapped.

H. To develop guidelines, papers, and other pertinent sources of information concerning procurement, use, and evaluation of materials.

III. Materials and Media Consultants Activities

The following commercial materials have been added to the Special Education library:

1. Peabody Language Development Kit, Level #P; American Guidance Service

2. Peabody Rebus Reading Program Supplementary Lessons Kit; American Guidance Service

3. Beginning Functional Basic Reading; Stanwix House

4. A Functional Basic Word List for Special Pupils; Stanwix House

5. On Their Way; Stanwix House

6. Self-Instructional Basic Mathematics, Level 1; Electronic Futures, Incorporated

7. Phonics, Level 1; Electronic Futures, Incorporated

The following commercial materials had been donated to the Special Education division of the Center and incorporated in its library:

1. "Spelling Learning Games," Kits B and D; Lyons and Carnahan

2. "Phonics We Use", Learning Games Kit; Lyons and Carnahan

3. Peabody Rebus Reading Program, Workbooks 1, 2, and 3; Readers 1 and 2; Teacher's Guide (1 copy each); American Guidance Service

4. The Open Highways Readers; Scott, Foresman & Company
Book 1, Part 2
Book 2, Parts 1 and 2
Book 3, Parts 1 and 2
Accompanying Workbooks and Teacher's Guides

5. Book samples; Century Consultants
9 Books, 3 Teacher's Guides

6. Phonovisual Method; Phonovisual Products
Phonovisual Vowel Workbook (1 copy)
Phonovisual Consonant Workbook (1 copy)

7. Book samples; Lyons and Carnahan
9 Books

8. Workbook samples; Sullivan Programmed Reading Program
Reading Program
9 Workbooks, 6 Teacher's Guides

9. Workbook samples; Sullivan Programmed
Math Program
16 Workbooks, 1 Teacher's Manual, 1 Placement Examination Booklet

10. 5 Teacher's Guides to The Learning Skills Series
Webster Division, McGraw-Hill Book Company

11. Workbook samples; Allied Education Council
Fitzhugh Plus Program
10 Workbooks

12. Samples of Mott Basic Language Skills Program; Allied Education Council
16 Semi-programmed Workbooks
8 Teacher's Guides

13. Samples of You and Your World, Know Your World, and other magazines; American Educational Publications

14. Phonics We Use; Lyons and Carnahan
Teacher's Guides for Readiness Program, Books A-G

A nail board for teaching the process of carrying in addition for E.M.R. students was devised by Mrs. Housh, special education materials consultant, and Mr. Chuck Bryan, Wabash Valley Education Center audio-visual specialist. A package of the materials developed, including the nail board, tape-slide, 8mm movie and worksheets have been and hopefully will continue to be field-tested in intermediate classes for educable mentally retarded students. It is hoped that in the future there will be field-testing in regular primary classes and with older trainable mentally retarded students.

We feel that development of materials such as this will benefit teachers in many ways. First, the nail board kit itself may be used by teachers in teaching children the process of carrying. Second, teachers can increase the effectiveness of this kit by offering suggestions for refinement and improvement that will help their students learn more effectively. Third, we hope that teachers, by witnessing the effectiveness of teacher-made materials will be stimulated to try their own creativity in devising inventive instructional materials and to share their ideas and innovations with other teachers.

A book of teacher ideas for teaching reading (games, supplementary activities, etc.) which was compiled last year by Mrs. Geri Urich, Wabash Valley Education Center reading consultant, has been distributed to special education teachers and therapists. Teachers have found this idea book to be extremely useful.

With the cooperation of Mary Armfield, psychometrist with the Kokomo Center School Corporation, the special education section has established a file of teacher-made worksheets that can be reproduced and distributed to other teachers in the area. Mrs. Armfield and Mrs. Housh have refined and categorized those worksheets already received. Copies of all teacher-produced worksheets will be placed in each school served by the Wabash Valley Education Center by September 1971 so that teachers can reproduce them for use in their classrooms. It is believed that this plan will greatly benefit teachers since most of them now must spend an inordinate amount of time preparing and reproducing worksheets. By cutting down this time it is hoped that teachers will now have more time for effective planning.

Through the special education materials inventory we have assessed teachers' needs for various types of materials, so that the project staff could select those materials that would be most helpful to them. Many teachers sent in their ideas, as well as materials that they wanted to demonstrate for other teachers. By means of personal visits, the project staff learned more about these materials and ideas. Many teachers indicated, through their replies on the inventory, that they were interested both in giving and receiving information about methods and materials used by other teachers.

Many teachers also indicated on the inventories that they were interested in helping to evaluate commercial materials available through the Center, so that they would be better able to select materials to purchase for use in their classrooms full time. While the materials available from the Center were to be used as instructional aids, they were also to be used for preview. Teachers could not effectively evaluate materials during the one week allotted through the regular check-out service. Therefore, if a teacher was interested in evaluating materials rather intensively, they were checked out for a period of about three to four weeks and taken to the teacher where the media consultant explained how to use them most effectively. The teacher used them with her students and evaluated their usefulness with her particular group of children. Two purposes were served by this method: the teacher could determine if the materials are useful enough for her to recommend purchasing them, and the Center was better able to justify their use by other teachers with the same types of classes. This procedure enabled the media consultant to make recommendations that were then more helpful to other teachers. Evaluation of materials was also carried out by two speech therapists, one from Lafayette School Corporation, and one from Tippecanoe School Corporation.

The special education kit supplement and the special education film supplement developed by George Wallace were sent to special education teachers and therapists in September 1969. As new materials arrived and were catalogued, flyers were sent to all teachers describing the new items.

The special education division of Wabash Valley Education Center held two workshops during 1969-70. An orientation workshop was held November 1. Special education teachers and therapists in the area were given an opportunity to learn what the Center as a whole, and the special education division in particular, could do for them. A film concerning communication and involvement was shown; then the attendees and staff discussed ways in which they could communicate with and involve handicapped children in learning. Teachers were shown some of the ways overhead projectors can be used in a special classroom. Cindy Riggs, program director for the Comprehensive Association for Retarded Children in Monticello, demonstrated the Audio-Flash Card System, and the ways in which it can be used in speech therapy as well as in a class for the educable mentally retarded or in classes for other types of exceptional children. Jim Taylor, special education curriculum consultant, held a precision teaching section as a follow-up activity for those teachers who had attended the special education workshop held last summer.

The second workshop, which dealt with language development, was held in cooperation with the State Department of Public Instruction, Division of Special Education. Miss Carol Eby, Projects Coordinator, was quite helpful in making the workshop a success.

Evaluation of the workshop by teachers and therapists who attended indicated that this particular workshop, concentrating on a specific curricular area, was most effective. Many teachers had used the Peabody Language Development Kits, and they were interested in the rationale behind the development of these kits. Teachers seemed to gain a better understanding of the extensive development and field-testing that must take place to perfect special education materials. Teachers were also quite interested in the Peabody Rebus Reading Program, as many of them had not seen it before the workshop. Following the workshop, the media consultant had numerous requests to demonstrate the usefulness of this kit for speech therapists, as well as teachers of the educable mentally retarded, trainable mentally retarded, emotionally disturbed, kindergarten, and first grade.

Mrs. Housh and Mr. Taylor were able to attend some excellent workshops in the area during 1969-70. The first workshop they attended was the Visitor Orientation Program at the Purdue Achievement Center, September 23-24, 1969. Since that meeting, they have taken several teachers to visit the Learning Disabilities Clinic. Many have expressed interest in the steps to follow in having children admitted to the clinic for evaluation. As teachers became aware of the services available to them in this area as well as the methods of obtaining these services, they could more effectively meet the needs of their students.

On October 23, 1969 Mr. Taylor and Mrs. Housh attended a conference for teachers and therapists sponsored by the Division of Special Education, State Department of Public Instruction. They have also attended several staff meetings of the state department regional consultants for special education. They also have visited the Instructional Materials Center in Indianapolis several times. Visiting these centers has enabled them to meet the needs of teachers more effectively.

Mrs. Housh attended an excellent workshop on Developmental Training of the Handicapped at Wabash Center for Retarded Children on January 2, 1970. The sessions dealt with the Wabash Center Training Manual and its effective use, the rationale and methods of early developmental evaluation and training, and techniques of motor therapy. She ordered several copies of these manuals for teachers of the trainable mentally retarded and primary educable mentally retarded to use in planning developmental programs for their students.

In addition to attending staff meetings of special education personnel connected with the State Department of Public Instruction, Mrs. Housh has discussed specific projects and ideas with several consultants in various fields. At Mr. Leslie Brinegar's suggestion, Mrs. Housh wrote an article entitled "Our Exceptional Children", which was published in the spring issue of the Indiana Teacher. The article dealt with the needs of exceptional children, and the role teachers must assume in meeting those needs, particularly with the passage of mandatory special education legislation. Mrs. Housh spoke on this same subject for the Parent-Teacher Group of Daniel Webster Elementary School in Logansport, Indiana, on February 10, 1970.

Nancy Paras, state speech and hearing consultant, has been a great help to Mrs. Housh in learning about new methods and materials in that field. She has also discussed with Lon Woods, state consultant for the mentally retarded, some of the needs of these students in the state of Indiana.

At the invitation of Mr. Bill McKinney, Director of the Instructional Materials Center in Indianapolis, Mrs. Housh attended an institute on the development of tape-slide coordinated packages held in Marion on December 12 and 13. After hearing presentations of the rationale for developing tape-slide programs, each of the eleven participants selected a particular material to demonstrate via a tape-slide package. We met again March 20 in Indianapolis to revise our programs. The primary purpose of developing tape-slide coordinated packages is to enable teachers to see the various ways of using materials. The tape-slide can be shown to several teachers at one time, and can be distributed easily, quickly and inexpensively through the mail. The tape-slide package is so complete that a demonstrator need not be present to show the item. Mrs. Housh's particular package was the presentation of the Peabody Rebus Reading Program.

The tape-slide package is now completed. The March 20 meeting gave all participants an opportunity to show their packages and suggest revisions for all 11 productions. The final production phase took place in May. At that time, a professional announcer recorded the tape, and background music was included. The tape and slides have been fully coordinated. The tape-slide packages will be available for distribution through the Indianapolis Instructional Materials Center, Office of the Superintendent of Public Instruction, in the fall of 1971.

Mrs. Housh also demonstrated the Peabody Rebus Reading Program at the South Newton Corporation Curriculum Day February 20, at Wabash Center for Retarded Children January 26, at Logansport State Hospital February 10, at the Center January 30 for speech therapists from Lafayette School Corporation, at a workshop for kindergarten teachers March 26, at teacher enrichment day in Logansport April 15, and at a workshop for primary teachers April 25. These demonstrations gave Mrs. Housh the experience necessary to develop an effective tape-slide presentation.

April 15, Mr. Jim Taylor, special education curriculum consultant, and Mrs. Doris Housh, special education materials consultant, held a teacher enrichment day for 15 special educators in Logansport, Indiana. Teachers from Logansport State Hospital were also invited. During the morning, the 15 teachers visited classes similar to theirs in Kokomo, Indiana. The afternoon sessions were divided into two alternating sections. One section consisted of demonstrations and displays of special education materials and media. The other section was devoted to a discussion of behavioral objectives and precision teaching techniques which helped teachers solve specific behavioral problems in their classrooms.

Summary

The past two years, July 1, 1968 to June 30, 1970 have been filled with numerous and varied activities. Special education teachers are among the most creative and vitally interested people in the field of education. These teachers have enthusiastically accepted new, innovative ideas and materials offered through the special education services of Wabash Valley Education Center. Their response and enthusiasm has been very gratifying.

The special education consultants feel that, through their efforts this year, they have been able to establish the most creative teachers in each school corporation. They hope that these teachers will continue to aid beginning special education teachers in the selection and use of creative materials. They also hope that all special education teachers will continue to try new and innovative curriculum techniques, such as precision teaching and individualized instruction. They feel that they have been successful in moving teachers toward innovative ideas and materials; now, they hope that educators will continue in similar fashion.

IV. Recommendations

The following recommendations are submitted for consideration, if special education services, which are vitally needed, are to be available through the Center next year.

1. New and innovative special education materials should continue to be ordered.

2. Teachers should be aided in the selection and use of materials to be housed in their classrooms.

3. Teachers should be aided in the development of learning objectives for special education, precision teaching, and individualization of instruction.

4. Curriculum guides should be developed so that learning objectives are conducted with specific instructional materials.

5. A special education supplement to the Center catalog should be printed and distributed to teachers by the beginning of the next school year. This supplement should contain all new special education materials obtained during 1969-1970, in addition to those already available from the Center.

6. Teacher guides for use of various materials should be devised so that teachers can more readily use those materials.

7. School corporations should consider other sources of aid in special education in addition to those services offered by the Center. All special education efforts should be coordinated. Other services available are:

   a. Instructional Materials Center, Indianapolis.
   b. Special education consultants in all disability areas, State Department of Public Instruction, Division of Special Education, Indianapolis.
   c. Corporations should consider hiring special education directors and consultants on a cooperative basis. State reimbursement, through Title VI, is available for this purpose.

Discussion of Activities of

Special Education Curriculum Consultant

A study done by Alex C. Moody, Consultant for the Wabash Valley Education Center in 1968 entitled "A Study to Determine Teacher-Principal Opinion of the Current Availability of Services Offered by the Wabash Valley Education Center" indicated that teachers and principals gave high priority for a visitation day whereby teachers would be able to observe teaching in other classrooms (Moody, P.U, June, 1968.) Along these same lines, another item of high priority was the need the teachers and principals felt for professional improvement of which included visitsbby specialists outside the classroom. Also mentioned, along with observing other classrooms, was the need for the opportunity for intercorporation visitations.

With these priorities in mind, the current consultant proposed to the superintendents a plan for a Teacher Enrichment Day for special education teachers. (See Appendix E.) This plan was overwhelmingly accepted by almost all of the superintendents in the WVEC region.

This provides the current consultant with the opportunity to "Assist special education teachers and therapists through recommendations for improving teaching techniques, managing classes," etc., thus fulfilling one of the objectives of the curriculum consultant as noted in the Continuating Grant, 1967-70, p. 51. This activity also enables the current consultant to "Evaluate programs and services with appropriate recommendations for improvement," another objective that was to be met by the curriculum consultant as proposed in the grant.

The Teacher Enrichment Day fulfills another need that was described in the grant: "Conduct in-service education programs for regular and special class teachers and therapists, relating to special methodologies and curricula".

A paper "An introduction to Precision Teaching for the Handicapped" recently completed and accepted for publication in the July, 1970 issue of the Slow Learning Child helps to accomplish two more of the objectives proposed in the grant that are: "Disseminate formation in to educators concerning new and promising approaches for teaching exceptional children" and "Establish guidelines to develop appropriate materials concerning specific approaches to instruction".

There is a need for a special education curriculum to be developed in the state. The current consultant attempted, along with other things, to start developing such a curriculum and to meet the objectives as described in the grant that states: "Work cooperatively with local and state department consultants and related personnel to develop instructional materials relative to the education of the handicapped and learning disabled children." A proposal to Mr. Lon Woods touches upon this and another objective of the grant that states: "Recommend promising programs and projects leading toward improved curriculum practices in the twelve counties serviced by the Wabash Valley Education Center." (See Appendix E) Mr. Woods did not respond to the proposal thus action regarding it stoping at that point. In regard to working cooperatively with local officials regarding material development for the education of the handicapped was a project undertaken by Mr. Bernard Hannon and myself. This project was an attempt to develop an appropriate community education series relative to education of the handicapped in the rural communities of Wabash Valley Education Center region. Also other activities have been done cooperatively with local officials such as workshops (See Appendix E) speeches etc.

A great concern of most of the superintendents I have visited is the concern for the lack of qualified personnel to teach in the special education classrooms. I have made a proposal to Mr. Leslie Brinegar, State Director of Special Education, concerning a program to stimulate interest in special education teaching. At this point it looks as if funds will not be available for this program.

The current consultant has worked on a project that is directly related to teacher shortage. The project, in some ways, attempts to fulfill a need that was proposed in the continuation grant that was "to encourage high school recruitment to the career area of special education." The research data is being compiled on this study at this time. (See Appendix) This, along with Pre-Professional Training in Mental Retardation is an innovative way of approaching an area of deep concern of people involved with special education.

Workshops and Programs
Conducted by the Special Education Section

Program Title: Special Teacher Orientation Program

Date: November 1, 1969

Location: Wabash Valley Education Center
Demonstration Room

Purpose:

1. To acquaint special education teachers with services of Wabash Valley Education Center.

2. To acquaint special education teachers with services of special education section of Wabash Valley Education Center.

3. To describe roles and services of special education curriculum consultant and special education materials and media consultant.

4. To demonstrate use of various materials and media for special education.

5. To develop curriculum models for special education.

Type of attendees: Special education classroom teachers and speech therapists

Number of attendees: Twenty-five

Consultants: Mr. Jim Taylor, Wabash Valley Education Center special education curriculum consultant

Mrs. Doris Housh, Wabash Valley Education Center materials and media consultant

Mrs. Cindy Riggs, Program Director, Comprehensive Association for Retarded Children, Monticello, Indiana

Program Title: Special Education Language Development Workshop

Date: November 15, 1969

Location: Room 114
Purdue Physics Building
Purdue University

Purposes:
1. To present an overview of the development of language development materials for special education, particularly the Peabody Language Development Kits and the Peabody Rebus Reading Program.
2. To demonstrate the usefulness of the Peabody Language Development Kits and the Peabody Rebus Reading Program for special education.

Consultants: Dr. James O. Smith, Professor of Special Education, University of Missouri; Co-author of Peabody Language Development Kits

Mrs. Connie Davies, Acting Director, Noble Center for Retarded children, Indianapolis, Indiana; Co-author of Peabody Rebus Reading Program

Miss Brenda Britt, Speech Therapist, Johnny Appleseed School and Training Center, Fort Wayne, Indiana

Mrs. Doris J. Housh, Wabash Valley Education Center special education materials and media consultant

Mr. James R. Taylor, Wabash Valley Education Center special education curriculum consultant

Type of attendees: Special education teachers, regular classroom teachers, speech therapists, curriculum consultants, graduate students, university professors, state department special education personnel.

Number of Attendees: 50

Program: Demonstration of Peabody Rebus Reading Program

Date: January 26, 1970

Location: Wabash Center for Retarded Children

Purpose: To demonstrate usefulness of Peabody Rebus Reading Program in the classes for trainable mentally retarded children.

Consultant: Mrs. Doris J. Housh, Wabash Valley Education Center special education materials and media consultant

Types of attendees: Teachers of trainable mentally retarded children.

Number of attendees: 6

Program Title: Demonstration of special education materials

Date: February 10, 1970

Location: Longcliff School, Logansport State Hosptial

Purpose: Demonstrate usefulness of language development materials and methods to teachers of emotionally disturbed teachers.

Consultant: Mrs. Doris J. Housh, Wabash Valley Education Center special education materials and media consultant

Type of attendees: Principal, teachers

Number of attendees: 15

Program Title: Demonstration of special education materials and uses instructional media for teachers of emotionally disturbed children

Date: February 24, 1970

Location: Longcliff School
Logansport Hospital

Purposes:
1. To acquaint teachers with special materials and their use in teaching emotionally disturbed children
2. To demonstrate the use of audio-visual aids, such as the overhead projector and the Thermofax copier.

Consultants: Mr. Charles Bryan, Wabash Valley Education Center audio-visual specialist

Mrs. Doris Housh, Wabash Valley Education Center seecial education materials and media consultant

Types of attendees: Principal, teachers

Number of attendees: 15

Program Title: Demonstration of materials for kindergarten teachers

Date: March 26, 1970

Location: Wabash Valley Education Center Demonstration Room

Purpose: To demonstrate usefulness of various materials for use in kindergarten classes

Consultant: Mrs. Doris J. Housh, Wabash Valley Education Center special education materials and media consultant

Types of attendees: West Lafayette kindergarten teachers, curriculum consultants

Number of attendees: 7

Program Title: Teacher Enrichment Day

Date: April 15, 1970

Location: Hendricks School
Logansport, Indiana

Purpose: 1. To demonstrate the usefulness of various materials for teachers of educable and trainable mentally retarded children.

2. To develop curriculum models for special education.

Consultants: Mr. Jim Taylor, Wabash Valley Education Center special education curriculum consultant

Mrs. Doris Housh, Wabash Valley Education Center special education materials and media consultant

Types of attendees: Teachers of mentally retarded children, teacher aides, director of special education

Number of attendees: 20

Program Title: Special Education Materials and Curriculum Workshop

Date: May 9, 1970

Location: Wabash Valley Education Center Demonstration Room

Purpose: 1. To demonstrate the usefulness of teacher-made materials for special education teachers and speech therapists.

2. To show the need for development of behavioral objectives.

3. To coordinate teaching techniques and materials to achieve specific behavioral objectives.

4. To encourage teachers to develop their own materials.

5. To encourage teachers to establish behavioral objectives.

6. To assist teachers in learning to use precision teaching techniques to facilitate learning.

Consultants: Mr. Jim Taylor, Wabash Valley Education Center special education curriculum consultant

Mrs. Doris J. Housh, Wabash Valley Education Center special education materials and media consultant

Eight selected demonstrators from among teachers and therapists in Wabash Valley Education Center area

Type of attendees: Special education teachers, regular classroom teachers, and speech therapists, selected by their superintendents

Number of attendees: 35

SUBSECTION E

SECONDARY SCIENCE PROJECT WVEC
HIGH SCHOOL PHYSICS
AUDIO-TUTORIAL PROJECT
FINAL REPORT

A. Introduction

Beginning July 1, 1967 and ending June 28, 1969. Wabash Valley Education Center has funded the High School Physics Audio-Tutorial Project. This final summary report will deal with these aspects of the project and its developments.

Rationale: Why teach High School Physics by Audio-Tutorial Mode?

Objectives; What were the aims and goals of the project?

Implementation: How well and to what extent was each objective carried out, or realized?

Expenditure Analysis: How were the funds spent?

New Directions: Now that part of the objectives have been realized, what is being planned for continuing the project?

Recommendations: How can Title III and/or other funds be used to further develop audio-tutorial work in Secondary Science?

B. Rationale:

Any comprehensive program of science in the high school must be flexible enough to use several approaches to solutions for educational problems. The program must attempt to be of equal assistance to the advanced student and to the slow learner. Whenever possible, this must be done without pacing the total program for one or the other of these groups, while giving each student individual help and attention. The program must recognize the different levels of readiness for physics; it must allow for a wide variance in previous experience. In objective evaluation, it must give weight, at least in part, to the progress each student has made from his own particular starting position. Finally, the program must make every effort to overcome the disparities which will exist in reading ability, mathematical skills, critical thinking ability, science background, and motivation.

The High School Physics project is based on the postulate that an audio-tutorial, multi-media method can provide the necessary flexibility, motivation, and quality of materials necessary to achieve the above program. For several years, Purdue University, under the guidance of Professor S.N. Postlethwait, has used an audio-tutorial approach in Botany. A description of the program at Purdue has been published and has served as a resource for this project.[1] While the high school physics project is in some ways similar to that program, different answers to similar educational problems have been sought because the subjects and educational structures differ widely. The audio-tutorial project in high school physics represents a serious attempt to individualize the teaching of physics, taking into account the above factors. In the program as it has developed, learning takes place primarily on an individual basis. Audio-taped lessons, audio-tape directed laboratory experience, and live lectures provide the basic contact with the student, with much individual student-teacher contact.

The student has contact with a text, reference books, outside reading books, laboratory manual, laboratory apparatus, 8mm film loops, slides, 16mm films, and other instructional aids. The student can travel at his own pace; confer with the instructor at the exact time a question arises; and confer with fellow students having similar problems. The more able student can progress at a pace which will allow him to investigate areas of content in greater depth. Students who missed school can begin exactly where they left off and catch up as time permits. Laboratory experiences are programmed using audio-tape, 35mm slides, 8mm film loops, and printed instructions.

For a more detailed description of the project rationale and procedures see addendum #1, "Individualization in High School Physics Through Audio-Tutorial Mode."

C. Objectives:

The objectives of the project as originally conceived by the project director and as revised during the initial stages of the project are pretty much as follows:

1. Establish a facility where such a course, as described above, could be developed and taught.

2. Provide professionally qualified development person or persons to develop the course.

3. Develop materials and techniques to make the course a reality.

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[1] S.N. Postlethwait, J. Novak, and H. Murray. An Integrated Experience Approach to Learning (Minneapolis: Burgess, 1964).

4. Design a course that is sufficiently self-operating such that the instructor is free to help and observe students, and such that different learning modes can be observed.

5. Employ as many different media as is feasible.

6. Evaluate the course as compared to a control group.

7. Investigate the adaptability of the course to other school situations within the Center area.

8. Investigate the feasibility of publishing the finished product.

D. Implementation:

In this section, each objective listed in "C" will be dealt with by number.

1. Facility: Since the project director was on joint appointment with Jefferson High School, Lafayette, Indiana, and since the physics facility was adequate in all respects except as to space, Jefferson High School was selected as Host School. In addition to a well-equipped laboratory, this school is singular in that there are usually five sections of regular Physics and two of honors Physics. This allows for adequate numbers of students for suitable control groups for evaluation purposes. An additional factor to be considered is that the host school regularly employs two physics teachers, one part-time and one full-time. The host school was one of ten schools in the U.S. to be selected for special recognition during 1968 for an outstanding Physics Department by the American Association of Physics Teachers.

2. Personnel: The Project Director, Lowell W. Knoop was selected as the primary developer, principally because the entire course was designed by him. He holds B.S. and M.S. degrees from Purdue University and received one of 15 awards for "outstanding competence in Physics" awarded during the year 1967 by AAPT. The secondary developer was Jack Smith who joined the host school faculty at the beginning of the second project year. He holds a B.S. from Ball State University and is presently working toward an M.S. at Purdue University.

3. Materials development: A complete set of materials for the course, as taught, is now on hand. This consists of the following:

   A. Hardware. Tape recorders, headsets, super 8 technicolor loop projectors, slide viewers, complete tape duplication system and ancillary equipment.

B. Software.

1. Paper goods. One student handbook, one student Lab Guide, 12 Student Unit Guides (about 20 pages each), 13 Unit tests and one semester test. In addition, a commercial (E.T.S.) test is used at end of year. Addendum #2 is a typical Unit Guide (Unit 4) and Addendum #3 is a typical Unit Test (Unit 4).
2. Slides. A complete set of slides was developed consisting of the following: 140 slides used as introductory visuals for 24 lab exercises. These are provided in 12 sets (duplicates) and boxed in containers by individual lab sets. Another group of 57 slides provides slide rule instruction and there are six duplicate sets.
3. 8mm Loops: Five laboratory visuals (3 min.) and three single concept loops have been produced. All but three are now on Super 8. Five duplicates of each are mounted in cartridges for technicolor, for student use. Twelve commercial titles have been added. Five of these are in class quantities of five each; the other seven being single for extra lab exercises.
4. 16mm Sound Films. None of these have been developed but eight titles from the PSSC collection have been provided, four by the host school and four by the Center.
5. Audio-tape Masters. Each of 30 lab exercises and approximately 110 lessons have at least one master tape. Most of the early lessons have two masters, one for each teacher. Unit 7 is done by two methods, so there are two sets of masters for it. These are filed until superseded by a revised tape. Most of these also have a typed script to accompany them.
6. Diazo Transparencies. Several 9 x 11 diazo transparencies are in the planning stage but none are yet produced. The student carrells being built will contain a translucent viewing box flush with the table, for these transparencies.

4. Self-operating design: Almost the entire course, except for about 20 line lectures are covered by the aforementioned media. For further detail, see addenda #1 and #2.

5. Media used: The media used are described adequately under 3 above. One additional medium planned for is video tape. This has been used experimentally on Unit 7, lecture 7-2, and will supplant live lectures when the host school acquires such capability, probably two years hence. Because of expense it is not planned to be a major input.

6. Evaluation: The course developed has been carefully evaluated both project years as explained in addenda #4 and #5.

7. Adaptability: Two short-term pilot programs were carried on in Center area schools using project materials and equipment. These are described in some detail here since this is the only summary statement of the two programs.

Lewis Cass Project: Lewis Cass, a rural high school near Logansport, Indiana, participated in the High School Physics project as follows. Jim MacDonald, the physics instructor asked to use the materials for units 10, 11, and 12 in the following manner. Since his text was "PSSC Physics" by Heath his usual coverage of wave motion and optics was rather comprehensive. He decided to use partly project materials and partly his own lectures. He further complicated matters by using PSSC lab exercises. His conclusion was that this mixed up his students too much and even though they enjoyed the novel approach it was not an efficient procedure. The project director decided then that the only fair test was one in which the materials are used in toto, as designed, and for a minimum of six weeks.

Benton Central Project: Benton Central is another rural high school near Fowler, Indiana. Phil Kauffman, the physics instructor, asked his school to let him try the project for six or eight weeks of second semester 1968-69 with the stipulation that if it proved feasible he would ask them to adopt it in entirety for 1969-70. Accordingly he used Units 7, 8 and 9 exactly as developed, with the exception that his text was different. (He borrowed several texts from host school to supplement his own.) The instructor was sufficiently satisfied with the results that he is asking the school board to adopt the course next year.

8. Publishing: Because of the many changes made in the program the second year, and because of the many anticipated during the next three years, the project director feels that any publishing venture is premature.

E. Refer to Addendum #6

The expenditures of money in this project primarily reflect the following needs.

1. Hardware and software necessary for teaching an audio-tutorial course.

   a. Hardware includes tape recorders, duplicating system, headsets, 8mm loop projectors, slide viewers, and related equipment such as 8mm cameras. This was primarily provided by the Equipment Fund and in general represents equipment still on hand.

b. Software includes paper supplies for student guides, etc.; commercially prepared 8mm loops; film and supplies for self-produced loops; film and duplicating costs for slides; materials for diazo transparencies. These things have come primarily from movies budgeted for supplies.

2. Professional Services. Th project director served as the primary developer on the project and was released from part of his teaching duties to give time for writing, filming, cutting tapes, etc. The director then received part-time compensation from the host school (Jefferson High School) and Wabash Valley Education Center.

3. Contracted services represent the services of a curriculum specialist who reviewed some of the materials developed for Unit 7.

4. The other allocations are self-explanatory from addendum #6.

Two other schools became involved in the program, each for about a six-eight week period, as sort of a trial period. Since no funds were allocated for this purpose in the budget, about ten additional tape recorders and accessories were purchased for the project and then loaned to the schools as needed. In addition, the Center provided at no cost to these schools all the software necessary.

Lewis Cass High School used 11 tape recorders and related equipment during December, January and February. They provided most of the software from masters furnished by the Center.

Benton Central High School participated by using 19 tape recorders and related equipment during parts of March, April and May. In this case the Center furnished the software and Jefferson High School loaned much of the necessary lab equipment. Benton Central High School is considering continuing along with the host school and if so, will be granted use of some of the equipment owned by the Center.

The Center will continue to participate in the project by providing the present inventory of equipment to the host school on indefinite loan. The host school, then will assume the cost of replacement as equipment becomes worn out or obsolete. Reports will be made to the Center as to the disposal of such equipment. See the Expenditure Analysis on the following page.

Addendum #6

Expenditure Analysis
High School Physics Project

Item	Professional Salaries	Non Professional Salaries	Contracted Services	Supplies	Travel	Equipment
Budgeted 1967-68	$5800	$950	$3500	$2500	$350	$2964
Secretarial Help Lab Assistant		651				
Consultant			354			
Duplicating Paper, Film, Slide Dupl., 8mm Films				2514		
NSTA Convention					133	
Project Director (part-time)	7800					
Tape Recorders, Technicolor Projectors						2900
TOTAL EXPENDITURES 1967-68	$7800	$651	$354	$2514	$133	$2900
Budgeted 1968-69	$7450	$1777	$300	$2500	$200	$2660
Project Director (part-time)	7080					
Secretary		1013				
Technical Aid		270				
Visits to Cooperating Schools					30	
NSTA Convention					244	
Tape Recorders and Accessories						1635
8mm Projectors						535
Commercially Prepared Films, 8mm & 16mm				720		
Film, Batteries, Cassettes, etc.				1050		
Paper Supplies				218		
Other, Misc.				520		79
TOTAL EXPENDITURES 1968-69	$7080	$1283	0	$2508	$274	$2549
TOTAL EXPENDITURES	$14880	$1934	$354	$5022	$407	$5449

F. <u>New Directions</u>:

The type of individualized course being developed in the High School Physics Project gives the instructor a learning laboratory where he can learn more about how people learn. Some problems seem to be emerging that give the director insight into needed changes in the course structure.

1. The novelty of this type media begins to wear off and motivation becomes a problem.

2. The self-pacing aspect of the course makes it possible for the student to be more relaxed. There is serious question about the learning atmosphere where it is too relaxed.

3. Not all students require the tremendous amount of explaining found in the taped lessons. Thus, there need to be many ways to approach the learning. One of the best students during the second year did many lessons in reverse order and did almost no listening to tapes. This seemed to be his best learning style. (He did not become an 'A' student until he changed his style.)

4. The self-pacing feature has itself presented difficulties. Since a student has been, in a sense, locked in step at the end of each unit (typically 15 school days) he can only pace himself more slowly by spending more time. Often such a student is either unable or unwilling to do this.

5. The attempt to use behavioral objectives in any real sense during the second year proved unworkable.

Several changes in procedure are planned for the coming year which it is hoped will alleviate some of the problems and help the program to do what the director feels it can do, that is, not only make physics more enjoyable and meaningful to the student, but also to provide a learning system which can cause greater performance. An attempt will be made to combine the ideas of Professor Benjamin S. Bloom,[2] related to learning by mastery, and the use of behavioral objectives to implement the procedure and make learning more meaningful.

In a nutshell, a core of behavioral objectives felt to be part of the necessary minimum hierarchy (probably about one-half to two-thirds of all behavioral objectives) will be

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[2]Benjamin S. Bloom. <u>Learning for Mastery</u>, UCLA, CSEIP, Evaluation Comment, May 1968.

established. Each student will be required to perform on these at what has been previously considered the 'B' level. Students will not go on to new units until they have accomplished the minimum mastery level on the core objectives in the previous unit. This will necessitate more flexibility in pacing. Students will pace themselves for the whole semester, the only time criteria being that they must achieve certain minimum objectives by the end of each grading period to receive a passing grade. All grades will be a result of a quality index and time factor, even though some experts disagree on this particular idea.

In addition to this rather giant step, the project must consider ways to make the learning area more conducive to learning. The Laboratory-Lecture areas may be broken up into the following: carrells for quiet learning (passive tape learning); a section of the room for laboratory work using equipment; a place for small dialogue sessions on objectives, and an area to view 16mm films.

Along an entirely different track, the project director is exploring the possibility of placing the system in seven Appalachian schools near a Title IV center to see how effective the program can be where no effective physics teacher can be found.

G. Recommendations

The director of the project feels that the need for funding of the project is still present. The needed changes can occur more readily if more released time is available for development. This particular project can proceed, now, without a great amount of additional help but there is a need for sponsoring several comprehensive developments of this kind in other secondary fields where audio-tutorial is applicable.

A second need for funding concerns the bringing together of many developers in this whole area of individualization and audio-tutorial for brain storming sessions in which each may learn from the other.

There are essentially two centers for such developments, Purdue University area and Cornell University. This might take the form of a three-day conference each summer and a Saturday meeting four times during the school year. It might also be done at several levels -- Junior High, Senior High, Junior College and University. There are now adequate numbers of people working in these areas to make this feasible. Both Purdue and Cornell would be happy to host such meetings.

Descriptive Brochure

INDIVIDUALIZATION IN HIGH SCHOOL PHYSICS THROUGH AUDIO-TUTORIAL MODE

A description of a course in high school physics being developed as a pilot program in Jefferson High School, Lafayette, Indiana, by instructor Lowell Knoop and financially supported by the Wabash Valley Education Center, a Title III funded regional education center.

THE NEED:

Many of the 'very demanding' high school courses such as physics have the problem that when the instruction is pitched to the average or above average student the slower student is continually frustrated by seldom being able to grasp a point before the next point is being made. On the other hand, the very bright student may become bored while the instructor tediously answers a question for another student. Under the 'constant pressure' approach of many instructors a student may not learn to apply self-pressure and accept responsibility for his own education.

RATIONALE:

Basic assumptions:

Most experiments are begun with some sort of basic hypotheses and assumptions. This study is no exception. Listed here are the most prominent such assumptions with clarifying remarks.

1. The Audio-tutorial mode has been demonstrated to be a successful teaching mode for college courses, especially in Biology. Dr. S.N. Postlethwait at Purdue University has been using this approach in his Botany course for ten years or so and has demonstrated its effectiveness.[3] It is assumed that this mode can be made to be effective in high school physics.

2. Most teachers can instruct as well as or better when working with an individual student.

3. All students should be expected to become equally proficient in each subject covered in order to earn equal marks. This is by no means a safe assumption; however, in order to start each individual where he is and move him to some uncertain end point, raises

[3]Postlethwait, loc. cit., 1964.

serious questions about evaluation of his behavior. Also, techniques aimed at handling such a problem would be quite involved and beyond the scope of this program.

4. A student will enjoy his studies more if they relate to needs rather than to unnecessary repetition.

5. The student will learn more efficiently if allowed to proceed at pace comfortable to himself.

6. Self-induced pressure is better and more healthy than external pressure.

No brief is made for these assumptions either pro or con, but this will aid the reader to analyze the frame of reference for the study.

STRUCTURE OF COURSE:

The course is broken into 12 units, not unlike the format in most tests. The units vary from about 9-18 days in length. The students are required to be together at the end of each unit for the unit test; however, they may pace themselves in any fashion as the unit progresses. It has been found that some students who only finish two-thirds of the work in a given unit perform as well as some students in the traditional approach who were present for each lesson.

This also enables extra lessons or labs to be done by faster students so that they may gain extra points.

MEANS:

The main method of teaching is audio-taped instruction by the teacher. The content of the audio portion of the lesson usually consists of explanations, additional input, and self quizzes to supplement the reading of the text and reference books. The format is that of a teacher talking to an individual student (the instructor fancies himself talking to an individual rather than to a group and cuts the original tape accordingly). The content, further, must be the sort of thing an instructor might say equally to each student. Since this is found to be inadequate for all students, much additional individual instruction is given by the teacher since he is now free to move around and treat individual requests of his students much of the time.

The live lecture has been retained for at least one or two hours during the unit. It may be used to introduce new material and give an overview, and also to introduce dramatic demonstrations not possible otherwise. Secondly, it is felt that some group instruction is helpful.

Small group sessions are structured on occasion early in the year; however, later small groups meet with the instructor whenever there is a need to discuss common problems or to explore new ideas. There is some sort of visual approach with each lesson or laboratory exercise. The unit guide contains notes (handwritten) which the student watches while he listens to the taped comments of the instructor. These notes are the type often used on blackboards or overhead projectors. Sometimes the student must become actively involved by solving a problem or completing a derivation, etc. Often the visual approach involves slides or single concept 8mm loops. The slides are more often used to show equipment set-up steps for lab work or to illustrate in much the same way as overhead projector transparencies. The 8mm loops are of two kinds, technique films for the lab and single concept films. Some of the single concept loops are commercially obtained (six titles thus far). Some of these and all the technique films as well as the slides have been produced by the course developer.

Often the visual response involves the student in a demonstration with lab equipment in which he handles as well as watches, with directions and comments given him by tape.

There are enough slide viewers for about two-thirds of the students to use at one time and five technicolor loop projectors. (This has proved adequate to date.)

The recorders may be used by students during other hours (study hall, etc.) and may be taken home. An occasional night lab session is scheduled for those who have full schedules and no access to lab except during their regular class hour. This mode might be readily adaptable to flexible scheduling with open lab.

HARDWARE:

The tape recorder provided for student use is of the small, solid state cassette type which is virtually student proof. The trade name of the one used in this program is the Aiwa 707. When operating in the laboratory and classroom special 6 volt outlets are provided. When operating outside these locations, self-contained batteries are used. Alkaline type C batteries last much longer the first time and can be readily recharged. Some of the newer models with built-in AC adaptors will likely prove more effective. The master recorder for recording the instructor's master tape is an Ampex Micro 80 stereo cassette recorder. This gives high fidelity masters which insures that the duplicates used by the students will be of good quality.

Since each student must have available a tape of any lesson at any time, as many duplicates are made as there are students in the largest class (usually 24). Thus, 24 tape recorders are paralleled so that 24 tapes can be cut simultaneously. The 8 ohm output of the master recorder is paralleled with twenty-four 1000-1 voltage dividers which provide a proper microphone input to the slaver (see appendix). Student recorders could be used to duplicate; however, since the program being described involves two sets of tapes (two teachers) and many student recorders being out overnight, a separate set of recorders is provided for this purpose. When one batch of tapes is no longer needed they are demagnetized and new lessons put on them. In this way 500 cassettes are serving two teachers and 70 students for roughly 100 different taped lessons. Norelco and Infonics sell commercial duplicators which also work well, but are not as flexible and have the disadvantage of costing more.

The 35mm camera being used is a Cannon S.L.R. f-1.8 with thru-the-lens spot metering and many other features. Many times there is need for close-ups of slide rules, etc. so that SLR is desirable. For most labs 12 sets of slides are available, while for the slide rule series, which involves 57 separate slides, only six sets are provided and the students stagger their work with these. A Sears 4 in-table viewer is used which leaves the stack of slides in the same sequence after viewing. Furthermore, these are available in the neighborhood of $10 each.

The 8mm camera is in the process of being changed. The present regular 8 camera was purchased when good super 8 cameras were not too bad. Now that commercial loops are no longer being produced in regular 8, a Bolex 155 is being considered. All present loops will have to be refilmed. The detail in films being used to gather lab data was none too good at best. The Harvard Project offers some promising loops for consideration in the project.

Some of the PSSC 16mm films are used when a better procedure can not be found.

SOFTWARE:

1. Unit Guides. Whenever a course depends more on individual work and less on group work the problem of communication and guidance is increased. Thus, a unit guide is intended to serve as a guide and supplemental text. The first page introduces the topic and gives a list of lessons, lectures, and lab experiences in the order in which they should be completed. The next two pages list the behavioral objectives being stressed in the unit. Then follows an assignment page which lists text pages to study, problems to solve, and related references in three other texts. Following this are the lesson notes, usually two or three pages per lesson. The problems for the unit are next with the answers coming last.

2. Lab Guide. Since the laboratory guides are used in both experimental and control groups they are bound in a separate folder. The lab guides are more brief than most since a 10-15 minute tape accompanies it.

3. Text. The text being used is Physics, by Taffel, Allyn and Bacon Publishers.

4. Three current state adopted texts are used as reference books. Modern Physics, Holt; Physics, Houghton-Mifflin; and Physics, Heath.

STUDENT EVALUATION:

During the second year of the project a strong attempt was made to upgrade the evaluation of student performance. Since behavioral objectives were stated for the student's use all evaluation procedures attempted to evaluate achievement of these objectives. No assumption was made as to the possibility of achieving this in fact, but the attempt progressed.

Unit tests carry the bulk of the evaluation burden. The grading system is a point-index system developed some years ago by the author and which allows each test, quiz, lab report, or other device to be weighted according to its importance in the total scheme of things (see appendix for grading system). These unit tests are predominantly multiple choice with almost all new items being produced during the year. Purdue University offers a test evaluation service which scores and gives a detailed item analysis. Items shown to be good discriminators will be weighted more, and items shown to have low positive or negative correlation with total score can be eliminated.

Unannounced quizzes are given once or twice weekly but are purposely given two or three days after the lesson should have been studied. This means 80 per cent will have completed the requisite work and it will serve as a prod to the slowest. These come in for 10-20 per cent of the total grade.

Self quizzes are never graded but help the student evaluate his own progress.

Progress quizzes are sometimes given to check whether or not a student is ready to proceed. These may or may not be graded.

Lab reports carry 10-30 per cent of the usual unit weight.

Homework is never graded or checked except individually. While it is important for a student to do his homework, there seems to be poor correlation between homework papers and quality of performance on tests and quizzes.

Highly subjective measures are avoided, especially so since the results of student evaluation will be used to evaluate the experimental course in part.

PROJECT EVALUATION:

First year: During the 1966-67 school year while planning was underway for the experimental project, close records of performance were kept, a time schedule of units carefully observed, and anything else which would contribute to a fair control. It was felt that during the first year of development that the instructor-developer would have quite enough to do to teach two experimental groups and develop materials ahead of deadlines. Thus, the 1967-68 experimental group was compared with the 1966-67 control group. Tests were identical and variables kept to a minimum. Forty students were selected from each group based on the fact that there were only 40 in each group for which we could get data on the comparators we wanted to use. Our comparators used were PMA scores, geometry grade, and fourth semester cumulative index. Dr. William Asher and a graduate student, Michael Szabo, in Educational Research at Purdue University handled the evaluation.[4] The sum and substance of it was that during the first year (1967-68) no significant difference in performance was noted.

Performance was based on six unit tests, six weeks grades and final first semester grade. The major difference came in student opinion about their course. Roughly 90 per cent preferred the A-T approach. They felt they were enabled to know their teacher much better, and they felt that this emphasis on self-reliance would stand them in good stead in later schooling. All these findings are well documented. An interesting statistic developed when Mr. Szabo checked the predictive value of the comparators by the method of co-variance. These comparators proved to be good predictors for traditional approach but much poorer predictors for the A-T group. This would suggest that such things as personality, psychological, and socio-economic factors might play an increasing role as determinants.

During the current year (1968-69) side-by-side control and experimental groups are being taught by the project developer and a second instructor, Jack Smith, is handling two A-T sections. The students were placed randomly. New factors, suggested above, will be considered in addition to those used before. There is a continuing attempt to prevent the student being overloaded by questionnaires, etc. so these are kept to a minimum.

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[4]<u>A Preliminary Evaluation of The Wabash Valley Education Center Audio-tutorial Secondary Physics Project at Jefferson High School, Lafayette, Indiana, Lowell Knoop, Director</u>, by Michael Szabo and William Asher, Wabash Valley Education Center, West Lafayette, Indiana.

SUBSECTION F

SOCIAL STUDIES PROGRAM
1967-1968

The original proposal for the social studies section of the WVEC was written by personnel in the Social Science Education Consortium, then located at Purdue University. Consortium personnel initiated the program and assisted in directing the program for the 1967-1968 grant period. Funds were allocated for a continuation of this association for the following year, but this item was cut from the approved budget during the summer of 1968.

During 1967-1968, the social studies program had two major thrusts: (1) a seminar program designed to create a pool of local leadership talent to assist schools in implementing change in the social studies and, (2) a general workshop and service program designed to attack the task of affecting social studies education in 28 school corporations.

Sixteen teachers participated in the seminar program during the year. The seminar met twice monthly and participants were paid an honorarium of $25 for each session.

The general outline for the seminar dealt with curriculum analysis, piloting innovative curricula in the participants' classrooms, and the development of consultant skills. The analysis aspect of the seminar followed the system developed by the Social Science Education Consortium, Inc. Curricula piloted were: The Amherst American History materials, the High School Geography Project; the elementary anthropology materials from the University of Georgia; the Our Working World series written by Prof. Lawrence Senesh; the Greater Cleveland elementary program; and the elementary economics materials constructed by the Industrial Relations Center at the University of Chicago. Consulting skills were concerned with listening, redefining the problem, and offering help.

In each instance, the process for achieving behavioral changes in the knowledge, attitudes, and skills of the seminar participants was the use of inquiry. The Center staff, contracted consultants, innovative curricular materials, participants, and the curriculum analysis system with appropriate readings, constituted the resources for this inquiry process. The major task of the staff was to establish a climate of inquiry and to make available to the participants those necessary resources.

A chief objective of the seminar was to plan for the effective use of this pool of professional talent. Planning was conducted together with the participants on the various roles they would play in the Center's social studies program during the next school year. The Center staff and the contracted consultants estimated that at least ten of the 16 participants would become actively involved with the execution of the next year's program.

Another phase of the program was to act as a disseminating agent for innovative curricula and to provide area teachers the opportunity to visit classrooms using innovative materials. The seminar participants who piloted new curricula served as demonstration teachers. Letters were sent to area superintendents, principals, and curriculum directors in each of the 28 school corporations describing the materials being taught along with the list of the demonstration classrooms.

Each corporation was offered funds to allow six teachers to visit and observe these classes. A general discussion period followed each visitation so that the observers were able to offer comments and ask questions. Both the demonstration teacher and the observers were asked to complete questionnaires designed to test over-all responses to the visit.

In theory, the visitation plan was commendable. In practice, it was not entirely successful. Although schedules were sent to all Superintendents showing specific times and days when the demonstration classes were taught, there was much confusion, and visitors appeared on days and hours that were not listed. Perhaps such visitation programs should be arranged only on a school-to-school basis. Using the Center as a clearing house apparently was not the most efficient way to approach such a program.

Workshops

Several workshops were held during the year 1967-68. They were incorporated into the original program design because of requests for inclusion of more area personnel into the Center's social studies program.

A. Curriculum Advisory Workshop. This workshop was for 28 administrators who served as an advisory panel to the Center. Meetings were motivated by a desire to include administrators, especially those concerned with curriculum, in the activities of the Center. Seven meetings were scheduled. Professors Emily Girault and Robert Fox from the University of Michigan, conducted a problem-solving laboratory designed to help administrators participate in the development and application of new teaching techniques. Professor Harold Shane of Indiana University spoke on three topics at one of the group's workshops.

B. Inquiry Workshop. A series of six inquiry workshops were scheduled. These workshops attempted to translate that vague educational objective "the development of rational beings" into classroom practice. The objective was to help teachers understand the processes people perform when they think, when they create, and when they are solving problems.

A two-session conference presented by J. Richard Suchman was sponsored by the social studies section. Although the conference was well attended, the presentation made by Mr. Suchman did not make the impact anticipated. Even though he is a recognized authority on inquiry techniques, our teachers, through their evaluation responses, were not enthusiastic.

C. General Workshops. Two week-end activities for administrators and teachers were planned. One was a two-day laboratory session on problem-solving skills and decision-making processes which was conducted by Professors Fox and Girault and the social studies consultant.

D. General Services. The social studies project also sponsored evening activities which featured programs explaining the use of new audio-visual materials in the social studies and other short programs of a more general nature.

Summer Workshop for Administrators and Teachers, June, 1968

The workshop attendance design called for a principal from each of the 28 school corporations to participate in a one-week leadership training program from June 10-14, with follow-up meetings on Thursday, June 27 (half day session) and Friday, June 28. Each principal was asked to select two teachers from his building to participate in the teacher phase of the program for two weeks following the administrator session. Corporations were asked to send three participants from a single school who would work together as a team within the workshop and within the school the following year. (Not all schools followed through on this plan.)

Conference leadership and program design was the responsibility of a team of social scientist-educators, including Lucille Schaible, Project Director at the Center for Research on the Utilization of Scientific Knowledge; Professor Robert Fox, Director of School of Education at the University of Michigan; and Professor Emily Girault, who held a joint appointment at the University of Michigan in Education and at the Center for Research on the Utilization of Scientific Knowledge.

The Principals' Workshop was designed and conducted by Professors Fox and Girault. The design included sensitivity training intended to develop more effective communication patterns between teachers and administrators. Two ancillary areas included in the Principals' Workshop were leadership training and problem solving. The objectives of these activities were to help principals develop effective decision-making patterns.

The two-week workshop for teachers included two days and two evening sessions in sensitivity training. This training aimed to make the participants more aware of group processes and patterns of interpersonal communication. Two days were devoted to inquiry training. The new social studies curricula, almost exclusively, emphasize inquiry as the chief mode for presenting the new programs. The teachers were involved in an inquiry training laboratory designed to present them with new teaching tools. The following two days involved the teachers in designing and teaching an inquiry lesson to students in a micro-teaching pattern. The next two days were spent in investigating content in the new social studies. One day was devoted to the use of games to teach logic. Professor Layman Allen, author of "WIFF 'N PROOF" demonstrated that game. Demonstration lessons, films, tapes, etc. from social studies projects were presented for one and a half days. The last one and a half days brought the administrators and teachers together to plan for the next year.

Sessions were held at Burtsfield School in West Lafayette. A stipend of $75 per week was paid to teachers and administrators. A total of 47 people participated in the summer workshop: 14 principals from 13 corporations; 33 teachers from 13 corporations (not necessarily the same corporations as the principals). Twenty teachers taught grades 4-6; five taught grades 1-3; six were junior high teachers and two were high school teachers.

SOCIAL STUDIES PROGRAM
1968-1969

At the end of the 1967-68 grant period, there was a change in social studies personnel. This created some problems in follow-up and evaluation of much of the 1967-68 program, especially the summer workshop. The new consultant was on an NDEA Experienced Teacher Fellowship and was not, under terms of that fellowship, allowed to work elsewhere until August. As much time as possible was spent studying the 1967-68 program, the approved program for the 1968-69 year, and learning about the Center and the Center schools. These circumstances, however, caused somewhat of a break-down in social studies services during this summer period. (See section on comments and recommendations.)

Summary critique written by seminar participants, responses by school board members, principals, and superintendents indicated general support for the program, but stressed the need to reach more school personnel, to make the on-going program more accessible to those interested in it, and most important, to ask that the workshop be brought to the schools. These ideas were considered when the 1968-69 program was written. Ultimately, a social studies program was designed and recommended with a budget of $55,700 for its implementation. It should be noted, however, that although this was the amount recommended, it was not the amount that was approved for the consultant. Various problems arose that necessitated the budget be cut during the year.

An attempt was made to follow through with the preceding year's program, especially in the use of seminar participants as teacher-consultants. Indeed, it would have been almost impossible to get any programs started had it not been for the assistance and advice of those teachers who had been involved in the seminar the preceding year. Some of the teachers were available during the pre-school months and were most helpful; others could not be contacted until September.

A half-time assistant social studies consultant had been hired in the spring. Unfortunately, he was not back in the area until September. This situation meant that some "crash planning" had to be done.

The plan to provide workshops at the local school level was commendable. Unfortunately, due to a breakdown in communication or oversight, this offer was not publicized until fall. Consequently, a small number of local workshops were requested. School administrators were not eager to grant released time in many of the corporations, and teachers were not eager to attend workshops during the evenings or on Saturdays.

The teachers who had participated in the first year's seminar were used as an Advisory Board and assisted in planning the laboratory workshop programs. They also assisted in some of the "Lab" workshops and seminar sessions held during the 1968-69 grant period. School administrators cooperated to a limited degree in releasing some of these teachers for a half-day. When teachers were used as consultants for week-day workshops, the substitute was paid by the Center.

As in the preceding year, 1968-69 program had two major thrusts: (1) a seminar program designed to create a pool of local leadership talent with skilled social studies resource persons, and (2) a general workshop and service program. Changes were make to broaden the base of participation and the scope of these programs. The biggest changes were made in the general services--the consultant spent much time out in the schools or in the Center working with individual teachers and school staffs.

I. Seminar Programs:

Two seminar programs were designed--one for elementary teachers and one for secondary teachers. Consensus seemed to be that teachers prefer this division. Teachers believed that they would have a better opportunity to work with problems, materials, and methods of most concern to them, and benefit most by working with others on the same grade levels. This plan gave Center personnel a better opportunity to assist in the development of programs by concentrating in the elementary area during one phase, the secondary during another phase.

Post meeting evaluation forms, feedback, and teacher enthusiasm seemed to prove that this innovation worked. One of the immediate benefits of the program was the opportunity to work with teachers from other corporations, to sit down together in small and large groups and discuss problems, ideas, and materials with each other, drawing from each other helpful suggestions and assistance.

The Center goals were to develop teacher-leaders involved in practical innovation. No one involved felt that everything now being done should be discarded. They wished to examine and test the "old" and the "new", blending together the best of both in order to enrich the learning experiences of school children. The staff continued to work with administrators and teachers to develop a school climate for innovation, where teachers had the right to fail--to experiment, knowing in advance that not everything they tried would be an unqualified success.

A second innovation was in the time involved for seminar sessions. Sessions were changed from all day to half days with meetings beginning at 9:00 a.m. and adjourning by 1:00 p.m. The agendas were flexible, yet full, and participants worked through the morning and had afternoons free for other commitments. Participants were paid a stipend of $15 per session.

A. Elementary Seminar

Nineteen corporations were represented in the elementary teachers' seminar. Administrators from the non-participating corporations indicated a willingness and a real interest in having teachers involved, but two major reasons were given for their non-representation: (1) majority of elementary teachers are married women who have family obligations and can not or will not give up Saturdays; (2) interested male teachers are also assigned part-time coaching activities that involve Saturday attendance.

The seminar program involved ten half-day sessions. The first session was held on October 12, the last on March 22. Meetings ran from 9:00-1:00 and participants were paid a stipend of $15 per session. The group was divided almost evenly between male and female teachers.

An agenda was developed for each session, but the schedule was flexible and teachers were given wide latitude in determining the nature of the continuing program. Among items developed were: micro-labs in inquiry techniques, sometimes using elementary students in demonstrations; use of instructional and evaluation materials and media--tape recorders, video tape recorders, overhead projectors, records, films, study prints; a session on production of A-V materials with the Center's media specialist consulting; teacher-consultants working with the group and presenting their experiences with project materials; games and simulations for the classroom. New materials were identified and made available to the participants who then tested them and brought back their evaluation to share with the group. Time was alloted during each session for a general exchange of ideas and problems.

Textbook adoptions were a major concern, and there was an expressed need for some method of evaluating the adoption list materials. The SSEC Curriculum Analysis system was explored, but consensus was that there was not time nor expertise for training in this system--that something on a very "practical" level needed to be made available to all area adoption committees. Participants studied and considered several types of evaluation guidelines and adapted what they felt to be most valuable from them. This checklist was then furnished to Center schools and was used by many in their adoption procedures. Many seminar participants served on their local adoption committees--several served as chairmen. During this period, the seminar group requested that some administrators be invited to meet with them and exchange views and guideline ideas. This was one of the most interesting seminar sessions--for several teachers, it was their first opportunity to engage in free and open discussion with administrators.

While emphasis was placed on enrichment of existing programs and on adoptions, teachers and administrators were made aware of new materials being developed. To give interested teachers opportunities to experiment with innovative materials, teacher-consultants (trained in 1967-68 program) worked with participants. Several seminar participants used the Senesh primary program, Greater Cleveland elementary program, and Georgia Anthropology Project materials on a unit basis.

Each participating teacher had the opportunity to survey and study elementary social studies materials and projects and to develop ideas to be used in individual classrooms in the spring. Materials were furnished for their classroom experiments. The social studies consultant worked with the teachers on an individual basis in implementing these units. Emphasis was placed on materials and ideas that would fit into and enrich the existing Indiana curriculum.

B. Secondary Seminar

The purpose and objectives were essentially the same for the Secondary Seminar as for the Elementary Seminar. As in the Elementary group, there was a wide variance in training and experience among the 20 participants. Experience levels ranged from one to 30 years. This was one of the strengths found in our social studies programs--the young and comparatively inexperienced and the older experienced teachers working together.

The flood of resource materials being published can easily lead to confusion and chaos in selection and purchase. Seminar teachers were given continuous opportunities to examine, analyze, test, and compare a mass of new resource materials.

The social studies resource library offered participants, some for the first time, opportunities to plan units which gave their students experience in independent, or more individualized study, to develop basic research skills, and carry out problem-solving activities. Many of the school libraries are not built up to a level which is necessary for this kind of study. This supply of new materials also served to help the classroom teacher grow in knowledge in his subject area.

The format for the seondary seminar was similar to the elementary. Much time was devoted to the evaluation of textbooks on the state adoption list. Participants in the several subject areas evaluated selections individually, then returned to the seminar to share and compare evaluations with their groups. The Indiana State Council for The Social Studies checklist served as their guide.

Secondary participants, like their elementary colleagues, had the opportunity to develop units for their classroom and had materials furnished for their experimental activities.

Seminar Evaluation

Several kinds of evaluation methods were used. Mr. Richard Bergdahl, a doctoral candidate at Purdue University, developed an evaluation instrument which was given to the participants in each seminar group at the beginning and at the end of each ten week program. Post meeting response forms were used at most sessions and these gave the consultant a way of gauging changes which might be useful for the next sessions. In addition to these evaluation forms, the staff noted and assessed continuous feedback from participants and administrators. In addition, there was a definite increase in interest and use of services within the schools of most participants. Colleagues of participants often became interested through seeing the innovations being used, then they also became involved in Center activities.

It was significant that nearly all those teachers who have become interested and involved in the Wabash Valley Council for the Social Studies organized in October 1969 were teachers who had been involved in the social studies workshops and seminars. The Council, an affiliate of the Indiana Council, was formed by those teachers because they wished to have a continuing interchange across corporation lines.

Each participant also submitted a "half-way point" evaluation. Unsigned, these forms included the following questions:

a. In view of your pre-session expectations, do you feel you have gained anything professionally?

b. Do you feel that you have undergone any attitudinal changes as a result of becoming involved in the seminar sessions? If so, how?

c. Do you feel that these sessions have affected your teaching behavior in any way? If so, how?

d. Do you feel that your students have benefited from your seminar experiences? How?

e. In what way would you change the program?

f. What suggestions do you have for improving WVEC contacts and services with teachers?

g. Other comments.

Without exception, all responses were positive. In answer to questions a through d, all responded in the affirmative. Respondees stated that they: began to do some serious thinking about the way they were teaching; developed more positive attitudes toward resources and professional discussions; developed feelings of adequacy (Question b) in terms of trying new approaches and materials; broadened their ideas; became more interested in change and in learning to try; felt more secure; and became aware that they have to be willing to experiment to bring learning results. Traditional views have slipped and they were evaluating and reassessing the more familiar methods, primarily expository, and the new, in order better to involve their students in the learning activities.

Below are some comments teachers gave in response to questions c and d:

- Using inquiry techniques
- Now include more than assigning and discussing textbook materials
- Classes are not as teacher-oriented as before, and students are better motivated now
- Using more than question-answer
- Any time a teacher becomes involved, children are affected
- Using new ideas
- Becoming more conscious of my dominating the class periods and recitations
- Diversified methods and materials
- Trying changes

- Including current problems and current events - good discussions
- Trying techniques that motivate students
- More aware of the children and the way they react to my teaching and materials
- Becoming more excited about learning
- Students are being "heard" as well as seen
- Students enjoy the new approaches and go all the way on research and discussion
- Students benefit from the variety of resource and media materials being used
- Since I am willing to try and fail, try and succeed, so are the students
- Students are caught up in my interest
- Change in teacher attitude also changes student attitude
- (Primary) Our children have had their first Social Studies classes.

II. Laboratory Workshops:

With the help of The Teacher Advisory Board, topics of major interest to area teachers were chosen for a series of laboratory workshops. Eight topics were selected:

a. Team Teaching
b. Audio-Visual Materials
c. Innovative Secondary Curricula
d. Innovative Elementary Curricula
e. Games and Simulations
f. Effective Small Group Meetings
g. Inquiry Techniques
h. Values

(Due to scheduling conflicts, the last two were cancelled.)

Programs were designed for administrators and teachers, with some oriented especially for elementary, some for secondary, and some applicable to all grade levels. After holding the first two workshops at the Center, facilities proved to be inadequate to handle the number of people attending. The remaining programs were held at the Purdue Memorial Center where facilities allowed room for active participation of attendees. These were designed "doing" rather than "listening" sessions.

Members of the Advisory Board assisted in identification of topics and needs and served effectively as teacher-consultants in the first four workshops. Consultants were brought in for the final programs.

Workshops were one vehicle for bringing together teachers and administrators. By working together in a workshop situation, both had opportunities to exchange ideas and to become better acquainted with each other's roles. Administrators played an important role in creating a climate for change and creative teaching by becoming involved in the workshop programs.

Several ways of evaluating the impact of the workshop program were employed. Unsigned post meeting response sheets offered the participants the opportunity to express themselves freely. On a 1-5 scale, the overwhelming response was above 3, which indicated that those attending found something of value in the programs. A sample form is appended.

Much attention was given to continuing verbal feedback from area schools. After each workshop there was a significant rise in requests for resource materials, professional materials on workshop topics, and for follow-up services from Center personnel.

III. Corporation Workshops:

As stated earlier, this offer was extended after school calendars were set. Some very successful local workshops were held on released time during the second semester. Two model programs and response summaries are appended. (See Appendix D)

In dealing with a "captive" audience, the staff expected a higher percentage of negative responses than with volunteer groups (laboratory workshops and seminars). The feedback from corporation workshops showed that such sessions were valuable to staffs involved.

IV. Creative Teaching Conference:

A fall conference was included in the 1968-69 proposal. Due to the change in consultant personnel and the heavy teacher schedule during September, the conference was not held. A spring conference, "Springboard for the 70's" was held on May 10. The emphasis for this conference was on ideas, to bring to teachers' attention some of the most creative ideas that were being introduced in classrooms. The guideline: to include only those innovative techniques and materials that the teacher could use almost immediately, without unusual preparation or expense.

The Purdue University NDEA Economics and History Institutes cooperated with WVEC in sponsoring the conference, especially in arranging facilities at Purdue.

Outstanding consultants, some of the most creative and dynamic people in education and our area teacher-consultants conducted workshop, classroom, and special interest sections. By popular demand, the conference was expanded to include sections in language arts, reading, and science so that teachers in several fields could attend. Area students were used in many of the demonstration sessions, and as guides, aides, etc.

Attendance was open to interested teachers and administrators in several surrounding states. This was an entirely different approach than was usually used. There was a fee of $5 for the conference. This was not a money-making operation, but a large conference open to people outside our WVEC area. The conference fee was to cover the cost of the entire program.

For several reasons, although there was a great deal of excitement about the conference, attendance was disappointing. It was felt by the staff that the idea of paying to attend a conference was a bit of a shock to many area teachers. They had, perhaps, been spoiled for two years--they had often been paid for attending! The date of the conference also caused problems--it was Mother's Day Week-end and in the middle of the spring sports season for high school teacher-coaches. The biggest unforeseen problem involved a situation that had appeared on the Purdue campus after the conference had been planned. Students had been staging a sit-in/sleep-in in the Student Union lounges protesting the raise in fees. The Union connects with the Memorial Center where our sessions were being held. Although fears were completely unfounded - there was no need to fear trouble, the demonstration was completely peaceful - many teachers in our outlying areas would not come on to the campus, despite our assurances that their local media had completely distorted the picture of events on campus.

Summer Workshop for Elementary Teachers, June, 1969

As a result of an informal needs survey among administrators and teachers, a three week workshop was offered in June. It was open to elementary teachers interested in developing resource units to supplement the current curriculum. Sessions were scheduled for afternoons only to enable participants to teach in local summer schools, attend classes at Purdue, etc.

Twenty-five teachers participated in the workshop - it would have been difficult to have more involved because of the lack of suitable working space available in the Center.

Two teacher-consultants worked with Center personnel in planning and conducting the workshop. Center staff members most involved were the social studies consultant, media specialist and librarian. Other staff members cooperated when needed.

Participants worked in grade level committees, and in the case of fourth grade, on unit committees. (10 participants were fourth grade teachers.) A vast amount of resource materials were at their disposal. Special emphasis was given to first, second and fourth grades because these were identified as those most needing supplemental ideas, and more teachers from these grades were involved in the workshop.

While involved in the development of the units, participants had opportunities to examine and evaluate a great amount of resource material of all types and learned how to produce various types of audio-visual materials. While this was valuable to them personally, it was felt that it would in turn be of value to their schools and their colleagues since they would serve as resource people in their buildings and share their experiences and ideas with others.

Six units were developed for first grade, ten for second, 1 fourteen for fourth, three for fifth, plus comprehensive units of Western Europe and Latin America for sixth grade. Suggested activities, projects and resources were stressed, and in many cases "master" copies of activity sheets, maps, etc. were included. (The "Map Skills" unit included 30 maps and charts.) These materials can be used to make transparencies and can also be duplicated by spirit masters. Teachers from Clinton and Tippecanoe Counties developed local history units for schools in these counties.

The post-meeting evaluation tabulation is appended. During the school year, the consultant has had continuing contacts with most of the workshop participants.

V. Resource Materials:

For many Center area teachers, this was one of the most valuable services rendered to the classroom teacher and students. The "revolution" in social studies has brought with it a deluge of materials, both good and poor. Our goal has been to have as much as possible available for circulation among our schools. We offered an opportunity to see, use, and compare materials before ordering on their restricted budgets. Many teachers stated that this had been their first opportunity to really build enrichment units and offer their students the resources for individualized study. For some teachers, these resources offered an opportunity for in-depth study in preparation for teaching particular units. Many publishers supplied us with complimentary copies of their supplemental materials. Because of this cooperation, we were able to supply teachers with many materials on given topics, invaluable for comparative analysis and discovering what might be best adapted for their particular situation.

VI. Textbook Adoptions

Copies of the "checklist" developed in the elementary seminar sere distributed to all area schools. Many used this aid in selecting textbooks for adoption. The consultant worked with several corporation adoption committees during their selection process.

VII. Visitation Services:

A concerted effort was made to visit as many area schools as possible. It was in the area of general services that social studies services were most expanded during the second grant year. Requests for consultant services increased as the year progressed. Generally, meetings were held immediately after school on a social studies staff basis (secondary) or during an individual teacher's conference period.

Certain guidelines for visitation were set down by the consultant at the beginning of the school year. The consultant would never enter a teacher's classroom unless such a visit had been requested by the teacher. Administrators and teachers alike understood that the consultant wan not an administrative arm. The consultant could not be view as a "threatening" force or her role was useless. Establishing rapport with teachers was essential if her services were to be of any value to the schools.

SOCIAL STUDIES PROGRAM
1969-1970

The 1969-1970 social studies program was designed to continue aspects of the previous programs which would best fit the needs of the W.V.E.C. area teachers and schools. In an effort to directly assist as many area teachers as possible two major projects were emphasized during this grant period. Both were concerned with the development of supplemental resource units for schools in the W.V.E.C. area.

During the previous two years it was possible to pay participating personnel small stipends for meetings held at the Center. The stipends were not large enough to serve as a primary incentive for attendance, but merely enough to cover expenses for those who had to travel a distance to participate. There was no budget allowance for workshop expenses. Therefore, if seminars and workshops were to be continued, they would, of necessity, be on a cooperative basis.

I. Elementary Workshop

The June workshop described earlier ended at the close of the 1968-1969 grant period. July and August were devoted to preparing the units developed for distribution to the area schools. Complete packets were ready for distribution to the schools by September 1.

Ideally, individual sets would have been distributed to each area teacher for her particular grade level. This would, it is believed, have increased the value of the materials for the classrooms. This was not possible because of budgetary restrictions. Sets were sent to each elementary school principal. Along with the packets was included a 22 page listing of social studies supplemental resource materials available through the Center (excluding films, etc listed in the IMC catalog), instructions on ordering materials, and order forms. A cover letter was addressed to the building principal. It was suggested that the local schools might wish to duplicate the materials so that individual copies would be available for each of their teachers.

Workshop participants received complete packets of the units and copies were also sent to the State Curriculum Director with consent to duplicate or use all or any part of the materials. During the year, numerous requests were received from other parts of the state for copies, and in so far as the supplies allowed, these requests were filled.

II. Survey of Distribution and the Elementary Units

In January, survey forms were distributed, through building principals to first, second, and fourth grade teachers. The purpose of the survey was to ascertain distribution and usage of units, their weaknesses and strengths as seen by teachers, and to gather suggestions for possible future revision and improvement of materials.

The returns showed that some problems had not been solved, especially the communication problem. Responsibility for school distribution of units was at the local administrative level. In come cases, there was a long delay on distribution. In others, units were distributed in some buildings, but not in others. In some schools, materials were given to one teacher and were never passed around.

Generally, the responses were overwhelmingly positive, although a few teachers replied that they had no need for such aids (I have no time for social studies...I'm too busy with reading and math.) The majority of teachers expressed appreciation for the materials and a desire for units in other curriculum areas. Teachers commented that they found the activity and project suggestions and the bibliographies very helpful. A significant number volunteered to participate in any future development workshops.

As a result of the survey, the consultant contacted teachers who indicated a need for more materials and/or assistance. A small supply of surplus units were distributed to those requesting personal copies. There was significant reinforcement for the contention that these materials would be of most value to teachers who had individual copies.

The fourth grade materials have been most valuable for Indiana teachers. The new curriculum calls for "Indiana in a Regional and World Setting." There were not many textbooks available for this grade level - three were on the adoption list. Workshop participants developed fourteen units that could be used in the Indiana curriculum, and the response from administrators and teachers on these materials has been overwhelmingly positive.

III. Seminar Program

The general reaction to distribution of elementary units led to requests for a similar project for seventh grade. Teachers were generally uncertain about teaching Non-Western Area Studies, the new seventh grade required course. Thus, a seminar was suggested to cover this area.

A letter was sent to all superintendents suggesting an eight-session program. It was recommended that one seventh grade teacher per corporation be allowed to participate in the seminar for eight afternoons during the first semester. The letter also requested local corporations to grant released time and provide a substitute for their participating teachers. Thus, it was decided that a minimum number for the program to be held would be ten. Since requests for released time had been refused in other years, the probability of securing enough teachers for the seminar was low.

Fifteen corporations agreed to cooperate, and several others expressed regrets that they could not participate because of "tight" substitute budgets. A majority of superintendents expressed approval for such a project.

Thr first session was devoted to identification of general problems being encountered by teachers faced with the new Non-West curriculum. The participants, considering the "problems" list, developed their guidelines for resource units, then selected areas to develop and divided into "area" groups: The U.S.S.R., Middle East, Africa, Southeast Asia, and Asia (China, Japan, Korea). Units would include general concepts, objectives, and suggested content outlines, but emphasis would be placed on suggested teaching strategies, activities, projects, and resource bibliographies (all media) tailored for multi-reading and interest levels and would also include background materials.

An intensive search for resource materials was made by the consultant and participants. Participants tested and evaluated materials, then reported to the group, comparing student reaction, problems, and evaluating with seminar colleagues. Participants began to build "resource files" of materials they hoped to be allowed to purchase when school funds were available.

Several resource people worked with participants when possible. Included were Purdue Social Studies Education staff members who had had experiences in Africa. A member of the Social Studies Advisory Board demonstrated a project she developed while attending the summer World Cultures Institute at Denver, Colorado, and shared other ideas with the seminar group. The Center's Media Specialist also worked with participants in developing media projects to be used for motivation.

As a result of the activities of the seminar participants, fifteen units and comprehensive bibliographies were distributed to all corporations in the spring. Although participants had just twenty-four hours actual working time together, they obviously spent many other hours preparing units, reading, testing ideas in classrooms, etc. They expressed satisfaction with the seminar experiment, stressing the personal benefits they derived from it. The opportunity to meet and work with teachers from a number of corporations was given top rating.

IV. Workshops

It was recommended that emphasis should be placed on local workshops during the 1969-1970 grant year. Requests for such workshops must come from the local level. This was math adoption year in Indiana, and elementary administrators and staffs were most concerned about these adoptions - they had had social studies adoptions the previous year. Where secondary staffs are concerned, our high schools have small departments. Local workshops should be planned to include <u>all</u> curriculum areas - the type of workshop model used by the Center staff for the South Newton Professional Growth Day program described elsewhere in this report.

Two Saturday workshops were held at St. Joseph's School, Lebanon, Indiana for area teachers in schools operated by the Sisters of St. Joseph. These were all-day programs - the first was designed for primary teachers, the second for intermediate. They included a survey of materials, teaching methods, inquiry, micro-labs and, a discussion centered on solving social studies curriculum problems in their schools.

The consultant participated in an in-service day for the West Lafayette Corporation staff, conducting sessions for junior high school staff members.

In the Professional Growth Day workshop for South Newton, the social studies consultant conducted sessions for primary, intermediate, and secondary social studies and language arts teachers.

V. <u>Creative Teaching Day, April 25, 1970</u>

The finale for the Social Studies program for the 1969-70 year was a one day workshop held at Purdue Memorial Center. Unfortunately by the time the workshop plans had been granted approval, there were just eleven days to get information out to the area schools and finalize the list of teacher-consultants. Rooms had been reserved at the Purdue Memorial Center - this must be done well in advance - and the number of rooms needed could not be reserved at a later date.

The Creative Teaching Day was a workshop designed for those teachers who were tired of the "read-recite-test" methods of "textbook teaching". Twenty-seven area teachers and two center staff specialists were used as consultants, demonstrating and sharing ideas, methods, and projects they and their students had been developing. Major objectives were to interest our teachers in ways to involve their students in the learning process - in giving them some ideas to ponder during the summer months.

The program included sessions for every grade level, and some sessions that were applicable for many grade levels. Time was set aside in every session for questions, discussion, and exchange of ideas.

Despite the limited number of days available for disseminating information regarding the workshop, and the number of conflicts on that day, approximately 100 area teachers attended the workshop. Since they were encouraged to "drop by" and attend those sessions of special interest to them, and since sessions were held in rooms on two floors of the Memorial Center, we did not "catch" all participants for a post-meeting evaluation response. However, the result of the response sheets that were left at the desk is appended along with the program schedules and list of consultants.

Teacher consultants were paid $25 for planning and conducting their sessions. No stipends were paid to participants.

VI. Resource Materials

A continuing effort was made throughout the year to expand the library of social studies supplemental resources available to teachers and administrators. A twenty-two page catalog of all social studies materials (excluding films) was sent to all schools in September, and a supplement was distributed later in the winter. Particular emphasis was placed on the acquisition of materials that would supplement the Non-Western Areas course. In this area, especially, materials from the Center have given interested teachers, and administrators, a variety of resources to study and evaluate. A number of schools have purchased a variety of area studies for enrichment of their seventh grade programs next year.

Teachers who were interested in developing audio-tutorial, multi-media units relied, to a great extent, upon these resources. Had such a variety of materials not been available for experimentation, it is probable that these teachers would not have gone ahead with the innovative units. As a result, their ideas for multi-media and audio-tutorial programs have been approved by their administrators who have allotted funds for purchasing materials for next year.

In addition to classroom materials, the consultant accumulated selected social studies curriculum guides from schools throughout the nation. The guides were studied by numerous curriculum committees from the schools in the area served by the Center. They have proven to be a valuable source for ideas, bibliographies and possible models for curriculum development. There is a growing awareness of the fact that the development of curriculum guides should not be confused with a course of study, and that good guides will not be developed overnight or in a few one-hour meetings after a long school day. The guide collection available through the Center has helped in several ways - especially in providing examples to administrators of what <u>can</u> be accomplished by curriculum committees that are granted time and incentives to develop materials.

VII. Other Activities

A. Contacts with Teachers and Administrators

School visitations were not as frequent as hoped during the first semester. Priority was given to the development of the seventh grade units which involved identification of materials, contacting publishers, planning sessions, and working closely with the seminar participants.

Contacts were made with all corporations, and the consultant worked locally or at the Center with at least one teacher in 28 corporations. Materials and ideas were shared with teachers in the remaining corporations. However, at least one personal visit was made by the consultant to over two-thirds of the corporations.

Teachers were encouraged to visit the Center if possible, and arrangements were made to meet with then at their convenience - including evenings and weekends. Those who had an opportunity to visit the office and go through materials continued to make use of the services after the initial visit. Few could realize how much was available until they had actually seen all the materials in stock.

During the year, special assistance was given to teachers who were developing experimental units, especially in the realm of the audio-tutorial mode of instruction.

Two significant audio-tutorial programs were developed during the year: one at Delphi High School and the other at Wainwright High School. The consultant assisted the teachers involved in the Delphi program in planning, identifying and supplying materials, etc. She visited the classroom to observe and critique the culminating activities involved in the first unit. These teachers demonstrated their program at the Creative Teaching Workshop.

The consultant met with the Wainwright social studies teachers, principal, A-V director and the corporations' assistant superintendent in the preliminary planning sessions. American history students developed, with teacher supervision, four A-T units. The consultant met with the students, worked with their committees, and supplied resource materials for their units. This program was also presented at the Creative Teaching Workshop. It will continue to be developed next year with funds from the local corporation.

Several invitations were received and accepted to meet with building staffs during their regular staff meetings. A full day was spent visiting Hoover Elementary School, Crawfordsville. During the course of the day the consultant visited classes, met staff members, and had an opportunity to observe library classes and discuss materials with the librarian. The consultant met with the whole staff after school.

Unless specific invitations were received for classroom visitation, school visits were planned to coincide with the social studies teachers' planning periods. In schools visited, the respective principals and staffs have been friendly, cooperative, and interested in current social studies activities. A delightful experience involved working with a fifth grade class of a former seminar participant in planning a social studies fair. The students had obviously been actively involved in learning experiences throughout the year. The teacher had succeeded in putting seminar theories into practice.

B. <u>Social Studies Newsletter</u>

Until the 1969-70 grant year, the Center had distributed a newsletter, <u>Challenge and Change</u> monthly to all area school personnel. The discontinuance of this channel of communication created a vacuum in general Center - teacher communications.

In an attempt to make contact with all teachers in the social studies, K-12, the consultant prepared a <u>Social Studies Newsletter</u> which was distributed to all Center schools in February. The newsletter was written informally, giving information regarding services and resources, social studies council news, some ideas for classroom projects, brief commentaries about ideas some area teachers were trying, and other articles of general interest to social studies teachers.

The response from the schools regarding the newsletter was encouraging and positive. It was unfortunate that the idea was not implemented earlier and subsequently continued on a regular basis.

C. <u>Cooperation with Purdue</u>

Students from the Purdue Social Studies Education Department are sent to many area schools as student teachers. Many have become teachers in this geographic area. The supervisory staff in the Purdue Department and the Center staff worked together tp provide information regarding Center services and materials to these students prior to their student teaching experiences. Instructors from Purdue arranged for a Center visit by classes. Center personnel acquainted them with services and materials and provided time for questions and browsing.

On several occasions the consultant was invited to campus to speak to both graduate and undergraduate classes in Elementary Social Studies Education.

Student teachers have spent much time in the social studies office both prior to and during their "teaching" period to plan units and select resource materials.

This activity was not a formal program in any sense. It was rather, an informal arrangement between some of the university staff members and the consultant. It is believed that it was helpful to all involved.

D. <u>Area Council for the Social Studies</u>

While the Center did not pretend to be a teacher training institution, there was merit in providing opportunities for interested teachers from several corporations to meet together to exchange ideas, survey materials and new developments in their fields, to work together in searching for better methods and ideas for teaching. In small schools, especially, such opportunities for interaction are strictly limited. The lab workshops and seminars last year provided these opportunities.

As an outgrowth of our earlier programs, teachers from several corporations decided that they would like to form a regional council so that they could continue some of the activities started by the seminars and as described above. They also hope to bring about better understanding about social studies curriculum problems among teachers on all levels--elementary through college--through such an organization. The Wabash Valley Council for the Social Studies (WVCSS) was organized in October and is affiliated with the Indiana Council for the Social studies.

The WVCSS is an autonomous organization with members being drawn from all Center area schools and Purdue University. The Center offered its meeting room for Council meetings this year (there were four) and the social studies consultant served as the Council's secretary-treasurer. It is interesting to note that active members thus far are teachers who have been involved in some kind of Center social studies program in the preceding two years. Through this nucleus, they hope to build a large effective professional organization. This could be a lasting legacy of the Center.

SUMMARY

Through the social studies program, 1967-1970, better working relationships were developed between teachers and administrators in many schools and corporations. A climate of change developed in many schools, and teachers were allowed the right to fail occasionally in attempting classroom improvements. Often, the administrators proved to be the best agent for change by encouraging teachers to participate in workshops and seminars, and set an example by participating themselves.

Although it cannot be verified in a strict research sense, it seems that there has been real behavioral and attitudinal change in the various social studies programs of Center schools. Teachers and administrators contend that their students are becoming more than passive learners - they are actively involved in the learning process. Programs are becoming more individualized, more child-oriented than teacher oriented.

There have been changes, too, in the use of resource materials. Through the Center, teachers had access to a vast amount and variety of supplemental materials and have become aware of, and adept at making use of, these materials to enrich their social studies programs.

Obviously, it could not be claimed that these programs, in a three year period, touched and changed <u>all</u> social studies teachers. This was not one of the objectives in the original grant proposal. But, a significant number of teachers were involved in Center programs particularly those teachers with leadership talents who had influence on their colleagues. The Center goal was to develop change agents in the several participating corporations. With perhaps a few exceptions, this goal was achieved in the area of social studies.

In some corporations Center staff found elementary school teachers and administrators enthusiastic and cooperative while at the secondary level the picture was discouraging. In other corporations, the opposite was true. Fortunately, there were many corporations in which staff members on all levels were involved.

A pattern develops when an attempt is made to analyze success or failure by schools and/or by corporations. The key element would seem to be, in most cases, st least, administrative attitude. Generally, the building principal is the key to teacher attitude regarding innovation, in-service training, and curriculum services. This is especially true on the elementary level. (See comments and recommendations). On this level, if the prinicpal did not provide leadership or would not distribute or post information regarding Center programs, etc., the Center Staff had little opportunity to reach the teachers in that principal's building. Communication problems plagued the staff, especially in certain buildings.

There are still too many principals who place a silent classroom at the top of his priority list - the chairs in a straight line, no group work (because this encourages noise!), "the assign, read and answer questions" classroom is the "good" classroom in their eye. Haply, in a few cases, the teachers from such schools become involved in Center programs. They became excited about teaching and had some problems in implementing their ideas. It should be noted that these few changed jobs - they moved to schools where silence was not considered golden at all times in the classroom.

In a few buildings the principal worked with Center personnel in attempts to interest reluctant teachers into trying something other than textbook teaching. One principal said that his teachers had not had a new idea in twenty years and were not interested in hearing any! Out of that staff, two became enthusiastic and valuable workshop participants. One helped develop the elementary unit which teachers, in the evaluation survey, rated as the most valuable unit developed.

Distance to be traveled was a barrier to teacher participants in Center programs in some cases - at least, it was a reason often given. Yet some of the most "involved" participants came from periphery schools - from schools where administrators encouraged experimentation and involvement.

Saturdays and evenings were not ideal times to schedule workshops and meetings but the attitude regarding released time left no alternatives. During the first two years, not one superintendent would agree to released time (except for rare local workshops) for Center programs. Perhaps one of the most significant achievements in social studies was in getting half of the corporations to grant a teacher eight afternoons released time to participate in the 1969-70 seminar.

During the 1968-70 period, the following programs were conducted by the social studies staff:

Six Laboratory Workshops
Three seminar programs (28 sessions in all)
Eight local workshops
Two Creative teaching Conferences

An estimated 650 teachers and administrators participated in these programs.

In addition, the consultant met with all elementary teachers in corporation staff meetings in four corporations, with secondary social studies department staffs in seven corporations, plus building staff or department staffs in a number of schools.

No accurate estimate can be made of the number of teachers who visited the Center to examine social studies resources and work with the consultant, but there were many who did, and many who were regular visitors.

During the two year period, the consultant worked on a repeated basis with several hundred teachers and administrators - locally, in Center programs and visits, by mail, etc. A close cooperative relationship continued with the seminar participants and others who were most interested in change.

What was achieved, overall, through the social studies three year program, can not be fully and clearly evaluated. But, specific examples can be cited in at least twenty-seven corporations for example, teacher and administrative participation, visitations, one-to-one conferences, work in developing innovative programs, and teacher-administrators-consultant views of changes which have taken place.

Change in education is a slow process. The staff had less than three years to "sell" the idea of curriculum services to our teachers and administrators, a service that was unfamiliar to most. They began to accept services slowly - but many developed a working partnership with Center personnel. Originally, to many, the consultants represented a "threatening" force. Once they realized that curriculum personnel were not administrative "spies", that their purpose was to help them in any way to improve their educational programs - that the aim was to work together to search for solutions to their problems, cooperation became exciting.

Over fifty supplemental units were developed by workshop and seminar participants. Complete sets of these units were distributed to area schools.

If only through newsletters, other communiques and general visitation to schools, some kind of contact was made with every social studies teacher and every principal in the thirty corporations. In a limited period of time, it is believed that the overall Center Social Studies Program had an impact on area schools.

As the last semester of the final year progressed, it was interesting - and a bit sad - to note new, and in some cases, sudden, interest in curriculum services, especially from building principals. It seems rather apparent that communication problems exist within most corporations - from central office into the classrooms. What else could explain the fact that so many teachers - and even principals - up to the last school days were not aware that Center curriculum services were not being retained? Again apparently, they had never been questioned by their superintendent regarding their evaluation of services other than films, and had not been informed regarding problems involved in refunding the total Center operation. Up to the last schools days, curriculum consultants were receiving queries regarding "next year's programs", requests for programs, materials, help. Two corporations asked for help in curriculum revision during the 1970 summer months because teachers were to do summer work on new curriculum guidelines and be paid for their work (another breakthrough !).

This situation, frustrating as it was for curriculum consultants, would seem to reinforce the contention that an impact had been made on the schools. School personnel were learning how to use consultant services and were concerned over losing those services. To the staff, at least, this proved that the Center had been successful.

RECOMMENDATIONS

There will continue to be a need for curriculum services in schools such as those served by WVEC. These are schools which are too small or too poor to have curriculum specialists on a full time basis. Today, the emphasis and priorities are being placed on urban and suburban school needs and problems. While this is understandable, the small "non-urban" children must not be neglected.

Good curriculum materials should be developed for the schools involved in a Center project. Teachers from participating corporations should have opportunities to work together on such projects. WVEC area schools have recently demonstrated that released time can be used for such programs - with one teacher per corporation participating for a given length of time. Such materials can be developed to care for the special needs of the children in the area served.

Local workshops should be implemented, but on a broad basis with curriculum specialists from several fields involved in order to offer something of value to the total staff rather than to a portion of the staff.

If feedback from WVEC area teachers is a valid yardstick, then programs should also be planned that will bring together teachers from all corporations - the interaction and exchange of ideas was consistantly given as one of the biggest advantage to Center workshops and seminars.

NOTE TO THE READER

In the following subsection, page numbers were not affixed to the pages because various parts of the subsection had been duplicated previously and were subsequently assembled to form the Elementary Science Project report include herein.

ELEMENTARY SCIENCE

SUBSECTION

Final Report of Elementary Science Project

Introduction

Three years have passed since the initiation of the Elementary Science Project as a part of the Wabash Education Center. The three years represented periods of extensive organization and development, periods of reflection and evaluation, and periods of consultation and promotion. Many hands have added their particular bit of energetic effort and mental guidance and direction. It is to these people that the next few pages, which summerize and report the results and findings of the project, stand as a symbol of innovative and creative development in education.

The results of the Elementary Science Project represent for the most part the initial development and field testing of an impressive form of technogically sophisticated science instruction - present information relative to audio-tutorial programmed science instruction. The report will show the formation of A.T. science lessons, the energetic efforts to perfect the A.T. form of instruction and the efforts to promote and sensitize the general education public to the advantages of audio-tutorial forms of instruction. Included in the discussion of the results is a discussion of the efforts to sensitize people to the use of audio tutorial forms of instruction with special education students as well as a discussion on the expanding use of science instruction as a more meaningful part of elementary school curriculums. Other minor preoccupations of the various staff members are also reported as they often uniquely added to the full schedule of activities and developments undertaken by the Elementary Science Project during its three years of exsistance.

To briefly summerize, everything completed during the three years of the Elementary Science Project would do harm to the unique character and quality of each accomplishment. There will be related comments made (and intermixed) to give form to the individual reports and structure to the total report. The total report will be divided into three major divisions. These divisions consist of individual reports of the various stages, steps, and activities undertaken during the three years. The first division reflects the organization and development of the audio-tutorial science lessons and related materials. Also included is evidence of the master plan and rationale for audio-tutorial formed instruction. The second division reports the extensive evaluation efforts that were undertaken to prove the worth and value of audio-tutorial science instruction. The last division covers the promotion and consultation activities of the Elementary Science Project as it went about its job of research and development.

Division I:

Organization and Development of Audio-tutorial Programmed Science

Report I

Nothing of great importance moves along without a master plan or blue print to follow. This is true of the Elementary Science Project. As an infant the Elementary Science Project gave rise to a rationale and developed a program for audio-tutorial programmed science instruction. As evidence of this master plan a report co-authored by Dr. Joseph D. Novak, originator of the elementary A-T science, and Mr. William Floyd, Director of WVEC, is included in this report. The report, "Development and Use of Audio-Taped Programmed Instruction for Elementary Science" provides a brief history and rationale for the formation of audio-tutorial forms of instruction in elementary science. As an introduction, and for the person newly introduced to A-T instruction, this report provides the answers for how, what, and why, A-T instruction began.

DEVELOPMENT AND USE OF AUDIO-TAPED PROGRAMED INSTRUCTION
FOR ELEMENTARY SCIENCE

A. Introduction
B. Rationale
C. Program Development
D. Evaluation
E. Staff
F. Plans for Fiscal 1969

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DEVELOPMENT AND USE OF AUDIO-TAPED PROGRAMED INSTRUCTION FOR ELEMENTARY SCIENCE

A. Introduction

During the year 1966-67, a feasibility deminstration was conducted with the Wabash Valley Education Center, West Lafayette, Indiana. At that time, audio-tape programed elementary science lessons developed in earlier work were demonstrated to elementary school teachers in four area schools. In addition to observations made by teachers and administrators in these schools, other teachers and supervisors in the Wabash Valley area also observed children working with the programs. As a result of this demonstration program, it was recommended that the Center proceed in developing a series of elementary science utilizing audio-tape programing and other science activities for a Grade 1 through Grade 6 program.

In September 1967, under the operational grant to the Wabash Valley Education Center, program development began on a 30-lesson series for Grade 1. The plan was to complete 30 lessons with the view that approximately one lesson would be available for each week in the school year. The nature of the programs involves student guidance through audio-tape using associated activities with science materials. Included in most programs are a variety of visual aids, including 8 mm loop films, materials that pupils manipulate or experiment with, and any resources that would aid in presenting the concept or set of concepts being taught in the program. The length of the programs varies from 10 to 18 minutes.

In addition to program development, demonstrations were conducted in area schools to familiarize elementary school teachers and administrative personnel with the nature of the project. During 1967-68, classroom teachers were involved in using the program materials in a form of in-service training through the process of school visitation. Small groups of teachers have visisted classrooms where programs are being tested or used, observed students performing in the programed instruction, and discussed problems and issues with the classroom teacher. This experience has proved sufficient to prepare teachers for subsequent involvement in the program.

Program development and testing continued during the summer of 1968. The present proposal is for an extension of the activities through the school year 1969-70 with cooperation of Cornell University, Educational Council of Greater Cleveland and many school systems throughout the country and in Puerto Rico.

B. Rationale

At a recent conference reviewing the status of individualized instruction in sicence[1], a central issue identified was the degree to which structure of student learning experience should be a characteristic of individualized programs. While it was recognized by all that learning is inescapably an individual phenomenon, there was some concern as to whether individuals could profit from group instruction to an equal extent when classroom management permits each student to mose largely at his own pace in a variety of learning tasks. The two issues involved in individualized instruction appear to be: (1) the extent to which individual variation in both the pace and the character of activity is permitted; in contrast to, (2) group instruction, where the pace for learning and learning tasks are largely common to the group.

In audio-tape programed instruction, the rationale used is that it is important to permit students to repeat segments of learning tasks or to vary the pace in which they proceed through a learning task. The assumption is also made that highly structured learning sequences can be used by a broad range of elementary school youngsters when some flexibility in the pace of learning is permitted. This assumption appears valid in the light of experience with the programs developed to date. These programs have been used in schools with children largely from homes of business and professional people.

The elementary science program extends concepts developed in the structured learning sequences (i.e., the audio-tape programed sequences) through individualized activity which is relatively unstructured. For example, after students study and observe the growth of seeds and seedlings in the program sequence, they are given a variety of seeds, paper cups, planting materials and then permitted to proceed much on their own in the growth and observation of seeds and seedlings. Extensive pupil discussion is encouraged as an important adjunct to the audio-tape program sequences.

The audio-tape program sequences are an attempt tp put into practice the general theoretical concepts developed by Professor David Ausubel.[2] In his theory with

[1] Individualization in Science Instruction, a conference supported by Research for Better Schools, Phildelphia, Pennsylvania, December 7-9, 1967.

[2] David P. Ausubel, The Psychology of Meaningful Verbal Learning (New York: Gruen & Stratton, 1963). See also Educational Psychology: A Cognitive View, Holt, Rinehart and Winston, 1968.

reference to meaningful verbal learning, Ausubel identifies the importance of careful sequencing of experience, including the use of advance organizers. In the elementary science program sequences developed at the Wabash Valley Education Center, careful attention is directed to the formation of what Ausubel calls "subsumers"[3] which will facilitate subsequent relevant knowledge acquisition. The use of audio-tape programing is seen as a powerful tool for incorporating ideas of Ausubel's learning theory into science instruction.[4] In addition to the emphasis on meaningful "reception" learning, the importance is recognized of peer interaction for children and the role of the teacher in guiding and encouraging individual exploration of concepts related to the programs.

The program development has borrowed ideas and activities from the American Association for the Advancement of Science (AAAS) elementary science program, where heavy emphasis is placed on processes which are central to the development of scientific ideas. Unlike the AAAS program, where the primary emphasis is on the development of "process" skills, the focal attention of our project is on children's cognitive growth with concept learning as a central objective.

As a necessary dimension of concept learning, pupils are involved in experiences with science materials in such a way as to incorporate practice in the "process" skills identified in the AAAS program. The rationale used for pupil activity is closer to that of the Science Curriculum Improvement Study (SCIS) program as described by Karplus and Thier.[5]

This elementary science project exhibits significant difference from the SCIS program. In our utilization of audio-tape programing, highly structured learning sequences are presented; whereas in the SCIS program, structuring occurs only to the extent that the classroom teacher chooses to impose this. SCIS units have been studied as well as Elementary Science Study (ESS) units and AAAS lessons in an attempt to identify proven elementary school activities which can be incorporated into the programed sequences.

In addition to the development of programs and associated activities, a considerable increase is anticipated in demonstration projects in the Lafayette center as well as in several test centers where interest in the project has been expressed. These centers include Research

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[3] David P. Ausubel, The Psychology of Meaningful Learning

[4] Ibid., P. 50.

[5] Robert Karplus and Herbert D. Thier, A New Look At Elementary School Science (Chicago: Rand McNally, 1967),

for Better Schools in Philadelphia, Pennsylvania; the Educational Research Council of America; and several other Title III centers. While the staff will not be directly involved in the field testing and demonstration with these groups, there will be some necessary training and orientation conducted in Lafayette and Ithaca.

C. Program Development

Where presentations have been made describing the project work, ont of the recurring questions asked related to the nature of the conceptual structure which undergirds the projected grades 1 through 6 program development. As indicated in the section on rationale, the program sequences and associated activities are being designed with a heavy emphasis on development of concepts important in science. It is therefore, imperative that programs designed for Grade 1 introduce elementary or subsidary concepts which will be expanded at subsequent grade levels. This requires a conceptual "road map" that will provide some assurance that concepts useful for lessons in later grades will have received at least preliminary attention.

The project director, through work in association with the Midwest Program on Airborne Television Instruction, the National Science Teachers Association Committee on Curriculum, and other elementary school science activities has developed a curriculum structure for the elementary grades embodied in the World of Science Series.[6] Although the individual programed lessons are not directly related to materials presented in this text series, the conceptual structure delineated in the series is essentially the structure being used in the project. The availability of the textbooks and explanatory materials in teacher's editions provides a convenient base for explication of the conceptual structure to project staff members, particularly those who are new. Also, the text series, along with nationally developed elementary science programs, serves as a source of ideas for the programed activities.

Thirty programs are new available for use in the first grade. The development of these programs has included production of slides, 8 mm loop films, a variety of visual aids, and some student response forms as an intergral part of each program.

Wherever possible, commercially available materials are incorporated into the programs to facilitate future widespread utilization of the programs. Portable cartridge tape recorders, which retail for less than $50, and simple carrel units, which can be made available for less than $20 each are utilized.

[6] Joseph D. Novak, et al, The World of Science Series (Indianapolis: Bobbs-Merrill Co., Inc., 1966) 6 volumes.

The "software" included in each program varies in cost from less than $2 to approximately $30 for the more elaborate programs. It is anticipated that the average cost of software will be approximately $15 per program, and present plans call for a complete program set to consist of 30 programs. This cost per program set per classroom considers neither amortization, nor the possible sharing of program sets by more than one classroom.

The procedure for program refinement has been as follows. A preliminary version of the program is developed with criticisms from project staff and tested with individual students. It has been observed that the first version of a program always shows a number of difficulties that can be identified with as few as three or four students. The program is then revised and tested again with a small number os students.

In general, the deficiencies in the program are apparent with each of the students tested. As revisions continue, fewer and fewer deficiencies appear, and increasingly only students classified as slow learners pinpoint segments of the program that could benefit from additional refinement. The difficulties encountered include:

(1) vocabulary level;

(2) pace of audio instruction;

(3) difficulty with performance tasks required of the student;

(4) synchronization between audiotape and loop film observed by the students;

(5) density of information presented;

(6) failure of demonstration or inability of student to observe critical events;

(7) inadequacies in loop films or other visual aids; and

(8) unexpected distracting events or cues.

Program refinement has been conducted in "average" classes as well as with students from culturally disadvantaged homes. The end result, after four to eight or more revisions, is a program which functions relatively smoothly without assistance from a teacher in any classroom in the school utilized to date.

D. <u>Evaluation</u>

Evaluation of the program results partly as a natural process of refinement and debugging, but associated evaluation in terms of criterion behaviors expected through the programs is an integral part of the project activity. In May 1968, an evaluation team was brought in to review work of the project, observe programs in the schools, discuss the philosophy and rationale of the program development, and provide other forms of criticism. The evaluation team consisted of Dean J. Munro Atkin, University of Illinois; Dr. Ted F. Andrews, Educational Research Council of America; Dr. Alfred Braswell, National Science Teachers ASsociation; Dr. Joseph Lipson, Nova University; and Richard Schulz, Cedar Rapids Public Schools.

As program testing and refinement proceeds, an evaluation form is employed which identifies specific behaviors. A staff member observes students proceeding through the program, and indicates whether or not the prescribed behaviors are occurring. For example, if a student is asked to place a battery in a "tester" to see if it can produce electric energy, the observer indicates whether or not he does indeed perform this task. After a number of students are tested, the percentage of students performing each of the behaviors can be computed. This permits the staff to identify portions of the program which may need additional refinement and also serves as a form of evaluation of program success. It is hypothesized that if the activities required of the student are relevant to the concept being taught, a high frequency of observered desired behavior (90 percent correct or better) serves as a check for concept attainment.

Additional evaluation includes interviews with students and unstructured discussions with classroom teachers. Further objective evaluation will be attempted in future work and will involve observation of pupil behaviors and new related tasks that may contribute to understanding the concepts presented.

Demonstrations or testing programs have been conducted in over 20 schools involving more than 50 teachers. Without exception, the programs have been enthusiastically received by the teachers, pupils and school administrative personnel. There is every reason to believe that continued development of the programs and their eventual widespread utilization in schools can be expected.

The project director is conducting an independent but related research project in Ithaca, supported by funds from another agency. In this project, an anaylsis is being made of the relative contribution to concept growth of three instructional modes used in various combinations. The effect on concept learning of programed instruction, programed instruction with associated independent learning activities, and small group pupil discussions and conferences is being explored. Our preliminary data suggests that most of the increment by the groups tested has resulted from the programed instruction. Large enough samples have not been tested to perform a factor analytic study, although this is comtemplated for the future.

A continuing liaison will be maintained with work being done at Oakleaf School in Pittsburgh and with other elementary science curriculum programs. Based on the feedback obtained from the May conference of consultants, two or three additional evaluation sessions are contemplated employing consultants and additional personnel.

Copies of the Wabash Valley Education Center Newsletter, which carries information on this elementary science program, are made available to any interested persons. Reports will be presented at several national meetings during fiscal 1969 describing the rationale and progress of the program.

E. Staff

Qualification of staff in the project include not only competence in science or selected fields of science, but also some training in learning theory as incorporated in this project and experience in teaching children. It has been very difficult to identify sufficient numbers of staff members to meet established target dates for program writing. Part of the difficulty resulted from the move of the project director from Purdue to Cornell University. Staff training programs at Cornell and in-service training programs in Lafayette show promise for overcoming the staffing difficulties experienced during 1967-68. In addition to professional staff involved in program writing and testing, it has been possible to employ experienced elementary school teachers and certain graduate students in science for assistance in program testing and debugging. The creative talent required for program writing and planning of associated acitivities has not been widely found in ordinary graduate student populations.

The project should move forward with the staff team presently employed, plus additions that are in prospect. Activities in Lafayette will be coordinated by a research associate who will serve on a half-time basis. Working with the research associate will be three additional staff members currently with the project and two new project associates. A team of graduate students will conduct program development and field testing under the director's supervision in Ithaca, New York. An experienced secretarial staff will continue with the program in the coming year.

F. Plans for Fiscal 1970

A preliminary version of 30 programs for Grade 1 will have been completed. Since these programs were developed in two to six program sequences, with none of the students receiving all of the programs developed for Grade 1, further refinement and some alteration in program content was necessary as testing proceeded during 1968-1969. Relatively "final" versions of the first grade of "level I" sequence of lessons should be available by the summer of 1969.

The initial development and testing of lessons for Grade 3 (level III) will be conducted in Ithaca, New York. Thr procedure will be as described above. Cognizance is being taken of the problem of design and development of programs at the second grade level when students being used for development have not experienced audio-tape programmed instruction in the first or second grade. However, some work has already been done by the project director and Dr. Robert G. Bridgham[7] at the third grade level in programs dealing with electrostatics. It has been found that program sequences could be developed and used successfully by the third grade students. These students had not received any prior audio-tape programmed instruction, nor any appreciable amount of elementary science instruction, It remains an interesting question as to whether or not programs developed with such a population will function effectively with students who have had one or more years of prior audio-tape programmed instruction and associated science activity.

The staff resources of the Wabash Valley Education Center will direct their efforts to demonstration and evaluation programs. In addition to further demonstration and evaluation of level I programs, at least ten schools will receive level II programs. Refinement of level II programs will be conducted both in Lafayette and in Ithaca. Preliminary testing and evaluation of level III programs, developed in Ithaca, will be installed and evaluated in Indiana schools. The number of level III programs developed will depend on the funding available for this work in Ithaca.

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[7] Robert G. Bridgham, An Investigation of Piagetian Tests as Predictors of Student Understanding of Electostatics, Harvard University, 1967, Ed.D. dissertation (unpublished).

Report II

In every successful research and development program there arises a product of some type. Because of its very nature, it is impossible to place an A-T lesson in this report. So, the next best substitute is a breakdown of the description normally given to teachers who are using the 30 lessons of the Level One (first grade). The A-T lesson descriptions follow a brief rationale and note to the teacher. In the note to the teacher such things as the operation of the A-T lessons are explained, a description of the operation of the equipment is given and a brief explanation of the anticipated students reaction to the lessons are explained. Following the teachers note is a brief description of each lesson along with a general statement of purpose for its being included in the level one curriculum. A cursory perusal over a group of any of the lessons listed should provide one with an idea of just what is being taught in the A-T science curriculum.

Levels Two and Three are similar in nature to the direction and scope of Level One. The difference being only that they are more complex and designed for more mature students in grades two and three. The major portion of development of levels two and three took place at Cornell University in Ithaca, New York, under the direction of Dr. Joseph Novak.

A RESEARCH AND DEVELOPMENT PROGRAM FOR A NEW ELEMENTARY SCHOOL CORE CURRICULUM BASED ON SCIENCE READING AND MATHEMATICS

Joseph D. Novak, Cornell University

Rationale

For centuries the elementary school curriculum has had as its core the teaching of reading, writing and arithmetic. In the primary grades, these subjects remain today as central with scattered topics on American Indians, plants and animals and brushing teeth sprinkled in with occassional art and music sessions. They upper elementary grades extend this pattern and include the challenge of learning the major industries of United States cities and states, an array of mathematics algorithms and a few contrived experiments or demonstrations in science. If we accept a theory of learning that postulates the facilitation of new learning primarily through the acquisition of relevent concepts, the potpourri of present elementary school learnings necessarily ends in substantial failure. Add to the liability of existing curriculum the limitations placed on teachers and students and we have the basis for Holt's description of "How Children Fail". More patchwork is not needed; a new elementary school core curriculum is needed, together with utilization of practicable technological devices that will aid both teachers and pupils. This is the objective of the proposed research and development program.

A central premise of this project is that the learning theory formulation of David Ausubel (1968) is sound and applicable to the design of instructional systems. While Ausubel's theory incorporates many of the propositions of Jean Piaget, Robert Gagne, and B.F. Skinner, it contrasts with the work of these theorists in its specific inclusion of parameters associated with school learning. In our opinion, Ausubel's theory trancends the work of other psychologists and provides a powerful base for new curriculum design.

Much of the learning that takes place in school is <u>rote</u> learning and the value of this type of learning has been shown to be exceedingly limited when contrasted to <u>meaningful</u> learning. To Ausubel, <u>meaningful</u> learning occurs when new information and experience can be related to existing concepts in the learner's cognitive structure, with acquisition of the new material resulting in some additional differentiation of prior concepts. For young children, various paradigms may be employed to make use of existing concepts and for the development of elemental concepts that will have power for facilitating future learning. Some of these paradigms are described below as we indicate the methods by which program materials are developed.

There is now available a wide variety of technological devices that can be employed practicable to facilitate learning. Since the acquisition and differentiation of concepts necessarily involves the individual learner, the use of tape recorders, loop film projectors, slide viewers and study carrels can do much to individualize the learning experience. Though the specific sequence of cognitive events that results in concept learning is idiosyncratic, there is sufficient commonality in the requisites for concept learning to permit the design of instructional regimes effective for a wide range of learners. Much of the work of this project will involve the design of audio-tape programed lessons (see Figure 1) to facilitate individualized teaching of concepts.

Science as an organized program of concept learning is essentially non-existant in the primary grades. And yet, natural phenomenal probably impinge more on young children than any other kind of experience. If we were to provide children with concepts that could help then to organize and interpret some of this experience, the result could result in substantial enhancement of learning in other curriculum areas. Language and mathematics deal with the real world in a symbolic and abstract form. If important concepts in science could be taught to children, and there is evidence to favor this, the teaching of language and mathematics through meaningful learning experiences could be greatly improved. Another factor argues in favor of building elementary school curriculum around science concepts; there is wide recognition and agreement among scientists as to what are major concepts in science. No other field of human endeavor has the universality of science. School curriculum design should incorporate this culturally recognized universality as a powerful vehicle by which to facilitate broader concept learning in other disciplines.

Though few elementary school teachers are competent in science, the use of audio-tape programing for achieving important segments of cognitive growth circumvents this limitation. Moreover, teachers as well as pupils can learn from the programs, thus acquiring at low cost important and necessary "in-classroom", in-service teacher training. A significant feature of the proposed program is that elaborate re-training programs would not be needed, though modification of existing training programs would be obviously indicated -- and we believe long past due!

This project will utilize computers only to a limited extent, primarily for record keeping and as one means of pupil evaluation. Substantial use of the computer for instruction does not appear widely practicable at this time. Nevertheless, the individualized and semi-programed nature of the instruction under this project could provide easy transition to increased use of computers in future instructional systems.

A

TO THE TEACHER

Science and Children

Children, by their very nature, are attracted to science. They are curious, adventurous, imaginative, and enthusiastic. They are daring explorers, avid collectors, eager experimenters, and tireless questioners. They enjoy probing, investigating, manipulating, and controlling the resources of their environment. They have an intrinsic desire to know more and more about their friends, their homes, and the world around them. They possess, it would seem, an innate need for explaining and understanding the phenomena of nature. Children exhibit, in fact, many of the traits which usually are deemed characteristics of adult scientists.

In the preparation of this sequence of individualized audio-tutorial lessons, it has been recognized that, although children come from diverse backgrounds, they have had certain common experiences which can serve as starting points for developing understanding of scientific concepts and principles. The experiences of the children can be brought to focus on a particular principal or concept. Then, as new information and experiences are provided, each child achieves a larger or more complete understanding of the concept or principle. (It should be emphasized that each child forms his own concept in his own way; therefore, not all children attain the same level of comprehension and understanding at the same time.) The next time the child is confronted with the same principle or concept, he builds on that which he has established and retained.

The media used to develop the mode of audio-tutorial instruction represents only one facet of the program under development. Through the use of this media, the teacher is able to accomodate a form of individualized instruction in her classroom without placing an added burden to her teaching activities.

The major consideration in development revolves around the concept that these lessons are sequenced to represent an evolving science curriculum. A science curriculum which builds on itself toward the conceptual development of the learner in relation to the major themes in science as identified within the structure established for the program.

What Happens In Your Room

These individualized lessons are written and tested to enable each child to sit down at the booth, run the machinery, follow the verbal directions, and meaningfully learn the principles and concepts successfully. However, the first two or three weeks may be a little rough going for the children to completely master the tape recorder and movie projector and become familiar with the following verbal directions from a tape recorder. Do not be discouraged if one student forgets to rewind the tape or pushes the rewind button instead of the stop button. After two or three weeks, all of the mechanical things are mastered and the students can concentrate on the content of the material. Do not worry about the children breaking the equipment. In three years of testing, we have never had a child break a tape recorder or a movie projector. Sometimes a plastic bottle may break, or some minor piece of equipment may be damaged, but that is to be expected, and the A-T personnel will quickly replace any item. This staff will also be available to replace any defective tapes or films and damaged equipment. Please notify this staff of any difficulties as soon as it is convenient to you. A few things that you might do to help are the following:

1. Check the film and tape to see that they are still working.
2. Compare the equipment in the booth the beginning of the day with the picture of the booth that you will be given.
3. Unplug the tape recorder and movie projector at the end of each day and plug them in at the beginning.
4. Help the students find time to go back to the booth as often as they wish and is convenient with the running of your class.

C

These lessons have been tried with a great variety of first grade children. Our tests show us that we can expect the achievement of a class of children from a high socio-economic background not to differ greatly from the achievement of a class of children from a low socio-economic background. However, different things will happen in each of the classrooms. We have seen that the children from the higher socio-economic background will usually go through the lessons once each week and spend about fifteen minutes on the lesson. These children also are more verbal among themselves about what they learned and how they apply what they learned. Children from a lower socio-economic background usually go through each lesson two or three times, as time permits, and spend several more minutes on the lesson. If convenient, allow your children to go through the lesson as often as they wish. Very soon, the children can tell if they have successfully learned the concept presented. They become very effective in regulating their own learning and this science material becomes truly individualized. Encourage the children to talk among themselves about what they learned and how they can apply what they learned. We have found that it is often more beneficial for the children to discuss things among themsleves than for the teacher or one of our staff to lead a discussion.

<u>How can the Teacher Answer the Questions Asked by the Students?</u>

After reading the concept outline of this first grade science course you may feel that you will be unable to answer any questions asked by those little scientist. You will <u>not</u> have to spend three hours a day in the science library or take twenty hours of physics, chemistry, biology, or space technology to help your students. The most important thing for you to do is to sit down at the science booth before and after school and spend fifteen minutes going through the lessons yourself. A teacher's logical ability and general experience is so much greater then that of the students that the teacher will find that

D

she will be very successful helping the student if she goes through the lesson each week herself.

Do not hesitate to tell the student to go through the lesson again to clear up points that they missed. (If you have gone through the lesson yourself, you will be able to know if a question can be answered by going through the lesson again.) Another very successful procedure is to have the student ask his or her question to a group of students who have already gone through the lesson. If you would like some reading material which specifically covers the topics in the first grade science the following student text and teacher's guide will be helpful: Novak, J.D., The Inviting World of Science, Bobbs-Merrill Co. Inc., 1966 and/or Brandwein, Concepts in Science Series, Harcourt, Brace & World, at.al. It would be very helpful to us if you would keep a list of some of the questions asked by the students. These questions help us improve the material and help us plan the complete teacher's guide.

What is All of This Equipment?

TAPE RECORDER

This tape recorder has a piano keyboard operation system, There is a button for play (marked number 1), a button for rewinding (marked number 2), and a stop button (marked with a red stop sign). There are two other buttons; a fast forward button (covered with tape) and a record button (also covered with tape). This machine has a volume control which can be adjusted by the individual student. The recorder is equipped with earphones which help the child concentrate and reduces any disturbance to the class. There is a double earphone system available to enable an evaluator to listen to the tape, along with the child, and watch the child's responses. The tape has been fixed so that it cannot be erased. If the tape should break or stick notify the support staff. This recorder uses normal household current and should be unplugged when you leave in the afternoon. If the tape recorder should malfunction, notify the support staff.

E

MOVIE PROJECTOR

This is a Super Eight cartridge movie projector. The projector has an off-on knob on the top. There is also another knob on top (taped over), which adjusts the frame of the movie. Focusing is done by turning the lense nose on the front of the machine. Unplug the projector as you leave in the afternoon. The film is contained within the plastic cartridge which is sticking out of the back of the projector. The film is in a loop so that it does not need rewinding. When the film is finished the child will see four seconds of red stop sign and will be directed to stop the machine. After a little experience, the children have no trouble operating the movie projector. In some lessons, the student may be asked to see a short sequence and turn off the machine; then later in the lesson he may see another sequence and stop the machine. Therefore, there may be two or more sotp sign sequences in the film loop. Sometimes the film will stick and become damaged. This is due to equipment failure and is not the student's fault. If the film is running and you see the picture becoming distorted, either turn off the machine or pull the plastic cartridge right out of the machine. The film should not be used until it is repaired or replaced. Notify the support staff. These are malfunctions that are rare.

OTHER EQUIPMENT

The other equipment changes from week to week. The purpose of this support equipment is NOT to give the student something to do while they listen to a taped lecture. If you are going to study the liquid state of water you should have some of the liquid water around you. This is the purpose of the support equipment. When the students study electric energy and change of electric energy to light energy, they need some batteries and wires and bulbs. The tape makes clear what the objectives of the lesson are, and it leads the student through a series of experiences, which, along with some verbal connection and explanation, will build concepts and principles on the student's existing knowledge.

F

TO THE TEACHER

1. Encourage children to listen carefully to the voice on the tape recorder.

2. Children are to do exactly what the voice tells them to do.

3. Encourage children to touch and manipulate the materials available to them.

4. Child should not be interrupted by others during the lesson.

5. Child should face the table with both feet under the table as the best position for concentration.

PROGRAM #1

Description -- Orientation to Equipment. What is a Science?

Discussion of equipment and how we can use it to observe nature.

The child is guided in his first use of the tape recorder and is introduced to following directions given on the tape, which direct him through a number of tasks relating to observation and classification as process tools in science.

PROGRAM #2

Description -- An Experiment in Science

The child gains further experience in observation and classification in his experimentation carried out with batteries and a battery tester. The concept of electricity as one form of energy is introduced.

PROGRAM #3

Description -- Energy and Some of It's Forms

Measuring -- Measuring helps us to observe more carefully and thereby to answer questions better. The concept of electricity as a source of energy is reinforced and serves as a means of introducing the child to heat and light as other forms of energy. The major ideas of energy and change first become emphasized in the program.

PROGRAM #4

Description -- Transfer of Energy

The child manipulates a board mounted with different forms of energy apparatus to further illustrate the changes that can occur in energy once stored as electric energy in a battery. A worksheet provided for each child, picturing examples of heat energy, light energy, and energy of moving, relates uses of energy to things he has seen before. Gasoline as a source of energy for some moving things is discussed. The idea that energy can be obtained in many different ways and that all energy can be used to change things begins to be developed.

PROGRAM #5

Description -- Energy Without Electricity - Food as a Source of Energy

Food as a source of energy for living things is a concept that begins its development in this program. This is expanded to introduce the student to changes which occur in his own body that relate to the various forms of energy discussed in past programs.

PROGRAM #6

Description -- Energy Utilization by Living Things

The energy needs of living things is developed in this lesson. Food as an energy source is common to all living things. As the program develops, differences in energy utilization are shown to exist through pictures and film. In the process, the student is taught how to operate the technicolor loop film projector.

PROGRAM #7

Description -- Introduce Differences Between Living and Non-Living Things

This lesson concerns the use of food by living things for energy to move, and grow. The concept of differences between living and non-living things is demonstrated through this lesson. The child is guided through the first stage of an experiment involving corn seeds and pebbles to demonstrate the concept of differences between living and non-living things. He carries it away to his desk to observe the changes that will occur over a period of several days. He will use the planted seeds for the next lesson.

PROGRAM #8

Description -- Energy Utilization in Living Things

Observing the changes that have occured in the student's plant experiment from the previous program, the child is acquainted with other requirements of living things. The concept of energy needs for growth and movement in living things is further developed. After these topics are related to the child around his experiment, he is guided through a transplanting procedure for his germinating seedlings into a cup with soil. Again the child leaves the program with his seedling and is asked to maintain it in the soil and observe the growth changes which occur.

PROGRAM #9

Description -- Differences between Living Things

Having reinforced the child's concept of living vs. non-living things, this lesson goes on to introduce the differences between living things. Classification is employed to illustrate the differences between plants and animals. Major differences between the two groups are discussed in relation to previously learned energy concepts.

PROGRAM #10

Description -- The Food Chain

This lesson further develops the concept of plants providing food energy for animals. Also the fact that small animals, like insects, often are food to larger animals, like birds. The concept of the food chain in introduced, and the dependence of all animals directly or indirectly on plants is emphasized.

PROGRAM #11

Description -- The Food Chain - Food web concept is further developed

Through the use of pictures, examples of living things interacting are presented. As the lesson proceeds, however, the concept of the importance of the sun as a source of all of the energy available to the interacting living things begins to evolve.

PROGRAM #12

Description - Diversification Within Animal Kingdom

The concept of differences between plants and animals is reviewed. Introduced in this lesson is the concept of diversification within the animal kingdom. Characteristics of birds, reptiles, and fish are examined.

PROGRAM #13

Description -- Closer Look at Animal Diversity

The concept of animal diversification is further developed. The child receives practice distinguishing between fish and reptiles, birds, and mammals. Children are helped in their discrimination by being asked to try and think what is growing on the skin of the animals they are looking at -- Hair? Scales? Feathers? Habitates are seen to be a determining factor in what an animal is like. The child learns of the different adaptations of animals for air consumption.

PROGRAM #14

Description -- Animal Diversification - Invertebrates.

Animal diversification is carried through to the invertebrate group. A wide variety of representative invertebrates are presented and discussed by still pictures and loop film.

PROGRAM #15

Description -- Air is All Around Us

This lesson guides the child through an examination of air as an entity. The realization that air is a thing that is all around him begins its development in this lesson. Blowing air through a straw into water makes air visible in the form of air bubbles. He realized that empty things are not really empty, but contain air -- illustrated by immersing a small bottle in clear dish of water and watching the air escape in bubbles. Other activities discovering where air is are suggested for the child to do on his own.

PROGRAM #16

Description -- Solids, Liquids, and Air
Air is Real

The child's previous knowledge gained through experiments with air are reinforced in this lesson which goes on to introduce the child to the study of liquids and solids. The child is shown one way that air can be weighed -- with a straw balancing two air-filled balloons, one of which is later emptied, upsetting the balance by its lighter weight. Child learns the word "solid" in connection with the hard plaster. He compares the pliability of solid with that of air. He continues to examine air and what air can do. Child reviews from this lesson that air is all around us, air has weight, and air can push things.

PROGRAM #17

Description -- Solids are made of Molecules

The concept of solids, liquids, and gases is expanded in this lesson. The characteristics of solids are observed through the child's manipulation of clay and breakable plaster - like pieces. He begins to see that all solid pieces are made up of smaller pieces. He learns that even the smallest piece of plaster he has in his dish is made up of little parts that are so little that he cannot see them. He receives his first introduction to the word "molecules" at this time.

PROGRAM #18

Description -- Liquids and Gases are made of Molecules.

The child's concept of molecules is further developed in this program. His knowledge of molecules in solids is reviewed. In this lesson he is guided through an experiment with drops of water to illustrate the concept that even the smallest drop of water has many little parts he cannot see called molecules. An experiment with suds illustrates that even the smallest bubble is made up of small molecules. A review of the important ideas about solids, liquids, and gases is reviewed.

PROGRAM #19

Description -- How Solids, Liquids, and Air are different from each other.

The child's concept of arrangement of molecules in solids, liquids, and gases is developed in this lesson. He realizes molecules in solids are stuck together quite tightly; in liquids molecules are not stuck together, allowing liquid molecules to slide around each other; in gases the molecules are not stuck to each other and can be pushed around easily.

PROGRAM #20

Description -- Move about Air Molecules.

This lesson takes a close look at the movement of air molecules by having the child blow through various thickness of cloth held by hoops and feeling to see how much air is able to get through the openings.

Two bottles of vinegar are covered with cloth and plastic respectively. The child is encouraged to think about why smell comes through the cloth top and not through the plastic. As the child looks closely, he realizes there are no holes in the plastic to let the molecules out.

PROGRAM #21

Description -- Air Pressure.

This lesson introduces the concept of air pressure. With metal balls representing molecules, the child becomes acquainted with the concept of "pressure". The child recalls wind pushing against him-wind is air, so wind makes "air pressure". He learns that as we go further up into the sky, the air molecules get farther and farther apart. When we go up far enough, we are in space where there are no air molecules.

PROGRAM #22

Description -- Continued Study of Air.

This lesson pursues the study of air. Using a number syringe pumps the child continues to see that air molecules can be pushed about easily. He sees molecules in solids cannot be pushed much closer together and that trapped air can be pushed in but will push back with "air pressure".

PROGRAM #23

Description -- Introduction to Molecular Kinetics Molecules in Motion.

The concept of molecules in motion is the theme of this lesson. The child learns to visualize in his mind the general proximity of air molecules during normal air pressure and during high air pressure. He understands that increased squeezing together of air molecules causes increased air pressure.

Illustrations of things with little balls showing motion of molecules through the air aid the child in his visualization of the invisible molecules. A film further aids the child. The last illustration is realizing that all the smell really is, are germium molecules coming through the air to his nose.

PROGRAM #24

Description -- Continued Study of Motion and Energy of Molecules.

This lesson strengthens the child's concept of constant motion of molecules and of the energy molecules contain. He sees liquid molecules can become airborne and become "smells". Heating will increase the number of molecules leaving a liquid and a stronger "smell" results. A film of children representing molecules in motion in solids, liquids, and gases helps the child to better visualize what he cannot see. Using apparatus the child sees that no "smells" can get to his nose through things that don't have holes.

PROGRAM #25

Description -- Changing States of Matter.

This lesson further strengthens the child's concept of movement in molecules and the different movement in solids, liquids, and gases.

A film is shown depicting the energy changes taking place in a sequence of water changing to ice to water to steam. The child will make his own changes from a solid to liquid. The child guided by the tape, uses a small bottle of rubber beads to visualize what motion real molecules have in solids, liquids, and gases.

PROGRAM #26

Description -- Introduction to Change.

This lesson formally introduces the theme of change by exploring ways things change and different kinds of change. Weather changes are discussed accompanied by a picture series. The child realizes that seasonal changes are made up of endless small changes. Growing is reviewed as a kind of change of growth to further illustrate change. The child learns that when things move they are changing.

The child sees that plants and animals change in many ways and that most big changes are made from little changes.

PROGRAM #27

Description -- Measuring Change.

This lesson deals with measuring energy changes, The child manipulates - controlled light which makes a change on a thermometer as the bulb brightens. An air pump is manipulated to effect a change in the size of the balloon that is fitted into the apparatus. With a wooden device resembling calipers the child actually measures the change in balloon size.

The child learns from this lesson that change is often apparent and can often be measured.

PROGRAM #28

Description -- Energy and Change.

This lesson pursues the concept of energy in change. The child learns that his muscles use energy to make changes by pushing, pulling, or squeezing. He reviews the effect of transfer of energy in the lamp heater. The process of melting is reviewed as it effects the position of molecules. Melting of a large amount of solid takes more energy than melting of a small amount of the same solid because to the large amount of solid has more molecules that need energy to move apart. The child learns in this lesson that he produces heat energy that can be measured.

PROGRAM #29

Description -- The Sun.

This lesson develops the concept that heated air rises and that the sun gives off light and heat energy. A pinwheel mounted on the lamp heater is made to turn by heated air. The child realizes that the sun gives off light energy making it possible for him to see and the sun also gives off heat energy just like the bulb in the lamp heater. The child also recalls with the help of the film that plants get energy from the sun.

PROGRAM #30

Description -- The Moon.

This lesson reviews the concept that light energy and heat energy is made by the sun. It introduces the concept that the moon goes slowly around the earth in a large circle. This lesson makes use of a black box containing a light, an Earth, and a moveable moon model and a ring with a ball mounted on it that the child can revolve around his head.

Report III

The Elementary Science Project activities included another form of science instruction which were related to the A-T lessons in level one. These materials are called Supplementary Science Materials because of their supplementary nature to the standard A-T lessons. The supplementary materials design was based on an individualize science booklet which is used to guide the first grade student in performing some activity or experiment. These science booklets generally follow the format of a brief pictorially illustrated direction book. The booklet is included with a set of equipment for use by the individual student. The supplementary lessons have been written in five format guises which have been tested on limited numbers of students. A more detailed description of the supplementary materials developed by Elementary Science Project is given in the following report.

SUMMARY OBSERVATIONS OF A VARIETY OF SUPPLEMENTARY SCIENCE ACTIVITIES FOR THE FIRST THIRTEEN LESSONS OF AN AUDIO-TUTORIAL PROGRAMMED SCIENCE CURRICULUM

A project conducted by the Elementary Science Project of the Wabash Valley Education Center in cooperation with the Tippecanoe School Corporation.

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June 30, 1970

Acknowledgements:

Our appreciation to Mr. Mikels, Superintendent, Mr. Thayer, Assistant Superintendent, Mr. Minneman, Elementary Curriculum Coordinator, and Mr. Bohs, Principal, Tippecanoe School Corporation for allowing us the privilege to conduct the pilot study. Also, Mrs. Boggs, Mrs. Ellsberry, Mrs. Odle, Mrs. Hoover, and Mrs. Maddox for their aid and cooperation in helping us successfully evaluate the supplementary science activities.

Introduction

The Elementary Science Project, as part of its research and development, has attempted to develop individualized activities that supplement the science curriculum of the audio-tutorial (AT) programmed science instruction. The supplemental activities developed initiated as a response to appeals from the teachers who were using the audio-tutorial science lessons. The participating audio-tutorial teachers requested activities that would generalize and reinforce the concepts and skills the children were learning in the AT lessons. Thus the Supplemental Science Activities were developed to reflect the content of the first thirteen audio-tutorial lessons of the first grade level and to reinforce and help generalize the content. To continue the individualized nature of the AT lessons the supplementary activities were also designed to be given to individual students. Several formats were experimented with as a design for the individualized supplementary activities. The different formats are included with the original development and will be compared during the field testing of the activities.

Development of the Supplemental Activities

The development of the audio-tutorial supplementary activities was initiated during the spring semester of the 1968-69 school year. It was at this time during a pilot field study that the direct appeals of the field study teachers stimulated the Elementary Science Staff into producing some pilot supplementary activities. Mrs. Edity Doherty was the person who came up with the directional booklet design that became the backbone of the future development and format designs of the supplemental activities.

The directional booklet design is a modification of the SRA individualized reading programs for elementary schools. The booklets with words and pictures briefly explain the purpose and directions for doing the activity. The booklets are legal sized 8½ x 13" paper folded in the middle. The folding of the paper creates a booklet (8½ x 6½) containing a front page, two inside pages and a back page. The four pages of the directional booklet are the primary source of indirectional information for the individual students who will use the supplemental activities. The individual specific design of each booklet will be discussed later under the various design formats. Example copies of some of the directional booklets used in the field testing can be found in the appendix of this report.

After the basic design had been initiated by Mrs. Doherty, numerous people over a years time worked on the development of the activities. These people introduced several formats that were included in the field study. The activities were grouped by their common operational characteristics and tested as an unit. The formats included in the study are:

1. Manipulative Science Activities
2. Science Picture Magazine Activities
3. Science Worksheet Activities
4. Audio-Visual Science Activities
5. Audio-Taped Science Activities

The Manipulative Science Activities are characterized as having three dimensional objects which are manipulated by the study as he learns about science. The individual student would receive a directional booklet, the three dimensional objects and perhaps a worksheet to record his responses.

The Science Picture Magazine Activities focus on an eight page magazine containing a hundred different pictures that illustrate living and non-living objects, the major animal and plant types and different sources and uses of energy. The purpose of the magazine is to provide a limited collection of pictures that were to be used during various classifying activities. The individual student would receive a directional booklet, the Science Picture Magazine, and worksheets to place pictures cut from the magazine. Also, necessary for these activities are a pair of scissors and paste.

The Science Worksheet Activities focus on worksheets that must be completed by the students. The worksheets vary in design from color pages to data collection sheets. The student would receive a directional booklet and worksheet requiring some activity.

The Audio-Visual Science Activities employed the use of loop films and stereo-viewer slide reels. The loop films and slide reels were used to illustrate the major subdivisions of plants and animals. A student would receive a directional booklet, a reel or loop film, and a worksheet to record his responses. The projection machines for the audio-visual films and reels were provided in a carrel to which the child took his film or reel for projection.

The Audio-Taped Science Activities were a modification of the directional booklet and the original audio-tutorial lessons. The activities consisted of workbooks in which the student was directed to respond to various activities via a taped lesson. The directional booklet directed the child to secure the needed instructional tape, a workbook, and a pencil so that he could perfom the activity.

The forty-five activities that resulted from the development program were collected together in the fall of 1969 and organized for field testing. Ten copies were made of each lesson to be field tested. Several lessons, because of the materials needed, were not reproduced and therefore were not field tested.

Evaluation of Supplementary Materials

The Supplementary Science Activities were evaluated in field study during the spring of 1970. The field study looked at the design implications, the operational ability, and content validity of the numerous activities studied. The field study took place in an audio-tutorial science learning center that was instructing four classrooms of first grade students. The supplementary activities were first introduced to each class during a half hour presentation. The science pictures magazine activities were used as the introductory model. The directional booklet was fully explained and any questions the children migh had were answered by the research assistant. The science picture magazine activities, the audio-visual science activities and the audio-taped science activities were handed out in mass. The students received a new lesson upon their request. If they wish to change activities or not to complete an activity they were allowed to do so. The activities were handed out and collected in the learning center which was separated from the classrooms. Many returned or pickup up activities as they came and went from the learning center to do the audio-tutorial science lessons.

The manipulative science activities and the majority of the science worksheet activities were evaluated by the research assistant using small groups of students. The research assistant would handout the activity materials to the group of students and observe them as they completed the activity. Some groups would start the activity in the group and return several days later with a completed activity. Other groups would complete the activity in one setting.

The evaluative evidence was taken from two sources. The product for each activity if there was one, was one source evaluated for success or failure of the activities. The observations of the research assistant were also used to validate success or failure of the activities. The research assistant's observations were particularly important in checking the use of the directional booklet and for checking the activities associated with the manipulative activities. The results of the evaluation and the discussion of the findings for each activity tested will be included in the body of the report.

Brief Description of Field Study Setting

The Wabash Valley Education Center received permission to use a small room (8 x 15') at an elementary school in order to set up a demonstration AT science learning center. Four first grade classrooms with thirty students each made up the population of 130 students who were to use the learning center. The 30 students were to use thirteen AT science lessons developed by the Wabash Valley Education Center and a number of experimental supplementary science activities.

The school building used in the field study is an attractive, new building which has been operating for three years. It presently has an enrollment of eight hundred students with 25 self-contained classrooms. There are four classes at each grade level and one special education class. The school has a full-time principal, secretary, librarian, music teacher and art teacher. All the students except the kindergartners are bused to the school from areas around the city of Lafayette, Indiana. The socio-economic make up of the community is generally lower or lower-middle class. The community, ingeneral, has been classified by the U.S. Government as culturally deprived. About ten percent of the students live on farms. Many of the parents have construction jobs and a large number work in factories.

RESULTS AND DISCUSSION

Introduction

The pages that follow present the detailed field study evaluation of the audio-tutorial supplementary science activites. The activities have been divided up in relation to their general format design. The five format designs will be evaluated based on the outcomes of the individual activities contained in each format. The format design will be briefly described for each activity, a summary of the evaluation for each activity will be presented, any recommendations needed for the activity will be suggested, and a final summary of the activity will be made. A final overall summary of the formats and their activities will follow the results and discussion.

SUMMARY OF EVALUATION

Frequency of Responses

The following three tables show the frequency of responses made by twenty children to supplementary activity number one:

TABLE I

Without Directions from Observer

	YES	NO		TOTAL	% YES
Opened envelop of leaves	2	18	=	20	.10
Felt leaves	3	17	=	20	.15
Folded paper	7	13	=	20	.35
Classified leaves	2	18	=	20	.10
Total	14	66		N=80	

Some children did some tasks before they needed assistance from the observer. This explains why the total responses in Table II do not equal the total responses in Table I.

TABLE II

Directions Given by the Observer

	YES	NO		TOTAL	% YES
Opened envelope of leaves	18	0	=	18	1.00
Felt leaves	11	4	=	15	.73
Folded paper	10	3	=	13	.77
Classified leaves	17	1	=	18	.94
Total	56	8		N=64	

INTRODUCTION to:

Manipulative Object Supplementary Activities

In the manipulative object activities the concepts of "separate", "observation", "experiment", and "energy" are reinforced. These concepts and their related skills are developed during the activities and relationships among these concepts are reinforced by the activities. The activities provide opportunities for the children to separate, classify, and categorize objects. Observation skills and the experimental processes are inherent in each activity. Two of the activities are not directly concerned with reinforcing the students' knowledge of energy while the other five activities are specifically designed to reinforce this concept.

In the pages that follow the below listed supplementary activities will be discussed in detail. The detailed discussion will point out each ones unique **characteristic** and any related problems. Because of lack of time and materials Activity #2 "Classify See Shells", and Activity #4, "Classify Rocks by Color and Hardness" were not observed.

Manipulative Object Supplementary Activities

A. Activity #1 - Classify Leaves
B. Activity #2 - Classify Sea Shells
C. Activity #3 - Classify Rocks by Color and Shape
D. Activity #4 - Classify Rocks by Color and Hardness
E. Activity #5 - Battery and Light Experiment
F. Activity #6 - Classify by Magnet Experiment
G. Activity #7 - Classify by Electro-Magnet Experiment
H. Activity #8 - Planting and Observing Bean Seeds
I. Activity #9 - Classify Animals on Cards

A. Brief Description of Activity #1

Supplementary Activity #1 is to follow program #1 to reinforce the concepts "separate" and "observation" and to demonstrate skills associated with these concepts.

The materials enclosed in this activity are a direction booklet, an envelope with leaves some alike and some different from any of the others and three sheets of plain white paper.

The direction booklet is designed to show the children how to perform three tasks: feel the leaves; fold the paper; and classify the leaves.

Pictured on the direction booklet is a child performing these tasks. The first picture shows a child touching a leaf in a tree. The second picture shows this child feeling leaves of plants growing from the ground. In the third picture is a child placing each leaf on a surface. Fourth picture illustrates a sheet of paper unfolded and another picture folded. The last pictures shows a girl placing leaves on a sheet of paper. The last three pictures show leaves posted on a sheet of paper.

Table III

Child's Explaination of How He Classified Leaves

CRITERIA	YES	NO	%YES
Shape	15	5	.75
Edge	9	11	.45
Stem	3	17	.15
Texture	6	14	.30
Size	3	17	.15
Length of leaf	2	18	.10
Color	10	10	.50
Decoratively	1	19	.05
Different from each other	1	19	.05

Table I shows how effectively the twenty children responded to the direction booklets without guidance from the observer. There were four basic tasks that had to be performed in order for the child to demonstrate his understanding of the concept "separate." As indicated by the few yes responses, the children were unable to understand the directions presented by the instruction booklet.

In table II the responses recorded are a result of the observer verbalizing the directions in the order presented in the table. Ninety-four percent of the children were able to classify the leaves, thus demonstrating their understanding of the concept "separate."

Table III illustrates the reasons the children gave for their choices of separating the leaves into different classifications according to the categories listed in the table. As indicated by the table, the children classified most often according to shape. About hald of the children classified according to the edge or color of the leaves. These three choices for classification are taught in lesson program number 1.

Recommendation for Improving Activity #1

As indicated in section II, the weaknesses of this activity are due to the children following the directions given by the direction booklet. Therefore, changes to improve this activity require changes be made to the instruction booklet.

The following changes to the direction booklet are based on the limitations of the booklet shown in table II. These changes are as follows:

A. Cover Page

1. A child pictured emptying the leaves from the brown envelope.
2. A child pictured feeling the leaves.

B. **Inside first page**

1. A child pictured folding paper in half.
2. A child pictured classifying leaves into distinguishably like piles.

C. Inside second page

1. A child pictured pasting these like leaves on the paper.
2. A child pictured handing the finished worksheets to his teacher.

Included in the envelope only one leaf unlike any of the others will limit confusion as to the task of classifying like leaves.

Conclusions

With the changes recommended above, this activity could give the child a reinforcing experience of classifying as well as demonstrate his understanding of the concept of "separate."

This activity has no direct means for evaluating his understanding of the concept of "observation." It can only be assumed that he knows how to observe if he can classify the leaves into like categories. There is no direct way for him to tell his process of observation.

B. Brief Description of Activity #2

(omitted)

C. Brief Description of Activity #3

This activity is to follow program number one and is designed to give a child practice to reinforce the concepts of "experiment" and "separate".

Included in the materials are four plastic white dishes each labelled either black, red, yellow, brown or other. In addition there are two worksheets. One worksheet is titled "round" and has two rows of three circles per row. The other worksheet is titled flat and has two columns with four rectangles in each column. Also included is a plastic box containing approximately ten small rocks of varing colors, sizes, and shapes. There is a direction booklet requiring the student to perform seven tasks.

The cover page instructs the child to get the rocks, dishes, and to spill the rocks. The first inside page pictures a child sorting the rocks by colors and placing them in the appropriately labelled dishes. The second inside page pictures the two worksheets with instructions: Get These. The two worksheets completed are pictured on the back page.

Summary of Evaluation

Table 1

Response of Children to Activity #3

	YES	NO
Get equipment	4	1
Spilled rocks	5	0
Classified by color	1	4
Placed rocks in appropriate dishes	3	2
Get worksheets	5	0
Do worksheets correctly	3	2

As indicated by the table the children in general responded appropriately to most of the tasks pictured in the instruction booklet. Only one child followed the direction to classify the rocks by color before placing them in the appropriate dishes. Because the dish label was the color of the word on the dish the only difficulty with reading the words on the dishes was with reading the word "other". One child didn't respond to the rocks that could not be classified in the specified categories. Another child indiscrimately put the rocks in all of the dishes. These same two children had difficulty classifying round and flat rocks. One could identify flat rocks but could not identify those of a rounded form. Every rock that wasn't flat, he placed on the "round" worksheet. The other child just picked up the rocks one at a time and placed them on the worksheets filling just the "round" and then the "flat" worksheet. This child said he didn't like to do this activity.

Recommendations for Improving Activity #3

This activity requires very few changes as most of the children observed had little difficulty following the pictured directions. Since four of the five children ignored the initial classifying directions can be excluded from the instructions.

Labels on pictured objects should be like the actual label on the object included in the activity to guarantee clear directions. One child did not recognize the word "rocks" on the dish as the same word pictured in the first task.

Conclusions

This activity provides a good opportunity for reinforcing the concept of separate and practice doing an experiment.

D. Brief Description of Activity #4

(omitted)

E. Brief Description of Activity #5

Supplementary Activity #5 is closely related to the activities of program #2. Program #2 is concerned with developing the concepts of "separate," "observation", "experiment", and "energy" as well as skills associated with these concepts.

The materials for activity #5 are a direction booklet, a battern board with a light attached and an envelope containing a battery, wire connectors, and a light bulb. The front cover of the direction booklet has pictured a battery board and a battery box with instructions to "Get this" and "And this". The first inside page pictures a boy doing an experiment by lighting a light bulb in a battery which is placed on the battery board. The words at the top of the page states: "Do This". The second inside page pictures a boy lighting a light bulb on a battery using wire connectors. The words at the top of the page state: "Do This".

[illegible]

[illegible]

Initial Responses of the [illegible]

OPERATIONAL TASKS	YES	NO	OTHER	% YES
1. Follow direction sequence	11	9	0	.55
2. Get all materials	16	4	0	.80
3. Put battery on battery board	16	4	0	.80
4. Put light on battery board	16	4	0	.80
5. Remove battern from board	16	4	0	.80
6. Attach connector to light bulb	16	4	0	.80
7. Attach connector to end of battery	13	6	1	.65
8. Could attach wire connectors to battery with ease	4	16	0	.20
9. Did first experiment without looking at booklet	2	18	0	.10
10. Looked at back page	18	2	0	.90

The above table illustrates how well twenty children initially responded to the direction booklet. There were eight operational tasks the child had to complete. The responses of twenty children indicate that a little over hald of the children followed the sequence of the direction booklet. Eighty percent of the children, however, were able to perform the first four tasks of the experiment. This indicates that some children could perform the tasks without looking at the instruction booklet. Sixty-five percent of the children attached the wire connector to the end of the battery in the second experiment. Thirty-five percent of the children did not know where to attach one end of the wire connector.

The difficulty eighty percent of the children had was attaching one end of the wire connector to the battery while trying to touch the battery with the light bubl attached to the other end of the connector. This task was awkward because these children could not hold the battery and make connections at the same time.

Recommendations for improving activity #5

Numbering the sequence of tasks to be performed would guide the child through a step by step approach to experimenting.

The pictures need to be more precise in illustrating what is to occur in the experiment. As presently pictured the child has difficulty in the second experiment knowing when to make a connection on the battery.

The battery equipment for the experiments is contained within a small manilla envelope within the activity envelope. The instruction booklet has the battery equipment pictured in a battery box. This discrepancy was a source of confusion for many children.

Only twenty percent of the children were able to hold the battery and at the same time manipulate both ends of the wire connectors to light the light bulb. If the battery could be placed in a horizontal position on a holder, the child would have both hands free to grasp the ends of the wire connector to make appropriate connections on the battery.

Conclusions

In spite of the difficulties outlines, the children observed, enjoyed doing this activity.

With the above improvement included, this activity provides the child with two experiences as an experimenter. The second experiment is a discovery experience for most of the children. Thus, the children are provided an opportunity to the rewarding experience of experimentation: discovery.

The concept of "experiment" is reinforced in this activity as the child gets the feel of step by step procedures which result in a lighted light bulb. His ability to observe are tested by his following the steps outlined in the booklet.

F. Brief Description of Activity #6

Supplementary activity #6 is to follow program #2 to reinforce the concepts "separate", "observation", "experiment" and "energy".

The materials include an instruction booklet, a magnet, a plastic pill bottle of objects, and a worksheet.

The direction booklet instructs the children to get the materials, test the objects with the magnet, and then to identify on the worksheet those objects that can be picked up by the magnet and those that cannot.

Pictured on the cover is a magnet and a variety of objects: a button, needle, coin, hairpen, key, scissors, nails, paper clip and a spool of thread.

On the first inside cover is a picture of a boy and a girl experimenting with a magnet.

The second inside page pictures the worksheet at the top of the page with the instructions, Get this.

At the bottom of the page is a boy marking the worksheet. Above the picture are instructions stating, Do This.

Summary of Evaluation

Table I

Frequency of Responses to Instruction Booklet

Instructions:	Without Help from Observer		With Help from Observer	
	YES	NO	YES	NO
Cover page				
1. Get magnet	10	10	10	--
2. Find objects	10	10	10	--
Inside first page				
1. Try objects with magnet	11	9	8	1
Second inside page				
1. Get worksheet	6	14	14	--
2. Do worksheet	1	19	17	3

The table illustrates the children observed had difficulty following the instruction booklet.

In addition to the difficulties shown by the table, the observer noted that every child tried to find objects pictured on the booklet. When the child could not find an object pictured he would stop, look for the object, and then ask for it. Some children went through the first three steps without looking at the booklet. Nineteen children did not understand how to do the worksheet. Many could not remember from the frist part of the experiment what objects they had picked up with the magnet and which objects they had not picked up. If an object were on the worksheet they had not tried, every child said they did not know. When the observer said the object was made out of the same kind of material as one they had tried some would try that object again, some would remember. Many tried to do the worksheet pictured in the instruction booklet. As indicated by the table, only six children out of twenty found the worksheet without help from the observer. The worksheet requires the child to catagorize each object either as being of a material that can be magnetized or cannot. All children had difficulty finding the appropriate column to make their response. Many could tell the answer but needed help finding the correct block in which to respond.

Recommendations for Improving Activity #6

The instruction booklet could be more functional if each step required of the child were numbered systematically. In addition each step needs to be clearly pictured so that the child knows specifically the task required of him.

The following changes to the instruction booklet are:

1. Step 1 - Show child picking up the container of objects and spilling them all out.
2. Step 2 - Picture a child picking up a magnet.
3. Step 3 - Picture a child picking up the worksheet.
4. Step 4 - Picture a child trying an object with the magnet.
5. Step 5 - Picture a child marking the correct answer on the worksheet appropriate for the object he tested.
6. Step 6 - Picture a child handing a completed worksheet to the teacher.

This activity provides an opportunity to carry out an experiment thereby reinforcing the concepts "observation", "experimentator", and "separate".

There is no direct means of reinforcing the concept energy unless the child is aware of magnetic energy.

G. Brief Description of Activity #7

This activity is also to follow programs #1 and #2 and is designed to reinforce the child's understanding of the concepts of "energy" and "experiment".

Enclosed in the activity envelope are an instruction booklet, a worksheet, a vile of objects to be tested, a battery board, a battery and a nail covered with wire.

The direction booklet requires the children to perform six tasks: get the battery equipment, connect the wire connector to the battery to make an electro-magnet find the objects to be tested, test the objects, get the worksheet, and do the worksheet.

Pictured on the first page of the direction booklet is a battery, battery board, and a nail covered with wire.

Pictured on the second page of the direction booklet are arrows showing the child where to place the battery in the battery board and where to connect the wire connectors to the battery board.

Pictured at the top of the third page are objects to be tested. At the bottom of the page are a boy and a girl testing objects.

Pictured at the top of the third page are objects to be tested. At the bottom of the page are a boy and a girl testing objects.

Pictured at the top of the back page is a worksheet with instructions to "Get This". At the bottom of the page is pictured a boy holding a pencil on a square of the worksheet.

The worksheet has 12 items pictured in a column on the left side. To the right of this column are two columns. Pictured at the top of the center column is an electro-magnet. At the top of the far right hand column is pictured an electro-magnet with an X over the picture.

Summary of Evaluation

Table 1

	Without Help		With Help	
	YES	NO	YES	NO
Read directions	--	5	4	1
Get equipment	3	2	2	--
Connect wire connectors	--	5	5	--
Get object	3	1	1	--
Test objects	--	5	5	--
Get worksheet	1	4	4	--
Do worksheet	--	5	5	--

Of the five children tested none read the directions. When the observer asked them what the directions said to do four could read them, one could not.

Two of the children after looking at the complete instruction booklet sat looking at everything and did nothing. With instructions from the observer these two children could do the experiment.

All five children had difficulty connecting the wire connectors to each end of the battery connectors. None of the children were able to tell from the picture where the wire connectors were to be connected. Two tried to connect the wire connectors to the battery board, one tried to connect them to each other, one tried to connect them directly to the battery, and another tried to connect the wire connectors to each end of the nail. All were able to connect them to the appropriate place on the battery board with instructions from the observer.

Three children spilled the vile of objects immediately, one did given verbal instructions, and one never did open the vile even after given instructions to do so. This latter child was more concerned with feeling the nail get warm after it had been connected to the battery.

No child was aware that he had made an electro-magnet. Some saw the boy and girl testing objects on and near the battery board. One child tried each object on the battery. Another tried to test the objects on the board. The other children were puzzled once the electro-magnet was connected. They either prepared to leave the table or asked what to do next.

Like activity #5, all of the children doing this experiment had difficulty understanding what was required of them regarding the worksheet. Again, some of the children responded to the worksheet in the booklet rather than to get the worksheet enclosed. No child was able to do the worksheet without help. All were able to respond to the items, some incorrectly, but they did respond once they understood what to do.

Recommendations for Improving Activity #7

The greatest difficulty the children had was due to seeing unable to understand the pictured directions. In addition all five ignored the written directions. Thus, this activity could be made functional by numbering the steps and by clarifying the pictures demonstrating the tasks to be performed.

Conclusions

This activity presented the electro-magnet. In a sense this activity is a lesson presenting new material rather than an activity intended to reinforce concepts. The latter may be accomplished, but the responses of the five children revealed the "a-ha" phenomena after each discovered he had made a magnet. No child said he had made an electro magnet. All said they had made a magnet. After questioning them about the connections made to the battery, none were able to identify the electric energy as the source of strength for the magnet.

The children enjoyed this experiment once they understood the tasks required of them. This is an excellent activity but inappropriate as an activity to reinforce the concept of energy.

H. Brief Description of Activity #8

Audio-tutorial science program #8 is designed to teach the child to identify the root, seed, stem and leaves of a corn seedling. Supplementary Activity #8 is to follow this program and allows the child an opportunity to observe these same growth characteristics on a bean seed.

Enclosed in the activity envelope are a vile of beans, a worksheet, a petri dish with a blotter in it, and an instruction booklet.

Pictured at the top of the front cover is a worksheet and a vile labelled beans. The instructions over this picture is "Get This". The bottom half of the page pictures water running from a faucet, a petri dish containing three beans and the vile of beans. There are arrows from the water and the vile of beans to the petri dish containing three bean seeds.

On the first inside page is a picture of a boy sitting at a table working at his worksheet. The petri dish containing the three bean seeds in on the table near the worksheet. Instructions at the bottom of the page direct the child to: "Draw picture of bean seed each day on paper."

The second inside page pictures two sets of directions. At the top of this page a boy is pictured handing his worksheet to his teacher. The instructions say: "Give teacher paper." Pictured at the bottom of the page is a cup of soil and the petri dish containing the three bean seeds. The directions state: "and plant bean in cup."

On the back cover page is lettered the sentence: "Bean seeds grow roots and leaves that get bigger each day."

The worksheet for this activity has pictured six petri dishes containing bean seeds. Five of the dishes have three bean seeds, the first dish has only one. In the dishes containing three seeds is written day 1 or day 2, or day 3 and so on to day 5.

Summary of Evaluation

The first observation of this activity revealed the child was unable to follow the instruction booklet. When the activity was handed to a child from the learning center, he was back soon to find out how to do the activity. Therefore, this activity was presented to a group of ten children by a research assistant. She asked the children in a 15 minute group session to tell her what steps the direction booklet instructed them to do. With help from the research assistant, each child left the help session verbally acknowledging that he knew what he had to do. The children were instructe that in a week, they would return to the group session to discuss their results and to plant their bean seeds.

One week later the ten children responded to the activity in the following way:

1. All brought their seeds which were ready to be planted.
2. Two children had drawn changes of his bean seeds for every day.
3. Eight children did not respond to the worksheet at all.
4. All planted their seeds with no difficulty.
5. No child wrote the sentence on the back page.

Recommendations for Improving Activity #8

Eight of the ten children from the group situation ignored the worksheet. When asked why most said they forgot and others said they lost their worksheet. While drawing what is observed is an educationally recommended practice, in this particular situation most of the children did not draw the seeds. As a supplementary activity it is recommended that the children be given the choice to draw what is observed. The most important aspect of the activity is to observe the bean seed germinate as they had once seen the corn seed germinate. This the children had done as well as make comparisons among themselves as to whose seeds germinated the most.

In addition, the instruction booklet would be improved by pictureing the petri dishes more precisely. Those presently pictured look like circles rather than petri dishes.

Conclusions

This activity provides an opportunity for children to become more skilled in their observation of germinating seeds. The use of a bean seed instead of a corn seed provides the children the opportunity to observe similarities and differences during the germination of different seeds.

I. Brief Description of Activity #9

Audio-tutorial science program #10 includes a number of pictures of a variety of animals. Within the content of the program differentiation of the observable characteristics of a variety of living animals is made. Supplementary activity #9 provides the children with an opportunity to demonstrate their ability to differentiate among a variety of animals.

Enclosed in the activity envelope are an instruction booklet; three envelopes, one labelled BIRDS, one labelled MAMMALS, and the other labelled REPTILES; and a twelve post card photographs of a variety of animals.

The cover page of the instruction booklet directs the child to get the cards and the envelopes. The directions then instruct the child to look at the cards.

The first inside page asks the child to classify the cards in piles under the appropriately labelled envelope. After he has completed this task he then is to put the classified cards in their appropriate envelopes and give the completed activity back to the teacher.

The back page of the booklet has the following sentence lettered: "Animals came in many shapes and sizes."

Summary of Evaluation

The table below shows the frequency of the responses of 21 children who classified the pictured animals as either a reptile, a mammal, or a bird.

Table 1

	REPTILES	MAMMALS	BIRDS	Total
Yes	17	85	91	193
No	36	9	3	48
Didn't Respond	1	6	5	12
Total	54	100	99	253

The table indicated the children could identify mammals better than either reptiles or birds Twenty mammal choices were not made. The children selected a high percentage of the total possible reptiles but also classified as reptiles 14% of the photos were selected. Thirty-five bird choices were classified as either reptiles, mammals or not selected at all Twenty-four percent of the total possible choices were classified incorrectly either by no response or selection of an inappropriate category.

Recommendations for Improving Activity #9

This activity was a favorite among the children. There were no functional difficulties with this activity. The children understood the task. This activity needs no functional changes.

Conclusions

This activity requires little time and allows a child an opportunity to demonstrate his ability to classify animals without having to struggle with directions. This is an excellent activity.

Summary Discussion of Manipulative Object Supplementary Activities

The manipulative object activites were successfully designed to provide appropriate behavioral tasks to develop and reinforce the concepts "separate", "observation", "experiment", and "energy". The scientific concepts and skills which were to be taught were within the realm and scope of ability of the first graders tested. They were also related in a supplementary manner to the standard first grade level of AT lessons.

The function structure of all of the manipulative activities, except #9, were found to be operationally unsuccessful. One area of operational breakdown in the activities were the directional booklets. The design and directional quality of the booklets, for the most part needs vast improvement. Many worthwhile suggestions for the improvement of these booklets are listed in the body of this report. These suggestions, plus added field testing should aid in solving the operational problems of the directional booklets.

Another operational problem area is in the worksheets that record the activity responses of the children. These worksheets do not properly function in the activities and seem to be overlooked by the majority of the students tested. The writing activities on the back of the booklets are another operationa part of the booklets which are commonly forgotten by the students.

The activity which was most successful seem to be the Classifying Animals on cards activity. This activity resulted in a short consice effort on the part of the student. Activities that required longer periods of time or were more complex in nature, (ie like making electro-magnets) were less operationally successful. However, the directional quality of the booklet and the fimilarity of the materials in the activity seem to be the prime reasons for operational failure.

In conclusion the activities studied were found to be scientifically sound, but operational hindered by faulty directions and construction. The path to success seems to be activities with clearer, consice directions and invovlvement. Regardless of success or failure, the activities studied were, for the most part, enjoyed by the first grade students using them.

Introduction

Science Picture Magazine Activities

The tasks required of students in Supplementary Activities #10-19 include classifying separating and categorizing by cutting pictures from a Science Picture Magazine and pasting them on an appropriate worksheet. The basic format of all of these activities is the same. In each activity envelope there was an instruction booklet, one or more worksheets, and a Science Picture Magazine. In activity #15 there was a Foof Book and in activity #20 there was an Animal Book rather than a Science Picture Magazine.

I. Brief Description of Activities #10-20

The front page of each instruction booklet of activities #11-19 are identical at the top of the page is the direction. "Get these". Pictured are a Science Picture Magazine, scissors, paste, and paper.

At the top of the first inside page is the direction to find things. Pictured below the directions is a symbol of what ever it is the children are to classify. On the bottom half of the page are pictured scissors and a Science Picture Magazine with an object cut out showing that the students should cut the pictures.

The second inside page pictures a worksheet with an object pasted on it, paste, and the directions: "And this."

The last page of all of the instruction booklets, except two, have a sentence summarizing the activity. Activity booklet #10 has pictured a boy making a bulletin board. The heading, "Mother Uses Electricity" summarizes the activity. The last page of activity #19 is a blank page.

The science Picture Magazine has ninety-one pictured objects which the children can cut out and paste on the appropriate worksheets. These pictures include plants, animals, electrical equipment and appliances, modes of transportation, and other sources of energy.

The Food Book included in activity #15 has pictures of thirty-nine different food choices to be cut out. In activity #20 there are fourteen mother and baby combinations to be cut out and matched in the Animal Book.

The skills associated with activities #11-19 reinforce the concept "separate". The student must classify objects specified by each activity.

Activities #10-14 are to follow Audio-tutorial program #4. The primary objective of program #4 is to introduce the relationships between the concepts "energy" and "change". Program four is primarily concerned with developing an understanding of electric energy. This lesson concludes by illustrating how electric energy changes into moving energy, light energy, and hear energy.

These concepts are further developed and reinforced by activities #10-14. Activities #10 and #11 are concerned with identifying objects which operate by electric energy. In activity #12, the children are to identify things that move. Things that make light energy are the task requirements for activity #13. Activity #14 asks the children to identify objects that make heat energy.

Activity #15 is to follow audio-tutorial program #8. This programmed lesson illustrates the various sources of energy used by living things. Activity #15 concentrates on "things that give me energy." The children are to identify sources of human energy by cutting them from the Science Picture Magazine, and thereby reinforcing their skills and knowledge associated with the concept energy.

Following Audio-tutorial program #6, activities #16, 17, and 18 focuses on developing an understanding of the relationship among the concepts of "change", "living things," and "energy." In activity #16 the children find pictures from the Science Picture Magazine that illustrate "things that grow." Activity #17 requires the children to find pictures which show in which situations humans use energy. While activity #18 focuses on the identification of "things that make moving energy".

Supplementary Activity #19 and #20, following Audio-tutorial Science Program #7, are alike in that both develop differences between living and non-living things. The worksheet for this activity is divided into two sections: "living things;" "non-living things." The children are instructed to [illegible] pictures from the Science Picture Magazine and paste them under the appropriate heading.

"Mothers are big" "Babies nees energy to grow big," are the two sentences concluding Supplementary Activity #20. This activity directs the students to identify mothers and their babies by cutting pictures from an Animal Book and pasting them on a worksheet under either the column titles, "Baby", or the column titles "Mother." Activity #20 is a supplement of Audio-tutorial program #10 which develops the concept of energy by illustrating how various babies get energy to grow from the food given them by their mothers.

II. Summary of Evaluation

This evaluation is concerned only with the operational structure of activities 10-20 and does not include an evaluation of the children's answers given to individual activities.

There were common responses to all activities in this group which are illustrated in the Table I that follows.

Table I

Responses to Science Picture Magazine Activities

	Supplementary Activity											
Responses of Children	#10	#11	#12	#13	#14	#15	#16	#17	#18	#19	#20	TOTAL
Didn't Understant Act.	4	3	--	2	1	--	--	2	2	4	1	19
Turned in not done	3	6	7	3	1	3	9	3	7	10	2	54
Don't want to do them	--	--	--	--	--	--	--	--	--	1	2	5
Activities similar	1	2	4	2	2	1	1	2	2	--	--	17
Completed activity	25	20	20	24	19	22	16	19	18	21	16	220

Table I represents only those responses from children which were observed. Some activities were not returned but how many is not known. No record was kept of all programs lost or not returned. The possibility of children not returning the activities or not doing them was not considered until it started happening. At that time records were then kept of the information reported in Table I.

Activities 10 through 18 were concerned with developing the concept energy. Each activity in this group focused on a specific kind of energy. The child could tell what the task requirement was if he read the back page of the instruction book, or if the worksheet were titled. Some children did not respond to what was written on the back page nor the worksheet as evidenced by their questions requiring help with directions and as evidenced by the large number who did not complete the activities. Nearly half of all those students reporting back to the researcher expressed some problem which demonstrated their lack of understanding the activity.

Only five responses were recorded of children who did not want to do the activities. Both research assistants heard this repense several times but did not record the response. When asked why they did not like to do these activities some children said they didn't like to cut and paste. The research assistants then changed the tasks to numbering their responses rather than cutting and pasting. However, some children still returned the activities unfinished.

III. Recommended Improvements or Changes

One of the limitations of this group of activities was that the children could not understand the tasks required of them. These activities as a group could be improved by specifying more clearly the task requirement on the first inside page. Clearer understanding of the task requirement might result if more pictures were shown illustrating the particular criteria the students were to use when they classified the pictures. In addition, each activity could be titled so that the child understands the topic he is to pursue. For example, activity #12 could be titled, "Things that move."

The Science Picture Book is a good source for a variety of pictures. The book could be improved if the pictures were colorful and of varying sizes. The pictures now illustrated are all black and white drawings and lack color and variety of form of presentation. The children often expressed concern over having to select from so many pictures. The booklet could be improved by having fewer pictures so that the children can make their selections more quickly.

Varying the responses required of the children from one activity to another might also improve these activities as a group. For example, the worksheet for activity #12 could require the children to find things that move and things that don't move. Cutting pictures and placing them in appropriately labelled envelopes might be another response made which would give variety to the activities.

IV. Conclusions

The activities using the Science Picture Magazine have several basic problems which need to be solved before they are used. Changing the format of each activity within the group will make these activities more appealing to the students and this would be better suited to provide opportunities to reinforce the concepts associated with each activity. Better symbols for the classification criteria are needed. Less and more colorful pictures in the Science Picture Book are also needed changes. However, as an activity for reinforcing the concepts of "separate" and "energy" they have been appropriate.

Introduction
to
Worksheet Activities

This group of Supplementary Activities had in common a worksheet activity. These are supplementary activities #21-30. Each of these activities has a different task requirement and most of them follow different Audio-tutorial lessons.

Activity #21 includes an instruction booklet and a worksheet. The front cover page directs the students to get worksheets, scissors, and apste. The first inside cover pictures a picture sheet and scissors. The second inside page pictures a worksheet with four columns. Each column has a picture at the top indicating the category in which a response may be place. Beside the worksheet is pictured a jar of paste. At the top of the page are the directions: "Then do this." The outside back cover page is blank.

A source of pictures for the worksheet is provided. The picture sheet has a variety of eighteen picture choices. The worksheet has four columns. Pictured at the head of column 1 is food; at column 2, the sun; at column 3, a gas pump; and at the head of column 4, is an electrical outlet with a cord plugged into it.

Activity #21 is to follow Audio-tutorial program #6. This program is concerned with teaching the child different sources of energy. The objectives of this program are to introduce the relationships involved in the concept energy.

Audio-tutorial lesson #7 is to preceed Supplementary Activity #22. Lesson #7 is concerned with teaching the differences between living and non-living things. The children do an experiment by placing corn seeds and small rocks into a petri dish. They are instructed to put water in the dish and to take their experiment back to their desk to see what happens.

Supplementary Activity #22 provides the children with a similar experience using bean seeds. Included in this activity is an instruction booklet, a petri dish with blotter paper in it, a worksheet and a vile of corn seeds. The front cover of the instruction booklet directs the children to "Get this." Pictured is a worksheet containing six circles. In the circles are three dots and under the dots is a number. At the bottom of the cover page is pictured an oval shape with three solid dots and three rounded shapes. The instructions read: "And this." The second inside page pictures a boy at a table working with his worksheet. At the top of the page are the instructions; "Do this." At the bottom of the page are the directions, "Draw a picture of a corn seed each day on paper." The second inside page pictures a boy handing his worksheet to the teacher. The directions at the top of the page state: "Give teacher paper." On the back outside cover page is printed the sentence, "Corn seeds use water to grow leaves and roots." The worksheet has pictured six circles. In each circle is the word "day" with a number from 1 to 5 beside it.

Supplementary Activity #23 is to follow Audio-tutorial program #9. This program is concerned with developing the concept energy by illustrating through pictures the sources of energy for various living plants and animals. Activity #23 includes an instruction booklet and a worksheet. On the cover page of the instruction booklet is pictured a worksheet, scissors, and paste. The directions at the top of the page read: "Get these."

On the second inside page is pictured scissors and a worksheet. At the top of the page is stated; "Which comes first?" which asks a question about different aged bean plants. In the center of the page is written, "Do this," meaning to cut the pictures of the bean plants and place them in order. Pictured are a jar of paste and half of the worksheet. On the worksheet there are four rectangular blocks in column form. Beside each block is a number and the child is to place the bean pictures in the appropriate rectangle in the column.

Supplementary Activity #24 follows Audio-tutorial program #11. This program presents sources of energy for plant and animal forms of life. The objective of this program is to teach children to compare and contrast plants and animals in relation to mobility and energy source. Supplementary Activity #24 requires the children to classify pictures as either plants or animals. Their source of pictures is the Science Picture Magazine.

Included in this activity is an instruction booklet, a Science Picture Book, and two blank sheets of paper. On the front page of the instruction booklet are the words "Get these." Pictured below the words is a magazine, scissors, paste and paper. On the inside cover a picture of a scissors cutting a picture from a magazine and a picture of a page of blank paper being folded. On this next page is a folded sheet of paper with the words "Plants and Animals." Above the folded paper are the words "then do this" which means to paste the pictures of plants and animals on the folded paper. The back of the booklet is blank.

Supplementary Activity #25 and #26 were designed to follow audio-tutorial lesson #12 which is concerned with diversity in the Animal Kingdom. The supplimentary activities are to reinforce the differension of animals and their particular home environments. Activity #26 requires the student to look at a worksheet of an environment and to draw an "X" on animals in wrong home environments.

Included in activity #25 is a direction booklet and an environment worksheet. The front page of the direction booklet illustrates an environment worksheet, a jar of paste and scissors. The wording says "Get these" and "Do this." The do this is the cutting off of the bottom of the worksheet the animals that are to be placed on the worksheet with paste. The inside page shows a fish being placed on the environment worksheet and a boy handing in his completed worksheet to his teacher. On the back of the booklet is a sentence saying, "Animals live in special places."

Included in activity #26 is a direction booklet and an environmental worksheet with missed placed animals. The front page of the direction booklet illustrates a boy looking at a worksheet with a pencil. Inside the direction booklet is a worksheet with a large "X" on it. The writing says to "Do this", put an "X" on the animals in the wrong place. The other inside page shows a boy returning his completed worksheet to his teacher. On the back page is a sentence asking "Did you find animals in wrong places?"

Supplemental Activity #27 was designed to follow AT lessons #10. The supplemental activity stresses the classification of animals into there appropriate taxonomy. Included in Activity #27 is a direction booklet, a page of animal pictures, and a worksheet divided into 7 columns that represent plants, mammals, birds, fish, reptiles, amphibians, and insects. At the top of each column is headed by insects, one by birds, etc.

The front page of the direction booklet pictures the worksheet, the page of animal pictures, paste and scissors and is headed by the caption "Get these." The inside cover has a pair of scissors cutting out one of the pictures from the page of animal pictures and is headed by "Do this." On the next page is a copy of the worksheet with the seven columns and a jar of paste. The heading says "then do this" meaning one pastes the pictures in the correct column. The back page is blank.

Supplemental Activities #28 and #29 are related in that they use a frog's life cycle as the central idea. The activities are designed to follow the twelfth audio-tutorial science lesson which illustrates diversity in animals and their environment.

Activity #28 includes a direction booklet and a worksheet picturing four stages in the life cycle of the frog going from tadpole to adult frog. The front page of the direction booklet has pictured the worksheet, paste and scissors and says "Get these." Inside the front cover is asked the question "Which comes first" and then a picture of scissors cutting apart the worksheet. On the next page is a picture illustration of thworksheet being put together in its proper order showing the tadpole first and the other pictures following in order of the frogs growth. The back page is blank.

Activity #29 includes a direction booklet, two pictures, one a tadpole and one an adult frog. The direction booklet asked the child to "get these," the pictures, two pages of paper, crayons, scissors and paste on the front cover. On the inside cover page is a series of two pictures showing the tadpole and adult frog being pasted on the blank pages of paper.

On the next page is illustrated the two blank pages with the tadpole and frog with a statement saying "Draw a home for the frog and tadpole." The back page is blank.

Supplemental Activity #30, the last of the worksheet activities, continues the theme of the frog life cycle worksheets by looking at an energy cycle and a food chain. The activity is designed to follow audio-tutorial lesson #12 as a summary of the relationships included in food chains. The activity includes a direction booklet and one page worksheet illustrating a food chain. The front cover of the direction booklet directs the child to get the worksheet and pencil.

Inside the front page is a picture of the worksheet with appropriate arrows showing the food chain and the heading "do this." The next page shows the child giving the worksheet to his teacher. On the back is a sentence which states "Energy goes in a circle from the sun to plants and animals."

In summary the worksheet supplementary activities (#21 through #30) contain a direction booklet, and worksheet with some activity related to a major idea of the audio-tutorial lessons.

Evaluation of Worksheet Activities

The worksheet activities will be briefly summarized on an individual basis to illustrate the utilization by the students. Success or failure will be based on observations and utilization by students.

Activity #21, which is a classification activity on different sources of energy was completed successful by the students using it. A breakdown of the correct and incorrect responses for each category can be found in Table I.

Table I

Response Frequency for Activity #21

Classification Category	Correct Responses	Incorrect Responses
Food	61	2
Sun	50	20
Gasoline	71	4
Electric	90	2
TOTAL	272 (90.7%)	27 (9.3%)

From Table I we can see that 90% of the responses were correctly made by the students and that the least understood energy source was the sun. From the utilization data and from general observations it is felt that activity #21 was a success.

Activity #22 was not a success. The children enjoyed planting the seeds and watching them grow, but they failed for the most part, to relate what they saw as the seed grew to the worksheet. Of the twenty students, all but 4 turned in blank or completely incorrect responses on the worksheet. The four who turned in correct responses, did not fully understand what they were doing and their responses are only minimal. As an activity, the planting of the seeds was successful, but the worksheet as an illustrator of growth was a complete failure.

Activity #23, which also reinforces the concept of plant growth, proved more successful. The students were to arrange the pictures of a growing bean seed into a correct order going from seed to adult plant. Table II records the responses of the children who completed the activity.

Table II

Response Frequency of Activity #23

Correct Order	Picture Number 1	2	3	4
1	13	2	3	0
2	2	13	0	3
3	2	1	11	4
4	1	2	4	11

As can be seen from Table II, the majority of the children responded correctly in placing the pictures of the bean plants in the right order to demonstrate growth. The greatest confusion resulted in where to place Pictures 3 and 4 which are pictures of adult plants of different sizes. The largest size being the oldest plant. Generally speaking activity #23 was considered partially successful.

Activity #24 was centered on classifying objects into Plants and Animals. The majority of the students successful divided animals and plants into two groups. However, many excluded humans as part of the animal group. One student classified the objects by non-living and plants. The activity was successful, but was not generally viewed by the students as being an exciting activity. Too many pictures were provided for them to choose from and the classifying became boring. Activity #25, the home environment worksheet, proved only partly successful. Of the fourteen students who completed the activity only a few correctly answered all of the problems. Some animals proved to be easier to locate than others. Table III provides the responses of the children to placing the animals pictures in different environments on the worksheet.

Table III

Response Frequency of Activity #25

Environment	Dog	Mouse	Chicken	Fish	Bird	Rabbit
Water				13		
Dog House	13					
Barn		4	2			
Barnyard	1	3	9			8*
Tree		2*				2*
Bird House		4*	1*		2	
Nest			2*		12	
Below Tree						3
Sky				1*		

Correct Responses 62 (75%)
Incorrect Responses 21 (25%)

As can be seen from the table 75% of the responses were viewed as correct. The dog, chicken, fish and bird were correctly placed, however, the mouse and in particular, the rabbit were incorrectly placed. The rabbit was viewed as a domestic animal living in the barn yard instead of a wild animals. In general the activity proved valuable in illustrating differing home environments.

Activity #26 closely follows the ideas of activity #25 in illustrating correct home environments. Only ten students completed the activity and there responses can be seen in Table IV.

Table IV

Response Frequency of Activity #26

	Dog	Mouse	Chicken	Fish	Bees	Rabbit
Responses	7	6	9	9	1	9
Omitts	3	4	1	1	9	1

The students recognized that the dog, mourse, chicken, fish, and rabbit were in incorrect home environments. They did not however recognize that the bee was misplaced. With the exception of the bee, this activity was successful in identifying home environments. Activity 27, an animal classification activity, was also successful in obtaining correct responses. Table V summarizes the responses for the students using activity #27.

Table V

Response Frequency for Activity #27

Classification Category	Correct Response	Incorrect Response
Plants	31	0
Mammals	32	3
Birds	20	4
Fish	10	6
Reptiles	18	9
Amphibians	8	8
Insects	21	0
TOTAL	140 (82%)	30 (18%)

As can be seen from Table V, 82% of the classification responses were correct. However, the correct responses were centered in the categories of plants, mammals, birds and insects. The categories of fish, reptiles, and amphibians were not as successful classified. It would seem the students understand less the concepts of amphibian, reptile and fish. The operation of the activity was successful, although the directions were difficult for the students to obtain from the directional booklets. They went to the research assistant for a correct description of the various categories on the worksheet.

Activity 28, the first of two activities on the frog life cycle, was a successful activity for the fourteen students who completed it. The responses for activity 28 can be seen in Table VI.

Table VI

Response Frequency for Activity #28

Correct Order	Picture Number 1	2	3	4
1	13	0	0	1
2	1	13	0	0
3	0	1	13	0
4	0	0	1	13

As can be seen from Table VI the responses were very high and suggest the activity was understood by all who performed it.

Activity #29 was unsuccessful because of the failure of the directional booklet. The students did not understand that they were to do and when they did respond it was for the most part poorly done. Activity #29 needs restructuring so that it will illustrate the environmental relationships and not just the cutting out of pictures.

Activity #30 was a simple excercise to reinforce the concepts of energy cycles and food chains. The student was asked by the directional booklet to repeat what he saw. For the most part the students did report the activity. However, no one knows if they knew what they drew or if they had the concepts of an energy cycle or food chain reinforced. This activity also needs to be restructured.

Recommended Improvements

The same basic problem was found in the worksheet activities as was found in the Picture Magazine Activities, the problem is that the direction booklet did not provide clear positive information for the students. Most students received their directions from the research assistant. The directional booklets must be improved or an alternative form of direction provided.

The basic content of the worksheet activities, with the exception of activities #22, 29 and 30 were successfully comprehended by the students when informed in some way other than the directional booklets. The three lessons that were unsuccessful were so because the directional booklets failed or the content was clouded by the activities required. The planting of the seed, the pasting of the frog pictures and the copying of the arrows masked the principle reason for doing the activities. These three activities need redesigning so that the emphasizes can be put on the content and not on the activity. I suggest a daily worksheet to be handed in on the bean seed. After a week or two the child could see the changes made by reviewing this drawings of the seeds. The environment of the frog must be emphsized in #29 and I would do this by having the child place the frog or tadpole in a picture of the correct environment. After this he could color the picture with his crayons. The last activity could be changed to a lesson with audio-tpaed directions so that information could be given out as the child draws the arrows. In this way he could learn and reinforce the energy cycle and food chain concepts.

Another improvement is the changing of #24 to a brief group of pictures. This reduces the work load and the boring activities of classifying large numbers of the same type of pictures.

Conclusions

The worksheet activities which require the student to perform a task related to a concept in the audio-tutorial lessons were generally successful. They have a major problem of directions from the booklet and several also need redesigning to emphsize the content rather than the activity. If the directions can be improved or provided in another way they all could be successfully used as a form of individualized instruction.

The students attitudes toward doing the activities was cool because of the direction problem, however once they understood what was to happen they showed more interest in the science picture book activities. They seem to like the activities that they understood and could do rapidly.

Introduction
to
Audio-Visual Activities

Supplementary Activities #31-39 are concerned with animal classification and are designed to follow Audio-Tutorial Program #10. In program #10 the children see a loop film of many forms of animal life. The instruction which goes with the film guides the child in seeing the source of energy for each of the animals viewed. The objectives for this program are to introduce the principles of change in the energy cycle and to help the student compare and contrast plants and animals in relation to mobility and energy sources.

I. Brief Description of Activities #31-39

Activities #31-35 include an instruction booklet, a viewer, a reel, a pencil, and a worksheet. Activities #36-39 include a loop film and loop film projector rather than a reel and viewer. Other than the differences in visual equipment, these two activity instructional booklets are the same. The cover page instructs the child to get a worksheet, loop film or reel, and a pencil. He then is directed to put the loop film or reel into the appropriate viewer. The second inside cover pictures a boy sitting at a table watching a film of animals. The direction state: "Do this," and "Watch film for animals." The second inside cover directs the student "and this," "Mark wrong animals." A worksheet of twelve animals is pictured. There are X's over some of the pictures to indicate how the child is to respond to the worksheet. The directions at the bottom of the second inside page state. "Rememeber this." Pictured is a boy handing the worksheet to the teacher. The back page has written in script "Animals with hair are called mammals."

The worksheets that accompanies each of these activities has two columns of pictured animals. On this worksheet the student is to identify "the wrong animals." That is, the animals he does not see in the loop film or reel. The visual activities use two different worksheets which have two columns of pictured animals. Activities #31, 36 and 38 include worksheet #1 and activities #32, 33 and 35 use worksheet #2 while activity #39 contains both worksheets.

II. Summary of Evaluation

In the table that follows, the responses of the children to activities #31-39 are illustrated. There is an asterick beside each correct choice.

Table I

Responses of Children to Activity #31

Choices	Correct	Incorrect
Butterfly		(1.59%) (1)
Chicken		(1.59%) (1)
Frog		(4.76%) (3)
Starfish		(1.59%((1)
Bird		(1.59%((1)
Crab		(7.94%) (5)
Deer		(1.59%) (1)
Crayfish		(4.76%) (3)
Fish *	(30.16%) (19)	
Angel Fish*	(28.57%) (18)	
Bear		(1.59%) (1)
Snail		(14.29%) (9)
TOTAL	58.73%	41.27%

Fifty-eight percent of the children selected the two appropriate responses accompaning this activity. Forty-one percent selected animals that were not shown in the film. This reel illustrated fish and undersea plant life. The worksheet has only two fish choices. The students were not familiar with many of the fish pictured in the reel. It is hypothesized that many of the children wanted to select more than two pictures. This worksheet is also inappropriate for this reel because the worksheet only has two choices out of twelve which are correct responses.

Table II

Responses of Children to Activity #32

Choices	Correct	Incorrect
Fish		
Dog		
Bird		
Elephant		
Zebra*	15 (26.32%)	
Frog		
Bear*	13 (22.81%)	
Monkey*	14 (24.56%)	
Snake		
Giraffe*	15 (26.56%)	
TOTAL	100%	0

In activity #32 the children selected only the correct responses for the worksheet. The worksheet is felt to be appropriate for this activity because the children made no incorrect responses and because they did ask if there were more correct choices.

Table III

Responses of Children Activity #33

Choices	Correct	Incorrect
Fish		
Dog		1 (3.33%)
Bird		1 (3.33%)
Elephant		
Zebra		3 (10.00%)
Frog		1 (3.33%)
Bear *	20 (66.67%)	
Monkey		2 (6.67%)
Snake		
Giraffe		2 (6.67%)
TOTAL	66.67%	33.33%

There is only one correct response to the worksheet for Activity #33. Sixty-six percent of the responses were correctly made. Thirty-three percent of the total were incorrect. After this activity the children asked questions like "Is that all there are?" They were referring to only having one choice on the worksheet.

Table IV

Responses of Children to Activity #35

Choices	Correct	Incorrect
Fish		1 (1.87%)
Dog		4 (7.55%)
Bird		1 (1.87%)
Elephant*	20 (37.74%)	
Zebra		2 (3.77%)
Frog		1 (1.87%)
Bear		2 (3.77%)
Monkey		2 (3.77%)
Snake		
Giraffe*	20 (37.74%)	
TOTAL	75.47%	24.53%

The reel accompanying activity #35 illustrated seven wild animals of the world. The worksheet accompanying this activity had two of those animals pictured. The worksheet could be improved if one or two more pictures were included illustrating animals pictured in the reel.

Table V

Responses of Children to Activity #36

Choices	Correct	Incorrect
Butterfly*	14	
Chicken		4
Frog		4
Starfish*	13	
Bird		4
Crab*	15	
Deer		5
Crayfish*	13	
Fish*	11	
Angel Fish*	10	
Bear*	13	
TOTAL	80.91%	19.09%

Activity #36 includes a film loop viewed on the loop film projector. Illustrated in this film were a variety of animal life. Predominate among these illustration were creatures of the sea. Eighty percent of the responses were correct. Only nineteen of the responses were incorrect. Found on this worksheet are seven animals also found in the loop film. Thus, the worksheet is appropriate for this film. The only problem in this film is one animal picture that is difficult for the children to identify. This may account for their incorrectly selecting a bear and a deer.

Table VI

Responses of Children to Activity #38

Choices	Correct	Incorrect
Fish		
Dog		
Bird*	19	
Elephant*	19	
Zebra		1
Frog		
Bear		
Monkey*	20	
Snake		
Giraffe*	20	
TOTAL	97.50%	2.50%

The film accompanying this activity is predominated by birds and mammals. The worksheet has four responses appropriate to the pictures illustrated in the film. This worksheet is a good follow-up activity for this film as the children were able to select the four correct responses ninety-seven percent of the time. Only two and a half percent of the responses were incorrectly made.

Table VII

Responses of Children to Activity #39

Choices	Correct	Incorrect
Butterfly		
Chicken		2
Frog		5
Starfish		
Bird*	5	
Crab		
Deer		11
Crayfish		1
Fish*	16	
Angel Fish*	12	
Bear*	11	
Snail	1	
Fish*	10	
Dog		
Bird*	3	
Elephant*	15	
Zebra		
Frog		1
Bear*	7	
Monkey*	11	
Snake	13	
Giraffe		
TOTAL	83.06%	16.94%

In activity #39 the loop film illustrated various types of birds, a series of snakes and reptiles, a section on mammals, and a section on undersee life. Because of the inclusion of many forms of animal life in the loop film, both worksheets associated with all of these activities were included in this activity.

Both of these worksheets were appropriate for this activity as evidenced by eighty-three correct responses made by the children. In addition, there were ten choices out of a possible twenty-two thus allowing the children an opportunith to respond to many forms of animal life viewed in the film.

Not reported in the evaluation of these activities were #34 and #37. These two activities were omitted due to a shortage of the appropriate film loops and reels.

Recommended Improvements

Some charges were made in the original activities during the field testing of the materials. The original directioı booklets did not convey the correct instructions to the students. These booklets had to be totally disregarded, and the directions had to be given to the students orally instead. Without these oral instructions the students merely stared at the direction booklets, not knowing what they were expected to do. When these activities were first presented, the research assistant explained to the students that they were supposed to mark the animals on the worksheet, which they did not see in the film loop or reel. These were the instructions which the direction booklets unsucessfully attempted to explain to the students. These students seemed to have difficulty understanding these instructions even when they were given orally. Some students marked the animals, which they saw on the films, instead of the animals which they did not see. After some students had completed several of the activities, the research assistant began instructing the students to circle the animals on the worksheet which they saw in the films, in order to simplify the instructions. The students had no difficulty following these new instructions. The students responses which were recorded in tables I through VII were only taken from the worksheets of the students who had been instructed to circle the animals which they saw. The research assistant suggest that the revised directions would be more effective for continued operation of the activity. Thus, it is recommended that the instruction booklets be restructured such that the students will be able to understand the directions and such that the students will be instructed to circle the animals on the worksheets that they see in the films.

The following changes are suggested for the direction booklets of activities #31-39. The messages on the last page of each booklet could be clearly printed on the introductory pages of the direction books, so that the students who know how to read will be able to use this message as a guidepost of what to look for while viewing the film or reel. The directions which ask the students to write this message could be eliminated, since this would be a very meaningless task for the students who were not capable of reading the messages. The second page of the booklets could be the same as the present first page. The third page of the booklet could be the same as the old second page with the words, "Look at the animals," replacing the present words, "Watch film for animals," since this would make it easier for the first grade students to read. The last page of the revised direction books could be similar to page three of the old booklets, except the directions could say, "Mark the animals you see," instead of "Mark wrong animals."

The worksheets could also be changed, as suggested earlier, so that some of the worksheets would have more correct responses possible. Each activity could be planned so that its worksheet would be more appropriate for its reel or film.

Conclusion

The visual activities required a student to identify each animal on the film or reel and then to mark the corresponding animal if it appeared on the worksheet. Thus, these visual activities were exercised in observation and comparison. The student observed the film or reel to find out which animals were included. He could view the film or reel as many times as he wished. The student looked at his worksheet to compare the pictured animals on the worksheet with the animals that he had seen in the film in order to mark the animals which were on both the worksheet and the film. Thus, the visual activities focuses on the skills of observing, identifying and comparing.

The attitudes of the students toward the visual activities were positive, since they enjoyed watching the animals on the films and reels. However, some students complained that all these visual activities were the same.

INTRODUCTION

Audio-Tape Supplementary Activities

Supplementary Activities numbers 40-43 have a common format of design. Each activity envelope contains an instruction booklet, a taped lesson, a Plant Book, and a pencil. The differences among these lessons lie only within the taped instruction. The instruction format and response tasks are identical.

I. Brief Description of Activities #40-43.

In all four situations the front cover of the instruction booklet directs the student to get the plant book, tape cassette, and a pencil. Then the student is directed to place the cassette into the tape recorder and put on his earphones.

The front inside cover pictures a boy sitting at a table listening to the taped instruction. At the top of the page are the words: "Do This". Pictured on the second inside page is a worksheet which illustrates the response task required of the student. The directions at the top of the page read: "And this." At the bottom of the page are directions: "Answer Questions in Book" the following sentence which summarizes the activity they have been doing.

The sentences are as follows:

A. Activity #40: "Seeds need water to grow."
B. Activity #41: "Plants grow from seeds."
C. Activity #42 & 43: "Plants have many parts.""They have leaves, roots, and stems."

Activity #40 is designed to follow audio-tutorial Program #8. The objectives of this activity are to reinforce the concepts of"change", "living things", and "energy".

Program #8 requires the students to plant a germinated corn seed. Throughout the lesson the children observe the characteristics of the germinated seed. Supplementary Activity #40 reinforces these observational skills by requiring the students to identify these characteristics in the plant book activities.

Activities #41, 42, 43 follow audio-tutorial program #10. This program focuses on sources of energy for all form of life. The supplementary activities following this program provides the student an opportunity to demonstrate his knowledge and skill at identifying plant growth characteristics as well as to label the sources of energy for plant life.

II. Summary of Evaluation for Activities #40-43.

The first page of each activity asks the child to draw circles around seeds. Each activity has its own specific description of the seed characteristics. In each case the child is to respond by circling the seed with the specified characteristics. In activities #42 and 43 this response made presents no problem of interpretation to the evaluator. However, in activities #40 and #41 the child is asked to identify three different characteristics of a corn seed by drawing a circle around each of the specified characteristics. The end result pictures all three corn seeds circled and the evaluator is unable to determine which response followed which question.

This same limitation of response made is observed in activity #41, page 2 where the child is asked to circle the oldest and youngest bean plants out of three choices. Again, the evaluator is unable to identify to which question the child was responding.

The last page of each plant book pictures a grown plant in each lesson the child is asked to identify a place on the plant which matches the description of characteristics described in the taped lesson.

In activity #40, the task is to "draw a line from the water cup showing how water goes to the leaves of the corn plant." Out of twenty one children, 9 children responded by drawing a line from the water to the roots; 2 drew lines to the stem; 1 drew a line to the leaf; 4 drew lines to the seed, and 4 did not respond to the task.

There are four tasks required on the last page of activity #41. The child is instructed to identify the stem, the leaf, the pot and to "draw a water cup in the picture of the bean plant and show where the water goes so that the plant can grow." There were no incorrect responses to any of these tasks.

To "grow big" a plant needs sunlight, air, water, and plant food. The tasks required of activity #42 are to draw a line from a pictured representative of a plant's sources to the place on the plant where the plant takes in this source of energy.

The following tables illustrate the responses the students made to each of the four tasks:

Task 1.

Table I

Draw a line from the sun to the place on the plant where the sun's energy goes into the plant.

Frequency of Responses

Leaves	Stem	Soil	Pot	No Responses	
10	2	7	1	1	N=21

Task 2.

Table II

Draw a line from the ballons (representing air) to the place on the plant where the plant uses the air.

Frequency of Responses

Leaves	Stem	Soil	Pot	No Response	
11	4	4	---	2	N=21

Task 3.

Table III

Draw a line from the cup of water to the place where the plant takes in water to use for growing.

	Frequency of Responses				
Leaves	Stem	Soil	Pot	No Response	
2	2	14	2	1	N=21

Task 4.

Table IV

Draw a line from the bag of plant food to the place on the plant.

	Frequency of Responses			
Leaves	Stem	Soil	Pot	No Response
1	7	10	1	2

The responses indicate that the task instructions were functionally sound as only six "no response" frequencies occurred. The other responses indicate that there is some confusion as to the where the plant takes in the necessities of its life.

Activity #43 requires students to do the same tasks required in activity #42. Below are table illustrating the responses of the students to the four tasks:

Task 1.

Table I

Draw a line from the sun to the place on the plant where the suns energy goes into the plant.

	Frequency of Responses				
Leaves	Stem	Roots	Other	No Response	
9	6	4	1	1	N=21

Task 2.

Table II

Draw a line from the ballons to the place on the plant where the plant used the air.

	Frequency of Responses				
Leaves	Stem	Roots	Other	No Responses	
8	8	3	1	1	N=21

Task 3.

Table III

Draw a line line from the cup of water to the place where the plant takes in water to use for growing.

	Frequency of Responses				
Leaves	Stem	Roots	Other	No Response	
2	13	5	1		N=21

Task 4.

Table IV

Draw a line from the bag of plant food to the place on the plant where the plant takes in food to grow.

	Frequency of Responses				
Leaves	Stem	Roots	Other	No Response	
3	13	3	1	1	N=21

The students responded appropriately by drawing lines as instructed. Only three times were "no response" choices made. The mode of response was appropriate for the tasks. The variety of responses indicate confusion as to where the plant takes in its sources of energy.

III. Recommendations for Improving Activities #40-43.

The first page of each activity could be improved by requiring the student to identify each task using a different response mode for each task required. For example, a circle could be the identification of the "corn seed plants." Using two response modes would then indicate to the evaluator which response was made to which question.

This same suggested improvement applies to other pages of the activities having the same limitation.

Activities #42 and #43 only differ in that one focuses around a corn plant and the other an oak tree. The scripts are the same for both activities except for the above specified difference. The group of activities would be more useable to more students if these activities differed more in the task responses requirements. Presently, a child who does both activities will be repeating his experience.

IV. Conclusions

With the suggested improvements included, these activities afford a student opportunities to reinforce the concepts of "energy", "charge" and "living things". The children liked these activities and requested them often. It is speculated that the children prefer the taped instruction over the instruction booklet.

Final Conclusion

The supplementary activities developed by the Elementary Science Project, as part ot it's research and development, were evaluated to determine their effectiveness, their operational ability, their content validity and the implications of their design formats. From the results and discussion of the field study it can be determined that much work still lies ahead before the supplementary activities can be considered as a completely successful and operational set of lessons to compliment the first thirteen audio-tutorial programmed science lessons.

The backbone of the supplementary science lessons were the directional booklets. The booklets were to provide the principle source of information and guidance to the individual students as they went about completing the activities. The directional booklet concept, for the most part was totally inadequate for the job they were to perform. The students, in many cases, totally ignored the booklets. In other cases they used only the pictures to get a general idea of what they were to do. It was very seldom that the students used the booklets to understand the content of major idea of the activity. The instructions for the most part, came from their teachers or the research assistant who worked out of the learning center. The written phases and sentences contained in the directional booklets were not used by the students. They either did not know how to use them or did not care to use them as guides. Most first graders in the study, seem to focus on getting all of the directions and help from adult superiors and not from written or pictorial sources.

To solve the major problem of the directional booklets, two alternatives are proposed. One is the elimination of the directional booklets and their replacement by directional tapes, such as was experimented with in the Audio-Taped activities. This would require the presence at all times of a tape recorder for use by the students using the supplementary activities. It would mean the replacement of an adult supervisor by the tape recorder which is very similar to the concept of the audio-tutorial lessons.

The second alternative is to completely overhaul the directional booklets to make them more functional. Many suggestions and recommendations for the task are already listed in the previous results and discussion section. However, more study and evaluation would be needed to see that all the booklets function correctly after being revised. To aid the directorial booklets by the students an audio-tutorial lesson or set of lessons could be devised to illustrate and demonstrate to the students the concept and functional purpose of the directional booklets. An AT lesson with instructions to teach the student how to use the directional booklets so that he can get the directions and instructions for doing the supplemental activities. Both of the above alternatives should be considered during the next phase in the research and development of the supplementary activities.

Another question that the developers faced was the relationship of the content in the audio-tutorial lessons to the content in the supplementary activities. The results and discussion for the most part illustrate that the match in content was fairly successful. The formats were all faced with directional problems generated from the directional booklet. However, they were still evaluated since the directional problem was for the most part, overcome by comments from the teachers and research assistant. The Manipulative Object Activities were found to be scientifically sound, but operationally hindered by faulty directions. The key to their success seems to be in designing activities with clear, concise directions and involvement. Regardless of the activities success of failure, the activities studied were, for the most part, enjoyed by the first grade students using them.

The Science Picture Magazine Activities need variety in their format design, need less pictures in the magazine, need better classification symbols in the directional booklets and need more colorful and appealing pictures. This would improve the activities ability to reinforce the concepts of "separate" and "energy" and to become more appealing to the students who often become bored or fail to finish the activities as they now stand.

The Science Worksheet Activities need redesigning to emphasize the content of the activity and not the activity. The student sttitudes toward doing the activities were cool because of the directional booklet problems. However, once they understood what was to happen in the activity they showed more interest than in the science picture magazine activities. This may have been because the worksheet activities had more variety in their design.

The audio-visual activities were, with the exception of the directional booklet, very successful. The attitudes and the operational success of the students toward the activity were very positive. They particularly enjoyed watching the animals on the films and reels. One minor problem was the selection of pictured worksheets which could be more appropriate.

The Audio-Taped Science Activities were the most successful activities. The children liked these activities and requested them often. It seems that the children prefer the taped directions over the directional booklet design. It is from the success of these activities that the recommendation was made to make a tape for the directions to each supplemental science activity.

In summary, the field study evaluation of the Supplementary Science Activities found a basic problem in the directional booklet concept that reduce the effectiveness to all the activities studied. The content of the activities for the most part, was found to be valid in its relationship to supplementing the Audio-Tutorial Programmed Science Lessons. The most successful format studied was the Audio-Taped design. The next most successful formats were the Audio-Visual, the Manipulative Object and the Science Worksheet activities. The least successful was the Science Picture Magazine activity design. Many insights have been discovered, the ground work has been completed and proof that science activities of this type can be successfully used by first grade students has been validated.

APPENDIX

DIVISION II - Evaluation of Audio-Tutorial Programmed Science Instruction

Introduction

Ranking second behind development of audio-tutorial science instruction per se, was the evaluative efforts to prove and perfect A-T as an efficient and effective method of teaching. The history of the evaluation program shows that during the first year of the elementary science projects' operation few evaluation efforts were made. Evaluation centered mostly on the structure and operation of the individual lessons. However, the second year of work included testing of the A-T science lessons on small groups of students and then on whole classrooms. The results of these first testings are reported below as well as the outgrowth of those initial efforts, the development of measurement tools. Extended efforts were made by the staff to devise a measurement tool, or test, that could effectively determine the learning that was taking place by students using the A-T lessons. This effort by the staff resulted in the development of the WVEC Science Test.

Additional evaluation efforts were also being made by the staff on the A-T lessons as they operated in individual classrooms. The results of these field studies were collected as summary field reports in 1969 and in 1970. Much of the evidence for effective and successful utilization of the A-T science lessons can be found in these reports.

Efforts were also undertaken to prove the worthwhileness of learning centers using A-T instruction for special education students using A-T science and for socially disadvantaged students using A-T science. Add to these numbers, other reports expressing opinions or reporting on problems of A-T science and you have a rather extensive evaluation program.

Report I

The initial evaluations of the effectiveness of the A-T science lessons were completed on classrooms of students. The evaluations consisted of rudimentary comparisons of A-T instructed classes and non-A-T instructed classes. The science tests used for measurement tools were also just beginning to be developed and lacked the sophistication needed for good measurement. However, despite these handicaps early results clearly showed that the A-T mode of science instruction was a productive was of teaching first grade students science.

In the following report, written by the first research associate of the Elementary Science Project, Louis Giantris, three of the objectives of the Elementary Science Project can be found. The objectives are: results of the early evaluation insights into the measurement methods used, and a brief review of the instructional philosophy of A-T.

The Effects of a Conceptually Oriented Science Curriculum Through an Audio-Tutorial Approach with First Grade Students

by
Louis M. Giantris
Research Associate
Wabash Valley Education Center

August 4, 1969

INTRODUCTION

The Elementary Science Project being developed at the Wabash Valley Education Center in West Lafayette, Indiana and under the direction of Dr. Joseph D. Novak of Cornell University, represents a conceptually-oriented science curriculum utilizing the audio-tutorial systems approach to instruction. Through the use of a tape recorder, headphones, some type of 8 mm movie projector, pictures, slides, worksheets, books and any other forms of materials necessary for the specified learning to take place, the student is guided through a series of taped auditory programmed lessons which should enhance his chances for a successful confrontation with the material to be learned.

Through Title III grant funds awarded by the Office of Education, the elementary science programmed lessons, which have been developed and which are still in developmental stages, represent a series of exposures in science which hopes to establish and broaden the learner's concepts in science. The lessons represent a conceptual approach to the teaching of science as an organized body of knowledge within a structured curriculum. In their completed form, the programmed lessons will represent a curriculum whose philosophical base revolves around major concepts in science and will build from grades one through six.

With the audio-visual materials mentioned above, a portable carrel unit is placed in a convenient location in the classroom. A single lesson is set up in the carrel unit and each child has the opportunity to proceed through the programmed lesson while his classmates are involved in other learning activities. Any background noises from his classmates are reduced by the headphones and the child can proceed through the lesson without interruption. The other children realize that they will have their chance, so they are not disturbed by the activity going on at the carrel unit. The fact that the children adjust rapidly to this activity has been verified by all of the teachers who have used these programs.

The time spent by the child in this learning activity is no longer than fifteen minutes, and when he has finished, he leaves the unit and another child begins the lesson. In the average classroom situation then, all of the children will have had an opportunity to do the lesson within two and a half to three days. After each child has done the lesson once, it is then available for those students who wish to repeat because of need or desire or both. From many observations and comments from teachers, the <u>voluntary</u> <u>repeating</u> of any given lesson is a common occurance.

In order for a given programed lesson to function in the above fashion, and without teacher supervision, much time is spent by programers in development. When a programed lesson is first developed, it is taken into the field for testing on individual students as they proceed through the lesson. Data is collected and the lessons are reviewed and revised until over 90% of the children in a heterogeneous classroom can proceed through the lesson without any difficulty in performing the tasks required for successful completion of the lesson.

Once this 90% criteria has been achieved, the lesson is considered to be in an <u>operational stage</u> and can be placed into the hands of teachers for use with their students. Each operational lesson is presented to the teacher as an individual package complete with everything that will be needed by the students to perform the lesson. The program developers feel that the burdens of an elementary classroom teacher are great enough without adding to it the responsibility of having to procure materials. The packaged lesson also contains an explanation of the nature of the materials and a photograph showing the exact placement of the materials in the carrel unit.

An operational lesson then, represents only a lesson which can be successfully operated upon 90% of the learners involved, but is not meant to imply that over 90% of the learners will be involved in the meaningful learning of the concepts which are being developed in the lessons. This initial criteron for performance is necessary; for unless the child can perform the operations that the developers feel are necessary for learning the science concepts, then the chances of his learning the concept will be reduced.

In a conceptual approach to science instruction, one of the major considerations made, concerns one of dealing with science as an organized body of knowledge. In any curriculum, "facts" are facts, but in one instance, these facts or bits of information can be an end in themselves. Another curricular alternative however, is for the selectivity of facts on the basis of their relative power in providing the individual the opportunity to evolve a specific concept (s).

With this selective approach, facts or information become a vehicle for concept development within the learner. This process allows the individual the opportunity to view a major idea in a variety of contexts. This in turn, should facilitate learning through integration and the establishment of common cognitive denominators for the organization of specific information and experiences.

This view of a conceptual approach to the teaching of science in elementary schools is based on Ausubel's (1968) assumptions that subsuming concepts must be established in the learner in a hieratchical fashion with the apex of the hierarchy being the most inclusive concept. This most inclusive concept should provide ideational anchorage for the subsumption of less inclusive concepts.

One example of a highly inclusive concept which is developed through the design of the lessons is that of "energy". Using Novak's (1968) conceptual scheme and structure of science, energy represents one of the all inclusive concepts to serve as ideational anchorage for less inclusive concepts such as: (1) electricity, heat, light, and movement which represents forms of energy for living things.

THE PROBLEM

In that the programed lessons are sequenced according to Ausubel's theories on the subsumption process and how this process relates to meaningful learning, it was necessary to determine if those concepts deemed the most inclusive concepts had been adequately established within the cognitive structure of the individual. By taking into consideration Ausubel's concepts of integrative reconciliation, progressive differentiation and the introduction of "organizers" in the development of the science lessons, it was felt that students subjected to the sequenced science lessons could demonstrate that new learning of science concepts had taken place.

Figure 1: Smiling face used to denote correct statement and frowning face used to denote incorrect statement.

PROCEDURE

To determine new concept learning, a true-false type test was developed for use by first grade students. The test was given to the students via a tape recorder with each child having his own set of earphones. In this test, the first graders were asked to listen to the same statement said twice. The children responded on an answer sheet by circling a smiling face if they thought that the statement was right, or circling a frowning face if they thought the statement was wrong (See Figure 1). The following statement represents one of the statements to which the students responded:

Electric energy can come from a battery.

The test consisted of thirty items using the identical format. The first three items of the test were developed to teach the children how to take the test. Thr remaining twenty-seven items were ones which test for the presence of the science concepts presented by the programed lessons.

The population used for this study was obtained from an inner city school in Indiana. Of the first grade classrooms in the school, one of the classrooms was allowed to proceed through the programed science lessons and in this paper will be referred to as subjects (S's). The other two classrooms served as controls (C's) and were not exposed to the science lessons.

Upon completion of the thirteen weeks of science lessons, the S's and C'c were administered the true-false type test. The audio-taped test was administered to a whole class at one time, so that within two consecutive hours, all three classes had taken the test.

	N	M	SD
S's	21	20.67	2.93
C's	45	15.64	3.20
$t = 5.84$		$p < .01$	

Table I. Statistics of test results.

RESULTS

The mean score on the true-false type test for the instructed group was 20.97, while the uninstructed group obtained a mean score of 15.64. Standard deviations for the classes were 2.93 and 3.20, respectfully.

To determine the significance of the two uncorrelated means, the t distribution statistic was calculated at the .01 level of significance. The t distribution statistic was found to be 5.84 and highly signficant at the .01 level (See Table I.).

CONCLUSION

Based on the above findings, it would appear that the audio-tutorial science approach was effective in helping first grade students establish new science concepts.

SUMMARY

1. A true-false type test was administered to first grade students to determine the effectiveness of audio-tutorial science lessons in the teaching of science concepts.

2. Results showed that the mean scores of the test were significantly in favor of the instructed students at the .01 level of significance.

REFERENCES

Ausubel, David P. 1968. Educational Psychology, Holt, Rinehart and Winston, Inc.: New York,

Novak, Joseph D. 1966. The World of Science Series. Bobbs-Merrill Co. Inc.: New York.

Reports II and III

As an outgrowth of the need for better measurement tools for assesing student learning via A-T science lessons, a minor program for test development was initiated during the second year of the Science Projects' existance. Many test format were explored in an attempt to ascertain relevant methods of measuring abstract learning in first grade students. The test format that proved most successful and included in the two reports following this comment. It was the success of this early test development work, by some very creative members of the Elementary Science Staff, that resulted in a more complete and detailed learning study that was completed during the third year of the elementary science project. The WVEC Science Test, the test which was an outgrowth of the earlier efforts, proved it's effectiveness as a measurement tool. The results of its measurement ability can be found in a later report on Student Learning with Audio-Tutorial Science Instruction.

EVALUATION SUMMARY OF THE SCIENCE PICTURE TEST

A project conducted by the Elementary Science Program of the Wabash Valley Education Center, West Lafayette, Ind.

Edith Doherty
Project Assistant-Elementary Science Program
Wabash Valley Education Center

July 7, 1969

Acknowledgements:
Our appreciation to the teachers and school corporations who participated in the initial testing of the Science Picture Test. A list of the school corporations, principals, and teachers can be found in the Appendix of this report.

During the 1968-69 school year the Elementary Science Project made a preliminary evaluation of the thirteen audio-tutorial programs being used in twenty-eight first grade classrooms. The main objective of the study was to measure acquisition of science concepts by first grade children.

The Science Picture Test, which was then being validated, was used as the tool to measure acquisition. The test includes ninty-five multiple choice items. Each item consists of simple two-dimensional line drawings which sumbolize the stem and alternatives of the item. Instructions and verbal dialogue for each item is given by means of a tape recorder to the entire class during administration.

Five of the twenty-eight classes were given the test before and after they had had the thirteen programs. These five classes came from Frontier, Tippecanoe, and Delphi School Corporations and Lafayette Diocese. All of the classes had first grade students in them except for one class which had six first graders and sixteen second graders. One other class had not been able to finish the last three programs. Listed below are the means of the classes.

Class	Uninstructed Pre-test	A-T Instructed Post-test
A	50.7	61.5
B	49.0	62.2
C	46.7	54.7
D*	60.2	64.8
E*	52.5	62.2
Total Group		

*Class D = Contained second graders
*Class E = Had not finished all the programs when the post-test was given.

The means of the total group indicate that there is a significant difference between the classes before instruction and after instruction, that is, the difference in scores of the classes on the pre- and post-test could not have happened by chance.

EVALUATION OF J/S SCIENCE TEST

A project conducted by the Elementary
Science Program of the Wabash Valley
Education Center, West Lafayette, Indiana.

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and
Sonia R. Scheck
Project Assistants-Elementary Science
Program, Wabash Valley Education Center

July, 1969

Acknowledgements:
Our appreciation to the teachers and school corporations who participated in the initial development of the J/S Science Test. A list of school corporations, principals, and teachers can be found in the Appendix of this report.

It can be concluded that the children in the classes did acquire knowledge of science concepts. Thus, the inference can be made that the audio-tutorial science programs can teach first grade children science concepts.

The conclusions made from this study are subject to two limitations. The first limitation is whether the five classrooms which were tested can be considered representational of the whole population of first grade children. The criterion used to select these classrooms was their close proximity to Wabash Valley Education Center, that is the classrooms were not randomly picked. Secondly, the conclusions are subject to final validation of the Science Picture Test. Preliminary results indicate that it does measure acquisition of science concepts.

In summary, five classrooms using the thirteen audio-tutorial science programs were tested before and after instruction. The means of the classes indicate that the children did learn science concepts. This conclusion is subject to final validation of the Science Picture Test which was used to measure acquisition of science knowledge.

Finally, the Elementary Science Project Staff would like to thank the superintendents, principals, and teachers for allowing us to test their children. We were overwhelmed by your cooperation and hospitality when we intruded and interrupted your daily schedule.

The J/S Science Test is a verbal true-false test developed at the Wabash Valley Education Center (WVEC), West Lafayette, Indiana in the spring of 1969. The test (in its present form) consists of thirty items, three example items and twenty-seven substantive items. The test is administered via tape recorder and earphones so as to reduce any variation that might occur during the test presentation. The substantive content of the test is taken from the science content of the Audio-tutorial programed science lessons (lessons one through eight) developed by the Elementary Science Program of WVEC. The J/S test is a means of testing the responses of first grade students to verbal statements about science concepts. The student hears a conceptual science statement from taped instructions and responds true or false to the statement by circling a smiling (true) or frowning (false) face. Correct knowledge of the science concepts contained within the statement should allow the student to answer the science question.

The design of the J/S science test is new to the testing of primary students and therefore, requires valid evidence before it can be used in evaluating various science programs and various levels of learning for science concepts. The purpose of this testing report is to validate the test design and the test questions used in the design. The objectives of the study are:

I. To develop a test that could be feasibly given to pre-reading children in science.

II. To determine the science knowledge of children prior to actual in school science instruction.

III. To determine the ability of A-T Science Instruction for improving science knowledge in first grade children.

The above objectives will be answered from the results obtained during the development and testing of the J/S test.

POPULATION

The J/S test was given to 223 first and second grade children between May 9, 1969 and June 6, 1969. Of the 223 children tested, 141 had received Audio-tutorial science instruction, while 82 had not. The children came from rural areas surrounding Lafayette, Indiana and from inter-city industrial areas of

Gary, Indiana. Generally the socio-economic character of the children can be labeled as low working class people that range from farm laborers to steel mill workers. A more exact composition of the population can be found in Table I.

TABLE I - Population Description by School and Instruction

School	Grade Level	Total Students	A-T Instructed Students	Non-A-T Instructed Students
Otterbein	1	19	19	
Otterbein	2	54	54	
Centennial	1	24	24	
Centennial	2	21		21
Oxford	1	48	23	25
Gary	1	57	21	36
Total		223	141	82

RESULTS AND DISCUSSION

I. Feasibility of the J/S Test - Several questions must be answered if one is to determine the feasibility of the J/S test for testing pre-reading children in science concepts. The questions are:

1. Does the example items successfully work?
2. Does the substantive science items successfully work?
3. Does the answer booklet successfully work?
4. Is the J/S Test successful?

From the evidence obtained during testing, it can be seen that the three example questions correctly performed their role of introducing the testing format to audio-tutorial instructed and non-instructed students. The overall performance of three questions was 92.4% correct. Of the 223 students tested all correctly answered 2 or more of the example questions, with the majority answering all three questions correctly. The actual example questions can be found in the appendix of this report.

The true-false items were rated successful if they demonstrated an acceptable level of difficulty and discrimination in their measurement of the student's responses. Fifty percent correct on a true-false test is considered a chance score that can be obtained by guessing. Therefore one desires a percent correct somewhere above or below the 50% correct. The significant distance above or below the 50% as determined by statistical calculation was 41.8% or 58.2%. An item below 41.8% or above 58.2% was considered successful in measuring student responses other than chance responses. Of the twenty-seven items in the J/S Test, five were considered as being unsuccessful in measuring student responses, and twenty-two as being successful. Of the twenty-two successful items, ten were considered highly successful. A complete list of the questions can be found in the appendix of this report.

The answer book of the J/S Test worked very successfully in recording the responses of the students. With the exception of a few rare individuals (12 our of 223) who gave a patterned response (i.e. true-false, true-false or true-true-true-true, etc.) the booklet worked correctly in obtaining true-false responses from the students.

The success of the three example questions, of twenty-two out of the twenty-seven substantive questions, and of the answer book demonstrated that the J/S science test format was a highly successful and feasible design for the testing of pre-reading children in science concepts.

II. <u>Science knowledge of children prior to in school science instruction</u>. The testing of uninstructed students provides a sampling of the science knowledge of children obtained outside of school instruction. Several interesting considerations came out of the uninstructed data. The mean response of the uninstructed students was above a chance level (58.27) on the test, 63%. This demonstrates that uninstructed students do have a scientific frame of reference and can perform with science information on a conceptual level. Areas of high conceptual understanding by uninstructed students are: Energy exists in many forms, energy can change from one form to another, there are many uses of energy, and living things have certain requirements which are necessary for life.

III. Ability of A-T instruction for improving science knowledge. The overall score of the A-T instructed students was 74.7% or 10.7% higher than the uninstructed students (63.0%). From this data it can be seen that in the area of science, tested by the J/S Test, the A-T instructed students performed at a higher level. The A-T instructed students outscored the non-instructed students in all of the conceptual areas tested. The largest differences between instructed and non-instructed students occurred in the conceptual areas of energy exists in many forms, electric energy, heat energy, and energy can change from one form to another. Table II shows the results when instructed and non-instructed groups are compared. A complete listing of the conceptual areas follows Table II.

TABLE II - Comparison of Instructed and Non-instructed on Performance in Science Conceptual Areas.

*Conceptual Area	A-T Instructed %	A-T Instructed %	Differences %
1a	83.1	61.2	21.9
b	78.2	56.8	21.4
c	81.9	59.9	22.0
d	65.5	57.5	9.0
e	67.9	61.0	6.9
2	82.2	63.1	19.1
3	71.7	59.7	12.0
4	78.2	63.4	14.8
5	74.2	60.2	14.0
6	61.2	51.7	9.5
7	68.3	61.3	7.0
8	71.9	62.4	9.5
9	71.5	66.2	5.3

*<u>List of Conceptual Areas</u>

1a - Energy exists in many forms
b - electric energy
c - heat energy
d - light energy
e - moving energy

2 - Energy can change from one form to another.

3 - There are many sources of energy.

4 - There are many uses of energy.

5 - The sun is particularly important since it is the major source of energy for earth.

6 - Water is of particular importance because it is required by all living things.

7 - A key feature of living organisims is growth.

8 - All matter in the universe can be catagorized as living or non-living.

9 - Living things have certain requirements which are necessary for life.

SUMMARY

The J/S science test is a successful testing device for comparing the responses of first grade students to verbal statements about conceptual science. The J/S test was successful in determining that conceptual science knowledge does exist in students who have had no prior school instruction in conceptual science. Conceptual science knowledge is also increased with the use of Audio-Tutoiral Programed Science Instruction as measured by the J/S Science Test.

School Corporation
Principals
Teachers

Benton Community School Corporation
Fowler, Indiana

Otterbein Elementary School
Mr. Lawrence Pearl - Principal
Mrs. Wade - Teacher
Mrs. William- Teacher

Lafayette School Corporation
Lafayette, Indiana

Centennial Elementary School
Mr. Morris C. Etter - Principal
Mrs. Knaack - Teacher

Gary Community School Corporation
Gary, Indiana

Duncan Elementary School
Mr. Clement Watkins - Principal
Mrs. Pulliam - Teacher

Benton Community School Corporation
Fowler, Indiana

Oxford Elementary School
Mr. Wayne Smith - Principal
Mrs. Smith - Teacher
Mrs. Ruwie - Teacher

J/S Test Questions

1. We can use scissors to cut paper.
2. Boys and girls never use books in school.
3. Trees and dogs look the same.
4. Air is never important to animals.
5. People eat plants and animals to get energy.
6. All moving things need energy.
7. Plants are never important to animals.
8. Animals need plants to get energy.
9. Fish have gills.
10. Running takes more energy than walking.
11. Mammals have feathers.
12. Clouds are living.
13. Mammals, fish, birds and reptiles are animals.
14. Electric energy comes from a light bulb.
15. Some animals eat other animals to get energy.
16. Fish have lungs.
17. Animals never eat plants to get energy.
18. Animals and plants need the sun to grow and stay alive.
19. Baby plants come from seeds.
20. Plants eat dirt to get energy.
21. Plants only grow on the land.
22. Running takes less energy than walking.
23. Plants need animals to get energy.
24. Birds have gills.
25. People are mammals.
26. All mammals are animals.
27. People are animals.
28. Fish never get air from water.
29. All living things need air to stay alive.
30. If plants died, then animals would die.

Report IV

Besides evaluating student learning of science from the A-T science lessons, there was an effort made to better understand the operation of the A-T lessons in use by classroom teachers fitted with the first thirteen lessons of level one. These classrooms were closely followed and evaluations were made by staff on the effectiveness of the A-T lessons. A breakdown of the various areas studied and of the result obtained during the first field testing of A-T science instruction can be found in the 1968-69 field evaluation report which follows.

FINAL SUMMARY OF 1968-69 FIELD EVALUATION OF AUDIO-TUTORIAL PROGRAMED SCIENCE WITH FIRST GRADE STUDENTS

An on-going project conducted through the Elementary Science Program of the Wabash Valley Education Center.

Elementary Science Project Staff

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Camille Cardoza
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Pat Demerly

July 22, 1969

Acknowledgements:

Our appreciation to the thirty-one teachers and twenty-four school corporations who participated in the initial field testing of Audio-Tutorial Programed Science. A list of school corporations, principals, and teachers can be found in the Appendix of this report.

Data Collection

A field study was undertaken by the Wabash Valley Education Center to study the effectiveness of Audio-Tutorial Programed Science Lessons. The field study was initiated during November of the 1968-69 school year and ran until the end of school in June 1969. The study contained twenty-four school corporations that make up the Wabash Valley Education Center area. The classrooms were all first grade classes with the exception of one which contained half first graders and one half second graders. For the most part, the students reflected a rural, social and economic background. Several classes were however, located in small cities; Logansport Crawfordsville, and West Lafayette, while one classroom was in a large industrial city, Gary, Indiana.

The data for the evaluation was collected from two evaluation forms. Both forms relied upon teacher estimates and opinions for the data. One form centered on the teacher's opinions and estimates of her class as it responded to the Audio-Tutorial Science Lessons. This form is called the <u>class form</u> and reflects the actions and behaviors of the class as a whole. The second form centers on the actions and behaviors of individual students. For each lesson a student was randomly seclected for observation by the teacher. The <u>student form</u> reflects the actions and behaviors of only one student in each classroom as observed by the teacher.

The teachers who participated in the field study had two types of questions to answer on the evaluation forms. The <u>class form</u> had questions that asked for quantative information about the class. Examples of quantative questions are: class size, number of students using program, etc. A second type of question on the class form asked for opinion information about the class. The teacher's opinion was based on a scale that ran from a low (1) to a high (5). Examples of opinion questions are: level of class interest in science, motivation of class in science etc. The <u>student form</u> had both quantative and opinion questions that were asked in a yes-no format. Examples of the yes-no questions are: Did the student go through the lesson? Was the student motivated in science by the lesson? etc. Copies of the two evaluation forms can be found at the end of this section on data collection.

The forms were returned to the Elementary Science Project by mail. They were grouped by lessons and then summarized to find an average response for each lesson. A grand average for all lessons was also recorded.

Results and Findings

The questions on the evaluation forms (see previous two pages) will be evaluated and discussed individually. The findings for each question will be presented together on the same page. The order of discussion of the questions is the same order that they appear on the evaluation forms. As a guide for the questions and findings one can refer back to the example evaluation found in the previous two pages. A final summary of all the questions in the two evaluation forms will be found at the end of this secion.

RESULTS

Form I (Class Report)		Lesson Average
	Number of forms returned for each lesson.	48%
A-1	Class size (24 classes in study).	24.8%
A-2	Number of students using programed lesson at least once. (Total of 600 students)	97.7%
A-3	Number of students using programes lessons more than once.	24.6%
A-4	Number of students needing help in going through programed lesson.	5.2%
A-5	Number of days required for class to complete programed lessons.	3.05 da.
A-6	Total classroom time programed lesson was made available for student use.	17.89 hr.
A-7	Total time spent by the teacher to set up and maintain programed lesson.	22.59 min.
A-8	Total time spent in class on additional science activities.	34.59 min.
A-9	Number of students that said they could not understand the tape directions.	5%
A-10	Number of students that would not go through programed lesson after encouragement.	.4
A-11	Number of times it was noticed by teacher or student that equipment had been disarranged or removed from carrel.	6.6
B-1	Equipment breakdown or failure. (Software)	.6
B-2	Equipment breakdown or failure. (Hardware)	1.6
C-1	Student <u>interest</u> in the audio-tutorial programed lesson? (Scale- 1= low to 5 = high)	4.45 High
C-2	Student <u>interest</u> in repeating programed lesson?	3.38 Average
C-3	Student <u>desire</u> to engage in other related science activities?	2.83 Average

	Lesson Average
C-4 Student preoccupation with the novelty of the hardware?	1.54 Low
C-5 Amount of distraction caused to other students while carrel unit was in use.	1.42 Low
C-6 Ability of students to apply information gained in the programed lessons to other science activities.	2.70 Average
C-7 Student motivation to learn in other subject areas generating from the programed lessons.	2.80 Average
C-8 Your opinion of the programed lesson for helping teachers increase their understanding of science.	3.49 Average

Form II (Student Report)

Number of forms returned for each lesson.	48.6%
Sex of students reported by teacher.	51% Male 49% Female
1. Did the student go through the programed lesson?	100%/0%
2. Did the student need to be encouraged to go through the programed lesson?	1%/99%
3. Did the student need help while going through the programed lesson?	4%/95% *
4. Did the student request to go through the programed lesson more than once?	68%/30% *
5. Was the student preoccupied with novelty of the hardware?	9%/90% *
6. Was the student able to apply information learned in the programed lesson to other science activities?	67%/17% *
7. Was the student motivated to learn in other subject areas after completing the programed lesson?	66%/17% *
8. Was the student able to apply information learned in the programed lesson to other subject areas?	67%/13% *

* Missing percent do to omission of the question by the reporting teachers.

SUMMARY FINDINGS FOR EVALUATION FORMS

Only 50% of all possible evaluation forms were returned. However, valuable information and insights were gained from the limited amount of data collected. Approximately 600 pupils were in the study and they were in classrooms that averaged twenty-five students in size. Ninty-eight percent of the 600 students went through the lessons at least once, and 25% more than once. five percent of the 600 students needed help in some way in going through the lessons and 5% said they could not understand the tape directions. Four students refused after encouragement to go through a lesson. These same four, however, went through the other twelve lessons without problems. On the average, a lesson took three school days or eighteen actual classroom hours of availability. The teacher spent twenty-three minutes, on the average, to set up and maintain the programs. The teacher also spent thirty-five minutes per lesson on additional science. A gradual increase in additional science instruction on the part of the teacher was recorded.

Major equipment breakdowns were centered on the tape recorder and its durability. No software problems of any nature were recorded. Student desire in engaging in other science activities and their ability to apply information from the programed lessons was higher than expected and involved nearly 67% of all students reported in student forms. Teachers reported the lessons had an above average ability for aiding them in their understanding of science.

Overall there were surprising few problems in the instruction and only one major problem in the equipment, the tape recorder durability. The students were successful in going through the lessons and as reported by their teachers showed high interest, motivation, and an ability to apply the information they learned.

Report V

A letter which was sent to eighty teachers who comprised the 1969-70 field evaluation cadre for the elementary science project constitutes this report. Of the eighty teachers 25 teachers used Audio-Tutorial science instruction; 21 teachers used AAAS (A Process Approach to Science instruction); 26 control teachers using standard text book science curriculums; and, 8 special education teachers who were experimenting with audio-tutorial program science for mentally retarded students. These teachers faithfully participated in the study that produced an extensive evaluation and comparison of several forms of elementary science instruction under varying types of situations. A schedule of the testing schedule can be found after the letter.

To Participants in the Elementary

Science Project

As part of the research and development of Audio-Tutorial Programmed Science at the Wabash Valley Education Center, an initial evaluation program was established during the 1968-69 school year. The evaluation program consisted of a field evaluation using teacher questionnaires and of a test development area for measuring science learning generated by Audio-tutorial instruction. The purposes of the evaluation program were to (1) provide evidence of the effectiveness of audio-tutorial science, (2) to provide information to the developers for improvements, and to, (3) provide evidence of learning by the students using the audio-tutorial science instruction.

The initial evaluation program has been successfully completed and the reports that summarize the findings are enclosed in this mailing. If there are any additional questions concerning the information contained in the reports please feel free to contact the Elementary Science Project Staff.

The evaluation program has been continued for the 1969-70 school year and will include the following objectives:

1. Field evaluation of the Audio-tutorial Programed Science beginning on Sept. 15.

2. Field evaluation of the AAAS Science beginning on Sept. 15.

3. Field evaluation of other science being taught beginning on Sept. 15.

4. Comparison of learning for A-T and Non-A-T instructed students.

5. Comparison of learning of A-T and A-T supplemented instructed students.

Besides the comprehensive evaluation program listed above there will also be a continuation of development work. We, the staff of the Elementary Science Project, are looking forward to a highly successful and productive year of work. The staff would also like to thank everyone who worked with us during the last year for their generous help and cooperation. We are looking forward to seeing and working with you again in the coming school year.

Sincerely yours,

The Staff

EVALUATION SCHEDULE

Sept. 1 - Sept. 15

Contacting participating teachers and arranging science materials and testing dates.

Sept. 15 - Oct. 1

Random selected testing of students in all classrooms.

Oct. 1 - Oct. 10 - First week of field evaluation

Oct. 11 - Oct. 17 - Second Week

Oct. 18 - Oct. 24 - Third Week

Oct. 25 - Oct. 31 - Fourth Week

Nov. 1 - Nov. 7 - Fifth week plus testirg of randomly selected students in A-T classrooms.

Nov. 8 - Nov. 14 - Sixth Week

Nov. 15 - Nov. 21 - Seventh week plus testing of mental abilty of students tested during Sept. 15, and Oct. 1.

Nov. 22 - Nov. 28 - Eighth Week

Nov. 29 - Dec. 5 - Ninth week plus testing of randomly selected students in A-T classrooms.

Dec. 6 - Dec. 12 - Tenth Week

Dec. 13 - Dec. 19 - Eleventh Week

Dec. 20 - Jan. 3 - Vacation Period

Jan. 4 - Jan. 9 - Twelfth Week

Jan. 10 - Jan. 16 - Thirteenth Week

Jan. 17 - Jan. 23 - Last week for catching up and starting of testing of randomly selected students tested during Sept. 15, and Oct. 1.

May 1 - Retension testing of randomly selected students.

Report VI

The extensive field evaluation conducted during the 1969-70 school year by the Wabash Valley Education Center proved to be a valuable study of the effectiveness of both A-T science instruction and AAAS science instruction as compared to standard text book science curriculums. Problems and pitfalls of both systems were evaluated as well as the reaction of teachers who went about using them in their classrooms. Teacher utilization, amount of time required for preparation and teaching, teachers opinions, and teachers opinions of students reactions were some of the areas covered in the field study. Evaluations of this type, although not satistically pure, give valuable direction and insight into the gross effectiveness and success of an innovative program for teaching elementary science.

FINAL SUMMARY OF 1969-70 FIELD
EVALUATION OF ELEMENTARY SCIENCE
INSTRUCTION FOR FIRST GRADE STUDENTS

A project conducted through the
Elementary Science Program of the Wabash
Valley Education Center.

Elementary Science Project Staff

Camille Cardoza
Howard Poole
Lola Washburn
Kristin Grigsby
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June 1, 1970

Acknowledgements

Our appreciation to the sixty-five teachers and twenty-four school corporations who participated in the field testing activities. A list of the school corporations, principals, and teachers can be found in the Appendix of this report.

Introduction

As part of its research and development activities, the Elementary Science Project of the Wabash Valley Education Center under took an extensive fielf testing of two forms of innovative science instruction for elementary school use. The two forms of innovative elementary science instruction were Science A Process Approach, developed by the American Association for Advancement of Science (AAAS) and Audio-Tutorial Programmed Science instruction (AT). The field study was developed at the Wabash Valley Education Center initiated during November of 1968-69 school year. At that time twenty-four school corporations, who were participating in the Wabash Valley Education Center, received as a science option one first grade classroom of science materials for the AAAS and AT forms of instruction. The materials were distributed to selected teachers in each school corporation. The teachers were invited to workshops on the science materials and also received individual visitations from Elementary Science Project staff to help them become fimiliar with the new materials. As soon as the staff felt the teachers were successfully using the materials a field evaluation program was initiated.

The spring semester of the 1968-69 school year served as pilot study which was to extend into the 1969-70 school year. During the pilot study the major focus of evaluation was on the audio-tutorial form of instruction since this was its initial field testing. The preliminary finding of the 1968-69 field study are, in part, included in this field study report as a comparison. The 1969-70 field evaluation, however, focused on both AAAS and AT forms of instruction. To contrast these two forms of instruction, a third group of control classes was added to the study. The control classes, for the most part, represented classes using a traditional text book science curriculum. However, a few of the classes had no structured science curriculum.

The three groups of classes, AAAS, AT and Control, were followed during the 1969-70 school year as the major focus of the field study. The findings in this report represent a comparison of the utilization and effectiveness of the different forms of science instructions as reported by the participating teachers.

Population

The classrooms and their respective teachers were selected by school administrators in each school corporation. They were not a randomly selected sample, however, it is felt that they are a representative sample of the first grade classrooms in the field study area. None of the teachers or the school corporations which began the study in November of 1968 were included in the 1969-70 field study. There were many reasons why several classrooms were not used. These reasons will be discussed in the research design. The school corporations ranged in size from 1000 students to 10,000 students in size from grades K thru 12. For the most part the school corporations reflect a rural, social economic background. Several classes however, are located in small cities in Northwestern Indiana. Five classes, were also located in a large industrial city, Gary, Indiana. The socio-economic make up of the students, for the most part, reflects low or lower middle class. Many live on farms, or in or near farming areas. Many have parents who work on construction jobs, in factories or in small businesses.

Research Design

The research design for the field study was not rigid in nature. The very name "field study" relfects a study completed under field conditions. However, every effort was made by the staff to see that standarization of procedures and measures were maintained from classroom to classroom.

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The study consisted of three experimental groups. An audio-tutorial programmed science group of 25 classrooms. A science, A Process Approach group with 14 classrooms, and a control group of 26 classrooms. The three experimental groups were compared on thirteen weeks of science instruction and on teacher differences in science presentation. The thirteen weeks of instruction are not corresponding weeks, but the first thirteen weeks of school where science was taught beginning after the first month of school. The first month was used as an adoption period for the first graders as they started to school. Great variation occurred in the schools and teachers as to when they began and taught science in first grade. Great variation, also existed in the school schedules Schedules were interrupted by vacations, bad weather, power failures, and teacher strikes. Beginning on September 1, 1969, the study ran to May 1, 1970 before it was completed. The range of school time it took before a teacher was completed with the study varied from 15 weeks to 30 weeks. An average teacher needed 20 weeks to complete the thirteen weeks of instruction

Several classrooms from the 1968-69 pilot field study were not included in the 1969-70 study. These classrooms were dropped because of some atypical action on their part. In the AAAS experimental group six classrooms, for one reason or another, some teachers refused to use the materials presented them. One AAAS classroom shared the first grade materials with her entire school, making a total of 10 classrooms of varying grade levels using one classrooms worth of first grade materials. One principle shifted the first grade materials to the kindergarden teacher. As a result, only fourteen classrooms were maintained in the AAAS experimental group.

Several AT science instruction classrooms were also dropped for a variety of reasons. One teacher started four weeks before pre-testing. Two teachers started sharing the first grade classes. One catholic school with a large (40 students) mixed class of first and second graders did not use it. One teacher also did not use it because of her excessive absenteeism. Several classrooms of AT science instruction were added to the study to increase the number. These classrooms came from Gary, Indiana (2) and from West Lafayette, Indiana (2)

Data Collection

The information about the different forms of science instruction (AT, AAAS and Control) was collected from the individual teachers through one page evaluation forms mailed to the Elementary Science Project in self-addressed and pre-paid envelopes. Copies of the evaluation forms can be found in the appendix of this report. The evaluation forms had three different types of questions. The first set of questions were for specific quantative data about the individual class. Examples of the quantative questions are: Class size? Total time to teach lesson? A second type of question was for opinion information about the individual class. The teachers opinion was based on a scale that ran from a low (1) to a high (5). Examples of opinion questions are: Student interest in science? Ability of students to understand science? A third form of questions asked for general comments on the science instruction by the teacher.

The data from these forms was averaged for the thirteen weeks of instruction and for the individual teachers. The information from these questions will be discusses on a per/question bases. With the average response to each question for each experimental group being conpared and discussed together. A summary of all the average responses to all the questions will be made at the end of the discussion section.

Discussion

The discussion section of this report will contain the findings and conclusions of the field study. The questions on the evaluation forms will be evaluated and discussed individually. The findings and the conclusion of the findings for each question will be presented together on the same page. The findings will be listed along the right hand side of the page and the discussion and conclusions will start at the top of the left hand side of the page. The order the questions will be discussed and will be the same order that they appear on the evaluation forms. As a guide for the questions and findings one can refer to the evaluation sheets in the appendix of this report. The teacher comments will be summerized after the Discussion section. A final overall summary of the 1969-70 Field Study will follow the teacher comments.

Summary of Findings of the Teacher Evaluation Forms

Many insights were gained from the Elementary Science Project field evaluation study. The study compared various aspects of three forms of elementary science instruction for first grade classrooms. The three forms of instruction were Audio-Tutorial programed science (AT), Science, A Process Approach, and Control science classrooms. The study used 65 teachers who reported on thirteen different science lessons during the first part of the school year. Despite some minor sampling weaknesses, such as decreasing AT forms returned and forms returned reporting "no lessons taught" by the AAAS and Control Teachers. The class sizes reported were the same for the AT and AAAS teachers, while the Control teachers were slightly higher. The class sizes were consistant throughout the study suggesting that there was consistent and reliable sampling.

The time spent by teachers to teach the various forms of science instruction was significantly different. The AT form of science instruction required less total time and less teacher participation time than the AAAS and Control teachers. The AAAS teachers averaged 102 minutes per lesson, control teachers 70 minutes, while the AT teachers spent only 45 minutes with an additional 18 minutes being provided by the tape instruction.

The teachers reported that student interest in the science ideas for the various forms of science instruction was moderately high. The students, in all groups, had an average desire to engage in other related science activities. The activities most desired by the students where those with interesting and manipulative activities, that allowed more active student participation.

The teachers reported that the children using the AT form of science instruction needed less help in understanding the science lessons and had a higher understanding of the science ideas. This would suggest that the children had less difficulty in learning the science ideas taught via the taped instruction than those taught by the teachers in the AAAS and Control groups. The teacher opinion of availability of equipment was also higher with the AT teachers. The AAAS teachers also reported higher availability of equipment than the Control teachers.

From the above findings it would seem that the AT form of science instruction is less time consuming to the teacher, is as interesting as the other forms of science instruction studied, is less difficult for the students to learn and provides more of the essential materials and equipment needed to teach the lesson. The AAAS science instruction is as effective as the standard classroom science, requires more time to teach, and has more essential materials and supplies for teaching the lesson than Control classroom programs.

B. Comparison of 1969 and 1970 Field Evaluation of Audio-tutorial Science Instruction.

Many surprising insights were gained from the two field studies of audio-tutorial programmed science instruction. The two studies took place during different parts of the school year with the students at different degrees of "school maturity." The two field studies will be summarized by contrasting the difference in student maturity, the familarity of the teacher with the AT materials, and the classroom schedules developed by the teachers.

The first grade student at the beginning of the school year is considered immature in respect to his behavior in school. He is just beginning formal schooling and has yet to master the behavior expected of him by the school as an institution.

Immaturity is a lack of confidence or familarity in the system. If the "school maturity" of the student effects his and the teachers' use of audio-tutorial science instruction there would be expected differences in the two field studies. The 1969 study would represent mature students reactions, while the 1970 study would reflect immature reactions.

The findings of the Field Study Evaluation do support the school maturity hypothesis for audio-tutorial programmed science instruction. The more immature students in the 1970 study were more excited in repeating the lessons and had more desire to have related science activities. They, however, repeated the programs less, took longer to use the AT lessons, had less additional science taught them and had more who could not understand the taped lessons. They exhibited an immature emmotional interest coupled with a lack of confidence and ability in going through the lessons.

Another hypothesis that may also explain the facts listed above is the teachers' schedules for the first half of the school year. Reading and the language arts are considered by the teacher as being more important than science. This is particularly true during the first part of the school year when the teacher is attempting to shape the interest behavior and attitudes of her students for the work she feels they must complete during the school year. It is at this time that the teachers structure the entire class as a group for the entire day. It is the time when basic phonics and other preliminary skills are stressed. It is not usually untill late November or even January before the first grade classes are placed in reading groups. It is after the forming of the reading groups that the children have more free time to visit the science carrel. This may also explain why the children repeated the programs less, took longer to use the lessons, had less additional science taught them and had more who could not understand the taped lessons.

The study found that the teachers spent less time in preparing and in giving additional science in the 1970 study, despite the fact that the students demonstrated more interest in science instruction.

One hypothesis as to why the teacher spent less time in preparing for the science instruction may be the teachers' familiarily with the program. More time was spent the first year they had the materials (1969) than the second year (1970), however, if the familiarity hypothesis is true there should also have been an increase in the additional science instruction, a reduction in the number of days the lesson needed to be available and a reduction in the number of students who did not understand the taped lesson. These things did not happen therefore it would seem that this hypothesis of teacher familiarity is not a valid reason for the differences reported in the two field studies.

It would appear that the first two hypothesis discussed, the "school maturity" of the students and the classroom schedules developed by the teachers, greatly effected the operation of the Audio-Tutorial programmed science instruction while the third and final hypothesis, that of teacher familiarity with the program, did not.

SUMMARY EVALUATION OF TEACHER QUESTIONAIRES FOR
THE THIRTEEN AUDIO-TUTORIAL SCIENCE LESSONS

The pages that follow list the teachers explanation of how she used the AT lessons. The explanations contain observational notes, opinions, and evaluative comments about the operation of the particular AT lesson as it functioned in the teachers classroom. The explanations are grouped by the AT lesson. That is, all teacher comments about a particular lesson are grouped together. A list of the lessons and brief description of their content can be found before a summary of all the AT lessons can be found at the end of the teachers comments.

Description of A-T Lessons

Lesson #	Title	Description
1	What is Science?	Orientation to equipment and introduction to experimenting.
2	An Experiment in Science	Concept of energy introduced during experiment using skills of classification and observing.
3	Energy and Some of It's Forms	Concept of energy is expanded from electricity to heat and light.
4	Transfer of Energy	Transfer of energy from electric source to heat, light, sound, and kenetic energy.
5	Food as a Source of Energy	Concept of food energy is developed for all living animals.
6	Energy Utilization by Living Things	The transfer of energy from food as a source to all the activities of a living organism.
7	Living and Non-Living Things	Introduction of energy utilization as a means of determining living from non-living things.
8	Energy Utilization in Living Things	Growth of corn seedling is observef for utilization of energy.
9	Difference between Living Things	Classification of major plant and animal types by utilization of energy.
10	Food Chain I	The concept of plants providing food for animals and other animals being food for bigger animals.
11	Food Chain II	The concept of the sun as being the principal source of energy for all plants and animals.
12	Diversification within the Animal Kingdom	Classification of the major animal types.
13	Diversity in Animal Structures	Classification of animals dependent upon their physical structures.

Summary of AT Teachers

All of the 26 teachers in the study taught the audio tutorial lessons. All, but two completed the 13 lessons. The two who did not complete the 13 lessons were on #11 at the evaluation time. They could not finish because they were sharing the lessons which took to long. All of the lessons were completed in the order recommended by the developers. However the time schedule recommended was not strictly observed by the teachers. Fifty per cent of the teachers did not follow a weekly schedule, while three took vacations from using the lessons which made them take longer in the end. The vacations were blamed on Christmas activities and lack of student interest

Five teachers did not turn in a majority of their forms, while six other teachers did not make regular comments about the lessons. Ten teachers reported all positive comments while five reported only negative comments. The positive comments centered on the student's interest in the corn planting exercise, the student desire for additional learning and in the organizational nature of the lessons The negative comments centered on broken tape recorders, the immaturity of students, and on particular students with problems following the directions of the lessons. One teacher dislike the fact that one child use the lesson a time, while another praised the speed of completion, the excitement and the enjoyment obtained by the children in the individual approach. Several individual children were reported who did not perfer to use the lessons at first, but no similar reports were made after the lessons had begun.

In conclusion we can say that the group of teachers demonstrated the effectiveness of the audio-tutorial form of instruction by completing the thirteen lessons in the study. While eleven teachers made little or no comments, the other fifteen were divided into ten with all positive comments and five with negative comments. The positive comments centered on nature of the lessons and the learning demonstrated by the students. The negative comments centered on the equipment durability and the limits of the students using the lessons. It would seem, from our study that the AT lessons can be successfully utilized by all teachers with problems arising with the ability of some students and tape recorder.

SUMMARY OF A-T SCIENCE LESSON EVALUATION

Each AT science lesson that was used by the teachers is individually summarized. A summary of all the lesson can be found in the conclusion part of this summary.

Lesson #	Summary Comments
1	The teachers report lesson #1 to be a high interest generator, particularly the student preoccupation with the hardware, (tape recorder, etc). Problems arose because of students having difficulty following the directions to use the tape recorder and for being immature. Many students repeated lesson one, so many as four times.
2	The teachers reported no major problems with lesson two. One report of broken battery tester and too of more immaturity in students this year over last year.
3	Nineteen teachers made no comment of lesson three, while one reported a tape jammed and one expressed a fear her students did not understand concepts of energy.
4	Three teachers reported general lack of interest in lesson four, two teachers say the interest was high, two report tape recorders failed and sixteen made no comment.
5	Ninteen teachers reported no comment. Two reported comments suggest increase in student understanding of the concept energy.
6	Only four comments for lesson six, two about increased student interest and two about individual teacher problems.
7	Twelve teachers commented about lesson seven all saying it was enjoyed by their students.
8	Eleven teachers had positive comments about lesson eight while the other fifteen teachers had no comment.
9	One teacher expresses that students needed additional lessons to understand getting energy from sun for food.
10	No important comments about lesson ten.
11	No important comments about lesson eleven.
12	No important comments about lesson twelve.
13	No important comments about lesson thirteen.

Conclusion

For the most part the teachers failed to comment on the lessons, which is interpreted to mean nothing major was wrong with them and that they performed successfully. Some initial concern in a few classes was expressed about the immaturity of the students and the students understanding of the science ideas. The concern did not continue beyond lesson five. Individual teacher problems and a few equipment breakdowns were reported throughout the study by a few teachers for each lesson. The most popular lessons were 7 and 8 with the corn seedling activities.

Summary of AAAS Teachers

Of the 14 teachers in the study, all but one of the teachers attempted to teach the AAAS lessons. Of the thirteen who taught some of the AAAS lessons, only four did them regularly and in the order recommended by the publishers. Three other teachers did the lessons in order, but at a very reduced rate (average of one lesson/2 wks.). Five of the thirteen teachers did not follow the recommended order, but seem to have established their own order. They used such things as studying weather, mathamatics and a text book science series to determine the curriculum pattern of the AAAS lessons. Six of the teachers, nearly half, had a period of 4 to 7 weeks at the end of the thirteen week study where they gave no AAAS lesson. This might suggest a loss of interest in the lessons or a movement into the holiday season of Christmas and a loss of time to give the lessons. The one teacher who did not teach a lesson listed many reasons why she felt the AAAS lessons where invalid for her use. First of all she felt the children were not mature enough or that the lessons were too complicated for her class. She also expressed that it would require too much time to gather the materials for the lessons, a negative comment also suggested by two other teachers.

In conclusion we can say that the group of teachers demonstrated a wide variation in their utilization of the AAAS Process Science Lessons. Most teacher taught the lessons with success. They averaged 7.6 lessons during the thirteen week period. Half of the teachers did the lessons in the recommended order of the publisher while half created their own order or did only a few random lessons. A few of the teachers seem to stop presenting the lessons near the end of the study and one teacher failed to teach any lessons. It would seem, from our study, that the AAAS lessons can be successfully utilized by most first grade teachers, but care should be taken to aid a few teachers who feel the lessons are too sophisticated or time consuming.

SUMMARY EVALUATION OF TEACHER QUESTIONAIRES
FOR AAAS SCIENCE LESSONS.

The pages that follow list the teacher's explanation of how they use the AAAS lessons. The explanations contain observational notes, opinions, and evaluative comments about the operation of the particular AAAS lesson in the teachers classroom. The explanations of the teachers are grouped by AAAS lessons. That is, all teacher comments about each lesson are grouped together. A list of the lessons and a brief description of their content can be found below. A summery of all AAAS lessons can be found at the end ot the teachers' comments.

Description of AAAS Lessons

Lesson	Title	Description
a	Classifying 4	Observing Living and Nonliving Things
b	Using Space/time Relationships 7	Symmetry
c	Using Space/Time Relationships 8	The Shapes of Animals
d	Measuring 2	Linear Measurement
e	Observing 9	Observation, Using Several of the Senses
f	Using Numbers 5	Numbers and the Number Line
g	Observing 10	Observing the Weather
h	Communicating 1	Identifying an Object
i	Classifying 5	Variation in Objects of the Same Kind
j	Measuring 3	Comparing Volumes
k	Using Numbers 6	Numbers 0 Through 99
l	Measuring 4	Linear Measurements Using Metric Units
m	Observing 11	Observing Some Properties of Magnets
n	Measuring 5	Making Comparisons Using a Balance
o	Observing 12	Observing Color and Color Changes in Plants
p	Communicating 2	Introduction to Graphing
q	Using Space/Time Relationships 9	Shadows
r	Using Numbers 7	Addition of Positive Numbers
s	Using Space/Time Relationships 10	Recognizing and Using Angles, Direction, and Distance

Description of AAAS Lessons (con't)

Lesson	Title	Description
t	Using Space/Time Relationships 11	Time Intervals
u	Measuring 6	Ordering Plane Figures by Area
v	Observing 13	Observing Mold Gardens
w	Communicating 3	Describing Physical Changes
x	Communicating 4	Observing Collisions
y	Communicating 5	Describing Changes in Plants
z	Measuring 7	Seeds and Seed Germination

Summary of AAAS Science Lesson Evaluation

Each AAAS science lesson that was used by two or more of the fourteen teachers was individually summarized. A summary of all the lessons can be found in the conclusion part of this summary.

Lesson	No. of Teachers using lesson	Summary Comments
a	6/14	Most teachers did not use lesson "a" and one reported the death of her fish. The cost of equipment and willingness to set up the aquarium seem to hinder the lesson being taught. However, of the teachers using the lesson all reported that the children were very interested and liked watching and feeding the fish.
b	10/14	Lesson "b" was a very successful lesson used by most of the teachers in the study.
c	9/14	Lesson "c" was successful as a science lesson and was used by most teachers.
d	9/14	Lesson "d" was used by a majority of the teachers and the teachers reported that the children enjoyed actually measuring things in particular. Some concern, however, was expressed by the teachers in using the metric system.
e	12/14	The teachers reported that lesson "e" was a very popular lesson with the children. Essentially all of the teachers used the lesson.
f	7/14	Only half of the teachers used lesson "f" and some concern was expressed about the children understanding negative numbers.
g	9/14	A majority of the teachers used lesson "g". The lesson seemed to generate additional activities from the teachers (ie, films, projects, T.V. watching, etc.). There was also conflicting reports on children being able to, or not able to, read the thermometer used in the lesson.

Lesson	No. of Teachers using lesson	Summary Comments
h	9/14	No comments were made by the teacher on lesson "h".
i	8/14	A majority of the teachers used lesson "i" and many reported positive comments about its success with the students.
j	7/14	Half of the teachers used lesson "j". One expressed an opinion about the lesson "filling" the students full of scientific words that had little meaning.
k	3/14	Only three teachers used this lesson and they all used it in connection with their regular mathematic lessons.
l	2/14	Used by only two teachers who made no comment.
m	3/14	Used by only three teachers with one reporting the lesson was interesting to the children.
r	2/14	Used by two teachers who reported the lesson was successful.

* The following lessons from Part B of the AAAS science lessons were not used: n,o,p,q,s,t,u,v,w.

** One teacher used lessons i and r from the Part A, the Kindergarden set, of lessons.

CONCLUSION

For the most part all of the lessons used by the teachers successfully. Nine of the lessons from Part B of the AAAS materials were used extensively by the fourteen teachers in the study. These lessons were b,c,d,e,f,g,h,i and j, the first ten lessons with the exception of "a" which requires an aquarium. Five other lessons were used in a limited way by the teachers. They are a,k,l,m and r. The most popular lessons for the teachers are those with mathematics or observing skills which were used often in connection with their regular class mathematics lessons. The lessons most popular with the student are those with activities (watching fish, measuring, etc.) and with food (pop corn etc.). The lessons most used out of order by the teacher were generally mathematics lessons.

Summary of Control Teachers

All of the teachers in the control group taught science lessons during the study. Some reported thirteen lessons while the lowest reported was five lessons. The average number of lessons reported was nine Of the twenty-four teachers reporting only two based their curriculum on a science textbook Most of the teachers used a variety of miscellaneous sources for the structure of their science curriculums. These miscellaneous sources were seasons of year, films, radio programs, current events, animals, holidays, social studies, Weekly Reader, and the teachers' own science ideas.

Twenty-three of the twenty-four teachers used a topical approach to science while the other teacher used a conceptual approach. The nature of the curriculums centered around applied biological and physical science. Twenty of the teachers taught applied biology and sixteen taught applied physical science. Only five teachers taught any form of pure science, while two taught health, one mathematics, and two social studies.

The topics covered by the control teachers varied widely. One hundred different topics were reported used by the twenty-four teachers. Thirty-nine of the topics were biological in nature, fourty were physical science and twenty-one topics fell into a miscellaneous catagory. Animals in general and specific animals accounted for the majority of the biological topics. Plant topics were the next largest group, while human physiology made up another small group. In the physical science topics the largest group centered around weather and to aspects, like condensation, thermometers, etc. A second group of topics cluster around forms of matter (ie., air, water, etc.) while another group took up forms of energy (heat, sound, gravity, etc). The miscellaneous catagory had a social studies area (Indians, pilgrims, etc.) a holiday area, especially Halloween and Christmas, a skills area (measuring) discovery, etc., and a health and safety area. A complete list of the topics and the number of teachers who use them can be found in the Appendix.

Twenty-two different science activities were used by the control teachers. The only activity used by all of the teachers was classroom discussions. Classroom discussions were also the most commonly used activity for teaching science. The next most used science activity was classroom experiments of various types. Following the experiments came use of films, reading science stories, making bulletin boards, reading books or the weekly reader, drawing pictures, and observing activities like demonstrations or live animals. Seven field trips were taken during the study by five different teachers. Most were nature or collecting trips around the school, while one was to a zoo and another to a museum and aquarium. One teacher had a guest speaker on rock collecting, two watched the sixth grader's chicken eggs hatch and two teachers toasted pumpkin seeds for "Halloween science". A complete list of the activities and the number of teachers who used them can be found in the Appendix.

In conclusion, the study found that the control teachers all taught some form of science. The curricula were from a variety of sources with only two coming from textbooks. All but one of the teachers used a topical approach that emphasized applied physical and biological science. An exceptionally large number of topics were reported by the teachers. Fourty percent of the topics were biological in nature, fourty percent physical science in nature, while twenty percent of the topics were of a miscellaneous nature. Twenty different science activities were reported by the teachers. The most common of these activities was the class discussion of science.

FINAL SUMMARY OF THE 1969-70
FIELD EVALUATION OF ELEMENTARY SCIENCE
INSTRUCTION FOR FIRST GRADE STUDENTS

The 1969-70 field evaluation proved to be a valuable study in determining the effectiveness of several forms of science instruction for use in first grade classrooms. The three forms of instruction studied during the field evaluation was Audio-Tutorial Programmed Science (AT), Science, A Process Approach (AAAS) and standard classroom science (Control). The study used 65 teachers who reported on thirteen different science lessons they taught during the first hald of the 1969-70 school year.

The study found that the AT form of science instruction was less time consuming to the teacher, was as interesting to the students as the other forms of science instruction, was less difficult for the students to learn and provides more of the essential materials and equipment needed to teach a science lesson. The AAAS science instruction reported as effective as standard classroom science instruction, required more teacher time, and had more of the essential materials and supplies needed to teach a lesson than did the standard classroom.

The teachers using the three forms of science instruction were all successful in teaching some science lessons. The greatest number of lessons taught was reported by the AT group of teachers with the control teachers next and the AAAS teachers last in average number of lessons taught. The AT teachers followed the recommended order of teaching the lessons, but took longer than the developers felt was necessary in teaching the lessons. The AAAS teachers demonstrated a wide variation in their utilization of the lessons. Half of the AAAS followed the recommended order of teaching the lessons, while half created their own order of presentatio The control teachers used a topical approach to design their lessons. The topics used by the control teachers came from many sources, but mostely from resources near the teacher (ie, weekly reader, current events, the seasons of year, etc.)

The nature of the science curricula varied from one form of instruction to another. The control teachers had a topical curriculum that emphasized applied physical and biological science. The AAAS teachers had a topical curriculum programmed to teach the processes and skills of science, but which also emphasized the applied physical and biological sciences. The AT teachers had a conceptual curriculum programmed to the major generalization of pure science but which also taught applied physical and biological science. The biggest problems associated with the AT form of science instruction centered around a few students having problems operating the machines of the AT lessons and in the durability of the tape recorder. The problems associated with the AAAS teachers were the following: 1) the recommended order for teaching the lessons, 2) the teacher preceived over sophistication of the lessons, 3) the time consuming activities of preparing and 4) teaching the lesson and the availabili of recommended materials and supplied. The control teachers lacked science sophistication in their lessons, presented unrelated science topics and tended to spend science time discussing current events, the seasonal changes and "what ever happened along."

The the most part the individual lessons in the AAAS and AT curriculums were successfully used by the teachers. The most popular lessons were those that had activities that invovled the students or had, interesting and manipulative science equipment that the students used.

In conclusion the study found significant differences between the operation and success of the three forms of science instruction studied. The forms of instruction varied from point to point, but were all successful in presenting some form of science instruction to the students. Based on the overall operational efficiency and success and on the quality and nature of the science instruction AT has an advantage over Science, A Process Approach and standard classroom science as measured by this field study.

APPENDIX

Form I

AUDIO-TUTORIAL (A-T)
SCIENCE PROGRAM
INFORMATION FORM

Directions: After your class has completed a science lesson, please fill out this information form. The information you give below aids us in designing programs and in servicing and helping you with the science program operating in your room. We would appreciate any additional opinions and suggestions you might have regarding your particular science program.

A. Specific Information (Please fill in the appropriate information after each week of school.)

Teacher's Name ____________ School ____________ Lesson No. ______

1. Your class size - (Total Number) ______
2. Total time required to prepare for science lesson to be taught. ______ MIN.
3. Number of students needing extra help in understanding the science lesson. ______
4. Total time spent in class on additional science activities. (Do not include A-T lesson time.) ______ MIN.
5. Number of students using programed lesson more than once. ______
6. Number of days programed lesson was set up in your classroom. ______ DAYS

B. General Information (Please circle the one answer which represents your opinion of the science lesson you taught.)

1. Student interest in the specific science ideas in the lesson.

   Low   Moderately Low   Average   Moderately High   High

2. Student desire to engage in other science activities related to the science lesson taught. (Bulletin boards, Show & Tell, etc.)

   Low   Moderately Low   Average   Moderately High   High

3. In your opinion, the equipment and materials availability for teaching your lesson was:

   Poor   Fair   Average   Good   Excellent

4. In your opinion the ability of the students to understand the specific science ideas in the lesson.

   Low   Moderately Low   Average   Moderately High   High

5. Your opinion of the programed lesson in helping teachers increase their understanding of science.

   Low   Moderately Low   Average   Moderately High   High

6. Student interest in repeating programed lesson.

   Low   Moderately Low   Average   Moderately High   High

7. Number of students that said they could not understand tape instructions.

   Low   Moderately Low   Average   Moderately High   High

COMMENTS:

Form II

SCIENCE-A PROCESS APPROACH
INFORMATION FORM

Directions: After your class has completed a science lesson, please fill out this information form. The information you give below aids us in designing programs and in servicing and helping you with the science program operating in your room. We would appreciate any additional opinions and suggestions you might have regarding your particular science program.

A. Specific Information (Please fill in the appropriate information after each week of school).

Teacher's Name ________________ School ________________ Lesson Number ________

1. Your class size - (Total Number) ________
2. Total time required to prepare for science lesson to be taught. ________ MIN.
3. Number of minutes required for class to complete science lesson. ________ MIN
4. Number of students need extra help in understanding the science lesson. ________
5. Total time spent in class on additional science activities. (Do Not include Process lesson.) ________ MIN

B. General Information (Please circle the one answer which represents your opinion of the science lesson you taught.)

1. Student interest in the specific science ideas in the lesson.

   Low Moderately Low Average Moderately High High

2. Student desire to engage in other science activities related to the science lesson taught. (Bulletin board, Show & Tell etc.)

   Low Moderately Low Average Moderately High High

3. In your opinion, equipment and material availability for teaching your lesson was:

   Poor Fair Average Good Excellent

4. In your opinion the ability of the student to understand the specific science ideas in the lesson was.

   Low Moderately Low Average Moderately High High

5. Your opinion of how the PROCESS lesson help teachers increase their understanding of science.

   Low Moderately Low Average Mocerately High High

COMMENTS:

Form III

SCIENCE PROGRAM INFORMATION FORM

Directions: After your class has completed a science lesson, please fill out this information form. The information you give below aids us in designing programs and in servicing and helping you with the science in your room. We would appreciate any additional opinions and suggestions you might have regarding your particular science program.

A. Specific Information (Please fill in the appropriate information after each week of school.

Teacher's Name________________________________ School____________________________

Brief description of science lesson taught ____

____

____

1. Your class size - (Total Number) ________
2. Total time required to prepare for science lesson to be taught. ________
3. Number of minutes required for class to complete science lesson. ________
4. Number of students needing extra help in understanding the science lesson ________

B. General Information (Please circle the one answer which represents your opinion of the science lesson you taught).

1. Student interest in the specific science ideas in the lesson

   Low   Moderately Low   Average   Moderately High   High

2. Student desire to engage in other science activities related to the science lesson taught. (Bulletin boards, Show & Tell etc.)

   Low   Moderately Low   Average   Moderately High   High

3. In your opinion, equipment and material availability for teaching your lesson was:

   Poor   Fair   Average   Good   Excellent

4. In your opinion, the ability of the students to understand the specific science ideas in the lesson was:

   Low   Moderately Low   Average   Moderately High   High

COMMENTS:

Participating School Corporations, Principals and Teachers

School Corporation	School & Principal	Teacher
Attica Consolidated School Corporation George Hays, Supt. Attica, Indiana	Attica Elementary 503 E. Jackson Attica, Indiana C. Harvey Norman	Mrs. Balser Mrs. Leath
Benton Community School Corporation Charles A. Pratt, Supt. Box 512 Fowler, Indiana	Oxford Elementary Oxford, Indiana Wayne Smith	Mrs. Ruwe Mrs. Smith
Carroll Consolidated School Corporation Orville Howard, Supt. R. R. #1 Flora, Indiana	Flora Elementary E. Main Street Flora, Indiana Albert Spandau	Mrs. Dyson Mrs. Laird Mrs. Robeson
Clinton Prairie School Corporation E. H. Alexander, Supt. R. R. #6, Box 349 Frankfort, Indiana	Mulberry Elementary Mulberry, Indiana Bernard C. Martin	Mrs. Lytle
	Jackson Elementary R. R. #5 Frankfort, Indiana Bernard C. Martin	Mrs. Boten Mrs. Laverty
	Jefferson Elementary R. R. #6 Frankfort, Indiana George W. Newell	Mrs. Melz Mrs. MacDonald
Crawfordsville Community School Corporation C. Merrill Dailey, Supt. Box 272 1000 Fairview Avenue Crawfordsville, Indiana	John Beard Elementary E. College Street Crawfordsville, Indiana Robert Coleman	Mrs. Sendmeyer
	Laura Hose Elementary 800 Fairview Avenue Crawfordsville, Indiana Raymond Lutz	Mrs. Allen
Delphi Community School Corporation Arthur O. Weddell, Supt. 115 N. Union Street Delphi, Indiana	Hillcrest Elementary Wabash & Vine Street Delphi, Indiana Roger Campbell	Mrs. Kent Mrs. Nicholson Mrs. Mason
Diocesan School Corporation Father Donald Tracey, Supt. 610 Lingle Avenue Lafayette, Indiana	St. Mary's 401 W. Walnut Street Frankfort, Indiana Sister Marguerite	Sister Marguerite

Diocesan School Corporation (con't)	St. Boniface Elementary 816 North Lafayette, Indiana Sr. M. Joseph Ann	Sister Roberta
	St. Joseph Elementary 115 E. Monroe Street Delphi, Indiana Sister Louis Marie	Sister Leon
	St. Joseph Elementary 407 E. Pearl Lebanon, Indiana Sister Therese Carmel	St. Margaret Marie
	St. Lawrence Elementary 19th & Meharry Lafayette, Indiana Sister M. Alice	Sister Kathleen
	St. Mary's Cathedral 1212 South Street Lafayette, Indaina Sister Ann Clare	Sister Rosalie
Frontier School Corporation Dale T. Sheets, Supt. Chalmers, Indiana	Brookston Elementary Brookston, Indiana Howard Addison	Mrs. Scranton Mrs. Stark Mrs. Burns
Gary Community School Corporation C. E. Swingley, Supt. 620 E. 10th Place Gary, Indiana	Duncan Elementary 1110 W. 21st Avenue Gary, Indiana Clement Watkins	Mrs. McLaurin Mrs. Pulliam Mrs. Brown Mrs. Johnson Mrs. Taylor
Logansport Community School Corporation Dr. Ted Hughes, Supt. 630 East Broadway Logansport, Indiana	Franklin Elementary 410 W. Miami Avenue Logansport, Indiana Jim Sheely	Mrs. Cline Mrs. Bowman
	Washington Elementary 101 N. Cicott Street Logansport, Indiana Harlon Bonsett	Mrs. Bennet
	Columbia Elementary 1300 N. Third Street Logansport, Indiana James McKeever	Mrs. Barr
North Montgomery Community School Corporation Eual S. McCauley, Supt. 105 N. Main Street Linden, Indiana	Darlington Elementary Darlington, Indiana Randall Quimby	Miss Delaney Mrs. Cox
Northern Community School of Tipton County Glen E. Munro, Supt. Box 307 Sharpsville, Indiana	Windfall Elementary Windfall, Indiana Harold A. DeNoon	Mrs. Corn

Rossville Consolidated School Corporation Robert C. Egly, Supt. Rossville, Indiana	Rossville Elementary Rossville, Indiana James Montgomery	Miss Flora Mrs. Fisher
Southeastern School Corporation Larry Morris, Supt. P.O. Box 2038 Walton, Indiana	Walton Elementary Walton, Indiana Kenneth Miller	Mrs. Hinkle
South Newton School Corporation Kedrick Fisher, Supt. Kentland, Indiana	Kentland Elementary Kentland, Indiana Wilbor Hayes	Mrs. Funk Mrs. Wilson
	Goodland Elementary Goodland, Indiana John McKnight	Mrs. Hawkes Mrs. Knochel
Tri-County School Corporation William Christopher, Supt. Wolcott, Indiana	Wolcott Elementary Wolcott, Indiana Jerry Lelle	Mrs. Sears Mrs. Christopher
	Remington Elementary Remington, Indiana Roy D. Butts	Mrs. Cover
Tippecanoe School Corporation Charles Mikels, Supt. R. R. #13 Lafayette, Indiana	Wea Elementary R. R. #7 Lafayette, Indiana Charles McDonald	Mrs. Clayton Mrs. Quick
	Battle Ground Elementary Battle Ground, Indiana Mr. Hunt	Mrs. Lamb Mrs. Lawson Mrs. Wilson
	Hershey Elementary R. R. #4 Lafayette, Indiana Gordon Bohs	Mrs. Boggs Mrs. Ellsberry Mrs. Odle Mrs. Maddox Mrs. Hoover
	Klondike Elementary West Lafayette, Indiana Cecil Helmerick	Mrs. Cline Mrs. Hood Mrs. Kesler Mrs. Rohlfing Mrs. Walker
	East Tipp, Jr. High Buck Creek, Indiana Mr. Shoaf	Mrs. Yarrian
	Mintonye Elementary R. R. #7 Lafayette, Indiana Bryon Hund	Mrs. Bushman Mrs. Lamb Mrs. Warner

Tri-County School Corporation William Christopher, Supt. Wolcott, Indiana	Remington Elementary Remington, Indiana Roy D. Butts	Mrs. Cover
Twin Lakes School Corporation Herbert Hoffman, Supt. 565 South Main Street Monticello, Indiana	Meadowlawn Elementary W. Ohio Street Monticello, Indiana Fred Carmichael	Mrs. Jay Mrs. Jackson
	Woodlawn Elementary Beach Drive & Woodlawn Ave. Monticello, Indiana Jerry L. Banning	Mrs. Hennelly Mrs. Smith
	Oaklawn Elementary South & Juanita Street Monticello, Indiana Fred Carmichael	Mrs. Smith Mrs. Tierny
Warren Central Consolidated School Corporation Olin Swinney, Supt. West Lebanon, Indiana	Warren Central Elementary Box 218 West Lebanon, Indiana David H. Poer	Mrs. Kenworthy Mrs. Hipsher
Western Boone Community School Corporation James Fritch, Supt. Thorntown, Indiana	Granville Wells Elementary RFD #2 Jamestown, Indiana James Bunnell	Miss Ellett Mrs. Hankins
Warren Community School Corporation Willis Hor[illegible], Supt. Williamsport, Indiana	Williamsport Elemetary Williamsport Leonard Burns	Mrs. Rusk Mrs. Allmondinger
West Lafayette School Corporation Bruce Moore, Supt. 141 Andrew Place West Lafayette, Indiana	Burtsfield Elementary Salisbury & Lindberg St. West Lafayette, Indiana Emerson Jerkins	Mrs. Sefferin
	Kingston Elementary 1200 N. Salisbury West Lafayette, Indiana Robert Curtis	Mrs. Taylor
	Morton Elementary 222 N. Chauncey Ave. West Lafayette, Indiana Thomas Combs	Mrs. Thompson

Report VII

The evaluation of learning by A-T science lessons was the last necessary proof needed to determine if the already operationally successful program was a value addition to the instructional methods of education. The evidence and proof provided by the extensive learning evaluation of students conducted by the Elementary Science Project itself provides this proof. The relationship of this evidenced learning to numerous related school and learning variables was also a positive factor in determining the effectiveness of A-T instruction. Although the evidence uncovered during the last year is impressive, it is only the first step in the development of a theory of program evaluation needed to utilize the advantages of audio-taped forms of instruction.

Summary of Learning in First Grade
Students Using Audio-Tutorial Programmed
Science Instruction

A research project conducted through
the Elementary Science Project of the
Wabash Valley Education Center.

Elementary Science Project Staff

Howard Poole - Research Associate
Camille Cardoza - Project Associate
Lola Washburn - Project Assistant
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Sue Harner - Project Assistant

June 30, 1970

Acknowledgements:

Our appreciation to the sixty-five teachers and twenty-four school corporations who participated in the 1969-70 field evaluation program. A list of the school corporations, principals, and teachers can be found in the Appendix of this report.

A special appreciation and thanks for a good job done to the 1968-7 Elementary Science Project Staff whose ingunity and ideas went into creating the testing devises and research design for the 1969-70 field evaluation of audio-tutorial science; Louis M, Giantris, Edith Doherty, Sonia Schedk, James Wright and Pat Demerly.

Introduction

New instructional systems for education are not completely accepted until they have proven themselves to be agents of learning. Such is the case with audio-tutorial programmed science instruction. The audio-taped system of instruction needs evidence that it can provide instruction that caused students to learn as much or more than other competive learning systems. The research project reported in the paper is one attempt at gathering valid evidence that audio-tutorial science instruction is an instructional system that provides students with the opportunity to learn. The study will also make an attempt to compare the learning of audio-tutorial instructional students to students taught a process oriented science curriculum (AAAS) and to students taught nature of the learning that takes place during audio-tutorial science instruction and to compare the conceptual learning to the other two competive forms of instruction. The results of this study should help in proving the worth and character of learning provided by audio-tutorial programmed instruction.

Objectives of Study

The learning evaluation of audio-tutorial programmed science centers on the growth of learning generated by thirteen audio-tutorial science lessons for first grade students', and the comparison of the learning with control groups of Science, A Process Approach instruction (AAAS) and contemporary science instruction found in first grade classrooms. The audio-tutorial science programs, the testing devise (Wabash Valley Science Test) and the experimental design were all developed and utilized by the Elementary Science Project of the Wabash Valley Education Center, West Lafayette, Indiana. The actual research took place during the 1969-70 school year in a eleven county area surrounding Lafayette, Indiana, in Northwestern Indiana.

The success of the learning evaluation study will depend upon the outcome of the research objectives established by the Elementary Science Project. The objectives were established to give validity and direction to the research design. The objectives used in the study are listed below.

Research Objectives

1. To measure if learning occurs with Audio-Tutorial Programmed Science (AT) instruction by comparing the responses of students before (pre-test) and after (post-test) they received the instruction.

2. To measure if changes in learning occurred between the different audio-tutorial science lessons by comparing student learning prior to the instruction, after the first five lessons, after the first nine lessons, and after the thirteen lessons.

3. To measure if learning occurred with audio-tutorial programmed science instruction during its use in a learning center by comparing the students before and after they received the instruction.

4. To compare the learning of audio-tutorial science by students getting science instruction in individual classrooms and in a learning center by comparing the learning records of the various students using the instruction.

5. To measure if learning occurs with Science, A Process Approach (AAAS) science instruction by comparing the responses of students before and after they received the instruction.

6. To measure if learning occurs with contemporary classroom science by comparing the responses of students before and after they received the instruction.

7. To compare the learning of science that occurs with AT, AAAS and contemporary classroom science by comparing the learning recorded by the various forms of science instruction.

Audio-Tutorial Instruction

What is audio-tutorial (AT) instruction? A-T is a variety of taped programed lessons which act as a miniature classroom. Each audio-taped lesson is designed so that the student is guided through a series of short sequential steps that teach conceptual information and/or basic learning skills. A typical lesson utilizes an individual study carrel (miniature classroom) tape recorder, earphones, film loop projector and a variety of instructional props. In each lesson, which lasts from ten to fifteen minutes, the child listens to the instruction provided by the tape, performs the activities and is on his way to conceptual learning and/or skill development.

A-T has great flexibility in dealing with individual students since the student has the opportunity to pace himself according to his own learning needs. If he wishes to stop or repeat the instruction he can do so merely by pushing the tape recorder buttons. In this manner, the student can exhibit greater physical and mental involvement with his learning activities. The audio-taped lesson is also designed in such a way so as to afford the learner positive feedback as he proceeds through the programed lessons.

It is appropriate to point out that the student instructed by audio-tapes is not and should not be plugged into the tape apparatus for great lengths of time during the school day. A-T is by no means a fulltime replacement for the classroom teacher. Rather, audio-tapes should free the teacher to conduct group activities with other members of the class when AT instruction is being utilized by individuals. A-T also frees the teacher from many repeatitive instructional activities within the curricula so that more time can be spent by the teacher on the solving of individual learning problems of students.

Audio-taped lessons have been demonstrated and tested for the past three years in connection with an operational grant to the Wabash Valley Education Center, West Lafayette, Indiana. They have been used in disadvantaged areas, rural farming communities, with mentally retarded schools and inter-city schools. In all cases, AT has been accepted enthusiastically, has functioned smoothly, and has proved successful as an alternate to teacher directed classroom instruction.

Description of the WVEC Science Test

To evaluate student learning from the first thirteen lessons of the audio-tutorial programmed science curriculum a testing instrument was developed. Development of the test took place during the 1968-69 school year when several test formats were experimented with using first grade children. Two test formats proved useful in evaluating student learning on the concept of energy. The first format selected for use was a multiple choice picture test that required the student to correctly answer the question by circling a picture. The Science Picture Test, a 100 item multiple choice picture test, was developed and experimented with to determine its effectiveness in evaluating the learning of first graders on the concept energy. Some limitations were encountered in developing the test items, namely appropriate pictures for abstract ideas. However, the results found that a multiple choice picture test format could successfully measure student learning in science. (Doherty, 1969).

The second test format selected for development and testing was a verbal true-false type test that required the student to circle a smiling face (true) or a frowning fa e (false) to correctly answer the question. The J/S Science Test, a 30 item true-false test was experimented with to determine it's effectiveness for measuring learning. Some limitations, namely the syntactical structure of the science statements, were encountered. However, the results found that the true-false test format could successfully measure student learning in science. (Wright and Scheck, 1969)

The WVEC Science Test is a combination of the best items from the Science Picture Test and the J/S Science Test. The WVEC Science Test has two parts (I and II) which represent the two test formats. Part I contains 25 true-false science items from the J/S test and 10 true-false test taking ability items. Part I and Part II of the WVEC test are administered to the student via a tape recorder and earphone so as to reduce any variation that might occure during the test presentation. Total time require for Part I is 22 minutes. The substantive content of Part I is taken from the science content of the A-T programed science lessons (lessons one through eight). The test items in part I act as a means of testing student responses to verbal statements about the science concept of energy. A student hears a conceptual science statement from the taped instructions and response true or false to the statement by circling a smiling (true) or a frowning (false) face. Knowledge of the science concepts contained within the science statement allows the student to correctly answer the science question. The following three example statements represent the syntaxical structure of the items in Part I or the WVEC Science Test.

1. Electric energy can come from a battery.

2. Living animals never need energy to move.

3. Not living things use energy to grow.

The students, after listening to the science statements repeated twice, answer on a page containing five sets of smiling and frowning faces. Each page records the responses to five questions. After the fifth question the child is asked to turn the page and start again at the top with the first set of faces. The seven pages in Part I are color coded so that the child can move easily from one page to another.

Part II of the WVEC Science Test is also color coded with 28 pages of alternating blue, red and green pages. Each page contains one multiple answer question. The total number of recorded questions is 43. These 43 items, for the most part, represent items taken directly from the Science Picture Test. Several of the items, however, were improved by adding new pictures or changing alternative answers. The directions and questions for each item are presented via a tape recorder and earphones and requires 30 minutes to complete. The subject matter content of the 43 items in Part II reflect the behavioral objectives used to design the first thirteen lessons in the A-T programed science curriculum. The test items in part II act as a means of testing student responses to questions about the science concept energy. Correct understanding of the various concepts of energy contained within the science question allows the student to correctly answer the questions. The following three questions (without their pictorial counterparts) represent the structure of the items in Part II.

1. Where do plants get their energy?

   A. from the soil
   B. from the sun*
   C. from the water
   D. from the flower pot

2. Which picture shows something that does not make heat energy?

   A. a coffee pot
   B. a thermometer*
   C. a candle
   D. a stove

3. Make a circle around the picture of things that are not living.

   A. a log*
   B. a car*
   C. a loaf of bread*
   D. a flower

*Correct Answers

The student, after listening to the science question, selects one of the alternative answers by circling it. He then turns the page for a new question.

The total time required to take the WVEC Science Test is 60 minutes; 20 minutes for Part I; 10 minutes for a break, and 30 minutes for Part II. The students are tested individually with a tape recorder and earphones in a study carrol that has three sides enclosing the student. The student is given a ten minute break between Part I and II which he usually spends going to the restroom and getting a drink.

The WVEC Science Test has proven to be operationally effective and useful in testing over 1000 first grade students during the 1969-70 school year. It has also proven successful in measuring the learning of science content as taught by the first thirteen lessons of the audio-tutorial programmed science curriculum. The science content of both the WVEC test and A-T lessons will be discussed next.

Content of Audio-Tutorial Science Instruction and the WVEC Science Test

The concept of energy, a basic and broad generalization of modern science, was selected for the content of the first thirteen lessons in level one of the audio-tutorial programmed science curriculum. The concept of energy is the central idea that all lessons and their particular subject matter revolves around. The concept of energy is initially introduce to the student as a simple concept that gradually grows and develops as the lessons progress. At the end of the first thirteen lessons the concept of energy has grown in the students mind into an expanded network of interrelationships that included many of the basic ideas of modern science knowledge.

The basic ideas found in the science lessons were also put into test items for use in measuring learning by first grade students. The test items were included in the Wabash Valley Education Center Science Test. The WVEC Science Test parallels the subject matter of the audio-tutorial programmed science lessons and acts as a measurement tool for evaluating student learning. Each major sub-unit of the concept energy is tested by a subtest of the WVEC Science Test so that an evaluation of the many aspects of the concept energy can be made. The sub-units of energy have been arranged into a heirarchy that runs from the simple, most observable aspects of energy to the complex, most abstract aspects. A pictorial representation of the expanding nature of the concept of energy can be found in Figure 1.

A more formal breakdown of the conceptual structure of energy can be found in Table 1. Table 1 represents the organization of the subtests for the WVEC Science Test and the number of items from the test that are included in each subtest. Each subtest represents a special sub-unit of the content of the concept energy. The total score on the WVEC Science Test represents overall knowledge of the concept energy while subtest scores represent knowledge of a particular sub-unit of the concept energy.

Table 1: Sub-tests of WVEC Science Test and Number of Items for Each Test.

Subtest	Numbered Items
Basic Forms of Energy	14
Basic Forms of Matter	15
Secondary Forms of Energy	12
Biological Energy Interactions	18
Physical Energy Interactions	10
Basic Energy Interactions	13
Example Items	11
Test Taking Ability Items	13
WVEC Science Test	78

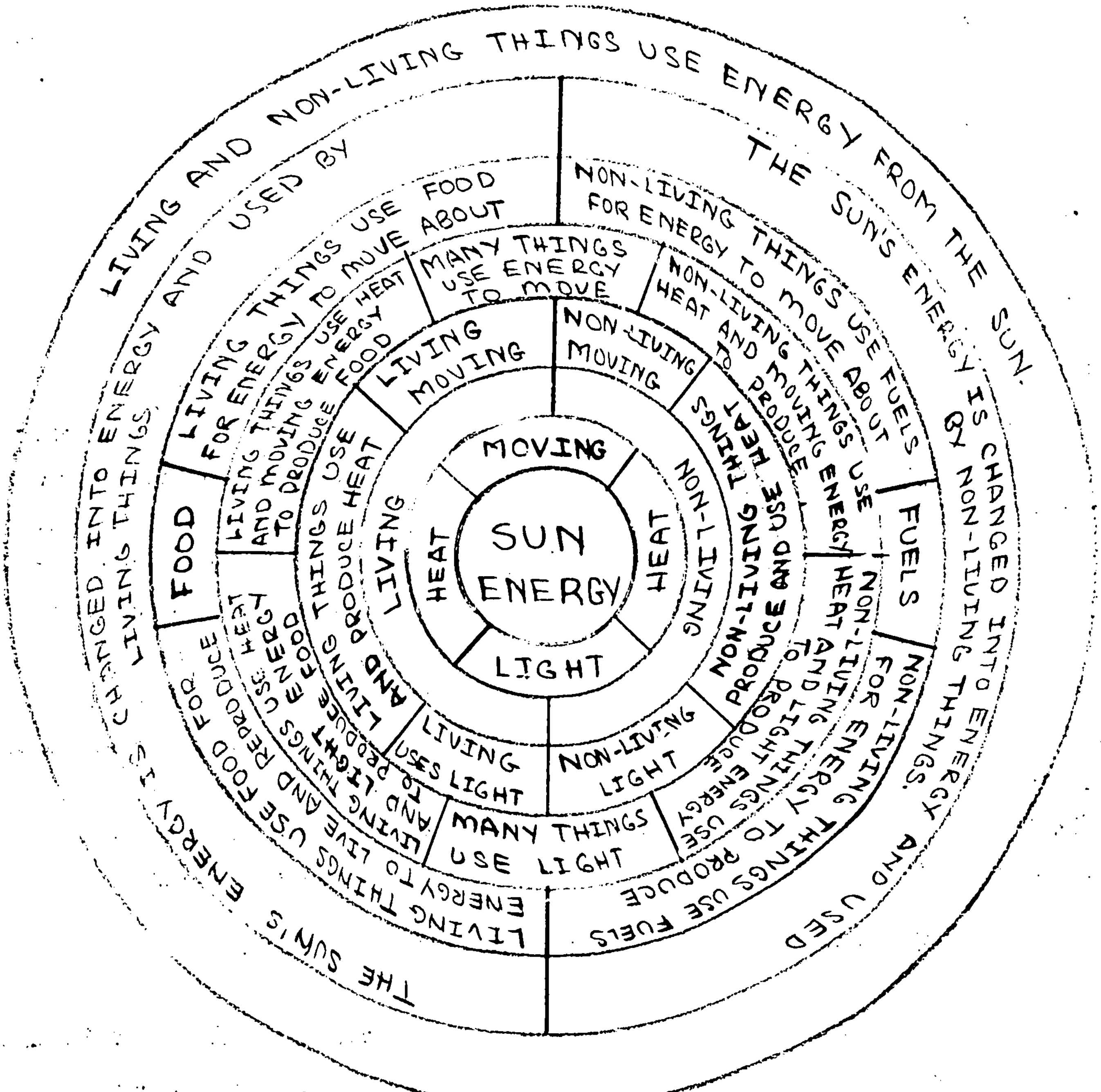

Figure 1

ORGANIZATIONAL NATURE OF THE
EXPANDING CONCEPT OF "ENERGY"

Thus the content of the audio-tutorial science lessons (1 thru 13) and the content of the WVEC Science Test are identical and parallel. The science lessons teach the basic ideas of the concept energy, while the WVEC Science test measures the amount and degree of learning of the concept energy. A more detailed breakdown of the WVEC test items and subtests can be found in the appendix of this report.

Research Design

The focus of the study is to determine if audio-tutorial programmed science instruction promotes learning of relevent science instruction by first grade students. The major research variable is audio-tutorial science instruction (AT) and it will be compared to two other forms of science instruction that will act as control groups. The two control forms of science instruction are Science, A Process Approach (AAAS) which will represent a programmed form of control science, and contemporary classroom instruction (Control) which will represent the science instruction now normally occuring infirst grade classrooms. These three forms of science instruction will be compared on a pre-post test research design with slight modification being made for the range of time that the audio-tutorial form of instruction takes. The modification takes into account the comparison of audio-tutorial science instruction in an eight week learning center (L.C.) and in a twenty-week individual classroom form (IC). The modification can be more clearly seen in Figure I which represents the time table and schedule of testing that took place during the research study for the various forms of science instruction.

Figure I - Time Schedule of Testing During School Year

Forms of Instruction*	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
AT (IC)	Pre-Test------	------	------	------	------	Post-Test		
AT (LC)					Pre-Test------	------	------	Post-Test
AAAS	Pre-Test------	------	------	------	------	------	------	Post-Test
					Post-Test I------	------	------	Test
Control	Pre-Test------	------	------	------	------	------	------	Post-
					Post-Test I------	------	------	Test

*See initial paragraph of Research Design for description of abreviated Forms of Instruction.

Three of the four experimental groups started the first week of October with a pre-test. The two control groups were post-tested (Post-test I) the first week of February. However, the AT group that began in October was only beginning to end its unstructional sequence. Beginning on February 1, the audio-tutorial classes were tested when they completed the thirteen lessons. The last class was tested in mid-April. The mean date for testing was near March 1. A second post test (Post-test II) was conducted around May 1, this provides two post-tests that bracket in the period of time when the audio-tutorial classes were being post-tested.

One experimental group, the audio-tutorial learning center group, was pre-tested in February and so can be compared to the two control groups post-test I. The learning center was post-tested on May 1 and can be compared to the post-test II of the control groups. The audio-tutorial instruction in individual classes will be compared to the post-test II which occurs after the time range of post-tests for AT instruction, while the audio-tutorial instruction in the learning center will be compared to the two post-test (I and II) which correspond exactly to the pre and post test times for the AT instruction in the learning center.

The independent variables that will be considered in the research design focus on the learning of the concept "energy" as defined in the previous section on the content of the audio-tutorial programmed science instruction. The total score of the Wabash Valley Education Center Test, as well as the six subtests, will be compared to demonstrate learning. The subtests fall into the groups, simple levels of conceptual learning and various levels of conceptual learning of the complex concepts of energy. Each subtest, as well as the total test score will be contrasted and compared during the study in relation to the study objective define earlier.

POPULATION

The classroom and their respective teachers were selected by school administrators in each school corporation. They were not a randomly selected sample of classrooms, however, it is felt that they are a representative sample of the first grade classrooms in the field study area. The students in the sample tested were, however, randomly drawn from the population. Not all of the teachers or the school corporations which began the study in August of 1969 were included in the 1969-70 field study. There were many reasons why several classrooms were not used. These reasons will be discussed later to explain differences in the pre and post test population. The school corporations ranged in size from 1000 students to 10,000 students in grades K thru 12. For the most part the school corporations reflect a rural, social economic background. Several classes however, are located in small cities in Northwestern Indiana. Five classes, were also located in a large industrial city, Gary, Indiana. The socio-economic make up of the students, for the most part, is low or lower middle class. Many live on farms, or in or near farming areas, while many have parents who work on construction jobs, in factories or in small businesses.

The study started with more classrooms and a large sample of the population than the study ended with. Three principle problems were responsible for the drop in the study population. The first problem was the atypical use of the instructional materials by several teachers and principals. A second problem was the absenteeism of students during the scheduled testing periods either because of sickness or of moving from the study area. The third problem centers on the testing of the students. If 25% or more of the questions were omitted during the testing the student's test scores were omitted from the final analysis of the data. A breakdown of the study by groups for each testing period can be found in Figures I and II.

FIGURE I

Description of Population and Sample Sizes During the Research Study.

Forms of Instruction	Pre-Test Pop.	Pre-Test Sample	Pre-Test Lost*	Post-Test I Pop.	Post-Test I Sample	Post-Test I Lost*	Post-Test II Pop	Post-Test II Sample	Post-Test II Lost*
AT (IC)	819	116	17	674	90	11	--	--	--
AAAS	495	88	0	420	79	13	420	79	12
Control	773	100	11	749	97	7	523	78	17
AT (LC)	--	--	--	130	41	0	130	125	5

*Lost refers to students who were lost because of absenteeism or because they omitted 25% or more of their test questions.

FIGURE II

Number of Classrooms During the Study

Forms of Instruction	Testing Times Pretest	Post Test I	Post Test II
AT (IC)	32	26	--
AAAS	17	14	14
Control	25	24	17
AT (LC)	--	4	4

Several classr-oms from the 1969-70 pilot field study were not included in the study. These classrooms were dropped because of some atypical action on their part. In the AAAS experimental group three classrooms for one reason of another did not correctly use the materials presented them. Two AAAS classrooms shared the first grade materials with the entire school, making a total of 10 classrooms of varying grade levels using two classrooms worth of first grade materials. One principal shifted the first grade materials to the kindergarden teacher. As a result, only fourteen classrooms were maintained in the AAAS experimental group.

Six AT science instructed classrooms were also dropped for a variety of reasons. One teacher started four weeks before pre-testing. Two teachers started sharing the first grade materials with other classes. One catholic school with a large (40 students) mixed class of first and second graders did not use it. One teacher also did not use it because of her excessive absenteeism.

One control classroom was also dropped because the teacher requested she not participate in the study. After the first post-test (Post I) three classrooms in Gary, Indiana were dropped because of lack of transportation money and four classrooms were converted to an audio-tutorial learning center. Of the 93 students lost during the test phase of the study, 43, or nearly half were because of excessive omits in questions on the WVEC test, 31 or a third, were because of students moved and 19 were because they were absent from school during testing. Despite the weakness caused by the loss of several classrooms and the loss of several individual students, the researchers still feel the population and samples are representative of the schools and students in the study area.

RESULTS AND DISCUSSION

The results of the study will be presented and discussed in relation to the seven research objectives established by the Elementary Science Staff. The scores on the WVEC Science Test and it's relevant subtests will be included in the discussion for each objective. A summary of conclusions of the results and discussion will be in the Conclusion section at the end of this paper.

Objective 1. To measure if learning occurs with Audio-Tutorial Programmed Science (AT) instruction by comparing the responses of students before (pre-test) and after (post-test) they received the instruction.

By comparing the pre and post test scores on the WVEC Science Test and its subtests, evidence can be found to confirm or reject Objective 1 above. The raw test scores and indications of significant differences in test scores can be found in Table I.

Table I Comparisons of the Pre-Post Test Scores for Students Using A.T. Science Instruction

		Mean Scores on Learning Measures						
Test Time	n	WVEC Test	1	2	3	4	5	6
Pre-Test	99	43.33	6.87	8.86	5.28	8.28	5.52	4.34
Post-Test	79	58.03	12.28	6.76	6.76	11.41	7.14	7.42
Gain		14.70***	2.86***	3.42***	1.48*	3.13***	1.62**	3.08***

df = 176
*** = P <.001
** = P <.01
* = P <.05
ns = Non-Significant

Significant increases in the test scores were found for the WVEC Science Test and its subtests. Significant (P<.001) were found for the WVEC Science Test and the subtests on basic forms of energy, on basic forms of matter, on biological energy interactions, and on basic energy interactions. The subtest on secondary forms of energy was significantly (P<.01) higher, while the subtest for physical energy interactions was only significantly (P<.05) higher. Mastery of the subtests (85% of questions correct) was not reached by the students on any of the learning measures.

Evidence of learning of the concept energy was validated by the significant differences recorded in pre-post scores. The differences were extremely high suggesting that the thirteen audio-tutorial lessons were highly successful in promoting the students using them to answer more questions correctly. Areas that were less significant and suggested less learning occurred were in the secondary forms of energy (ie. food, gasoline, etc.) and in physical energy interactions.

Objective 2. To measure if changes in learning occurred between the different audio-tutorial science lessons by comparing student learning prior to the instruction, after the first five lessons, after the first nine lessons, and after the thirteen lessons.

Evidence of how the audio-tutorial programmed science lessons promoted the learning exhibited under Objective 1 can be seen by comparing the test scores of student tested throughout the thirteen lessons. The first comparison will be made between the pre-test scores and test scores of students after only five lessons. The raw scores and indications of significant differences in test scores can be found in Table II.

Table II Comparison of Pretest and Intermediate I Test Scores for Students Using AT Science Instruction

			Mean Scores of Learning Measures					
Test Time	n	WVEC Test	1	2	3	4	5	6
Pretest	99	43.33	6.87	8.86	5.28	8.28	5.52	4.34
Inter I	82	51.51	8.93	10.67	6.21	9.77	6.89	5.77
Gain		8.18***	2.06**	1.81*	.93ns	1.49*	1.37*	1.43*

df = 179
*** = $P < .001$
** = $P < .01$
* = $P < .05$
ns = Non-Significant

The first five lessons created a highly significant ($P < .001$) increase in the overall test score. The large increase would suggest that the first five lessons were very powerful in generating learning by the first grade students on the over all concept of energy. However, when the WVEC Science Test is broken down into its subtests the level of significant difference in test scores drops. The subtest on basic forms of energy was only $P < .01$ significant, while the subtests on basic forms of matter, and on biological, physical and basic energy interactions was only $P < .05$ significant. The subtests on secondary forms of energy was not significant suggesting that little or no learning had taken place.

A comparison of Intermediate I test scores and Intermediate II test scores will provide evidence of the effectiveness of the AT lessons six through nine in promoting learning of the concept energy. The raw test scores and indications of significant differences in test scores can be found in Table III.

Table III Comparison of Intermediate I and II Test Scores for Students Using AT Science Instruction

			Mean Scores of Learning Measures					
Test Time	n	WVEC Test	1	2	3	4	5	6
Inter I	82	51.51	8.93	10.67	6.21	9.77	6.89	5.77
Inter II	92	54.86	8.91	12.14	6.43	10.36	6.71	6.40
Gain		5.35**	-.02ns	1.47ns	.22ns	.59ns	-.17ns	.63ns

df = 172
*** = $P < .001$
** = $P < .01$
* = $P < .05$
ns = Non-Significant

Audio-tutorial lessons six through nine promoted a significant ($P < .01$) gain in the overall test score for the concept energy. The gain suggest that learning did take place during the four lessons. However, an analysis of the subtests of the WVEC Science Test shows that no one conceptual area was involved in the increase in score. All of the subtests comparisons were non-significant. While learning did take place, it was not isolated in one area but intermixed throughout the different conceptual area.

The last four audio-tutorial lessons, lessons ten through thirteen, can also be compared to see if they produced significant amounts of learning. The raw test scores and indications of significant differences in test scores can be found in Table IV.

Table IV Comparison of Intermediate II and Post Test Scores for Students Using AT Science Instruction

			Mean Score of Learning Measures					
Test Times	n	WVEC Test	1	2	3	4	5	6
Inter I	92	54.86	8.91	12.14	6.43	10.36	6.71	6.40
Post-Test	79	58.03	9.73	12.28	6.76	11.41	7.14	7.42
Gain		3.17*	.82ns	.14ns	133ns	1.05ns	.43ns	1.02ns

df = 169
*** = $P < .001$
** = $P < .01$
* = $P < .05$
ns = Non-Significant

The last four audio-tutorial lessons, ten through thirteen, were only moderatly significant ($P < .05$) in providing increases in the overall test score. The analysis by subtests reveils that no significant differences were observed. Again there is a significant increase in the overall knowledge of energy, but no significant increases in the more specific conceptual areas of the concept energy.

One further analysis to be made is that of looking at the effect of the last eight audio-tutorial lessons'. That is, the influence of AT lessons six through thirteen. The raw test scores and indications of significant differences can be found in Table V.

Table V Comparison of Intermediate I and Post Test Scores for Students Using AT Science Instruction

			Mean Score of Learning Measures					
Test Time	n	WVEC Test	1	2	3	4	5	6
Inter I	82	51.51	8.93	10.67	6.21	9.77	6.89	5.77
Post Test	79	58.03	9.73	12.28	6.76	11.41	7.14	7.42
Gain		6.52***	.80ns	1.61*	.55ns	1.64*	.25ns	1.65*

df = 159
*** = $P < .001$
** = $P < .01$
* = $P < .05$
ns = Non-Significant

The last eight audio-tutorial lessons highly significantly ($P < .001$) in increasing the test score on the WVEC Science Test. This would suggest the overall learning of the concept energy did take place during the time the eight lessons were presented. The subtests of the WVEC Science Test did not demonstrate high levels of significant increases. The subtests of basic forms of matter and of biological and basic energy interactions were not significant. Highly significant increases were recorded for the overall concept of energy, but not for the various conceptual levels during the last eight audio-tutorial lessons.

A summary of the effects of the various audio-tutorial lessons finds that the first five lessons were the most powerful in promoting the learning of the concept energy. Lessons six through nine and ten through thirteen were less powerful as individual groups of lessons in promoting learning. The significant learning of basic forms of energy took place during the first five lessons and not during the last eight lessons. Moderately levels of significant ($P < .05$) increases in the basic forms of matter, in biological energy interactions and in basic energy interactions were recorded during the first five lessons and the last eight lessons, but not during the middle four lessons or the last four lessons. Moderately increases in the learning of physical energy was recorded during the first five lessons and not during the last eight lessons. No significant increase was reported by any group of lessons for the subtest on secondary forms of energy.

Objective 3. To measure if learning occurred with audio-tutorial programmed science instruction during its use in a learning center by comparing the students before and after they received the instruction.

Student learning of the concept energy was also validated by using the audio-tutorial science lessons during a learning center study. The raw test scores and indications of significant differences in test scores can be found in Table VI.

Table VI Comparison of Test Scores for Pre-Post Tests on Students in an AT Science Learning Center

		Mean Scores on Learning Measures						
Test Time	n	WVEC Test	1	2	3	4	5	6
Pre-Test	41	51.71	7.98	10.59	5.83	9.56	6.22	5.76
Post-Test	125	58.21	9.36	12.63+	6.50	11.38	6.89	7.59
Gain		6.50***	1.38***	2.04***	.67***	1.82***	.67***	1.83***

df = 164
ns = Non-Significant
+ = Mastery of subtest by students
*** = $P < .001$
** = $P < .01$
* = $P < .05$

Highly significant ($P < .001$) increases in learning were found for all test scores in the learning center study, with the exception of the subtest physical energy interactions that only significant ($P < .01$) increased. The high levels of significant increases would suggest that the audio-tutorial lessons in a learning center situation were powerful promoters of learning. The learning levels were high enough for the students to master the learning of basic forms of energy (mastery = 85% of all questions answered correctly).

Objective 4. To compare the learning of audio-tutorial science by students getting science instruction in individual classrooms and in a learning center by comparing the learning records of the various students using the instruction.

Evidence of how the learning center comparing to the individual classrooms in promoting learning can be seen by comparing the post-test scores for each group. The post-test scores and indications of significant differences can be found in Table VII.

Table VII Comparison of Post-Test scores for AT Science Instruction in Individual Classrooms and in a Learning Center

			Mean Scores on Learning Measures					
Test Time	n	WVEC Test	1	2	3	4	5	6
Post AT	79	58.03	9.73	12.28	6.76	11.41	7.14	7.42
Post AT-LC	125	58.21	9.36	12.63	6.50	11.38	6.89	7.59
Difference		.19ns	.37ns	.35ns	.26ns	.03ns	.25ns	.17ns

df = 202
ns = Non-Significant
*** = $P < .001$
** = $P < .01$
* = $P < .05$

There were no significant differences found when the post test scores were compared for the individual classrooms and the learning center. The finding would suggest that the level of learning for both groups was identical at the end of the thirteen lessons of instruction. Both methods of utilizing the audio-tutorial lessons seem equal in ability to promote learning.

One other consideration, however, is the differences in time required for the two methods of utilizing the AT lessons. The learning center took an average of nine weeks per class while the individual classed averaged twenty weeks per class to complete the AT lessons. Using the differences in time required to teach the lessons and the recorded learning of each methods an efficiency index was calculated. The efficiency index was compared to see if there was a difference in the learning efficiency of the two instruction methods of audio-tutorial science instruction. Table VIII lists the efficiency indexes for the two forms of instruction.

Table VIII Efficiency Index for Learning Using Two Forms of AT Science Instruction

Types of Instruction	No. of Weeks	WVEC	Average Weekly Learning Index 1	2	3	4	5	6
AT (IC)	20	.735	.143	.171	.074	.157	.081	.154
AT (LC)	9	.722	.153	.227	.074	.202	.074	.203
Differences		.013	.010	.056	.000	.045	.005	.049

As can be seen from Table VIII the effective indexes for the two forms of science instruction are remarkable similiar. This would suggest that the level of learning generated by audio-tutorial lessons does not depend upon the time sequence the lessons are used in. The more rapid utilization of the learning center method does not exhibit a learning advantage over the slower paced classroom form of utilization of the AT instruction.

Objective 5. To measure if learning occurs with Science, A Process Approach (AAAS) science instruction by comparing the responses of students before and after they received the instruction.

A comparison of the pre-test and post tests of the students using Science, A Process Approach (AAAS) science instruction can provide evidence of learning to confirm or reject Objective 5. The raw test scores and the indications of significant differences in test scores for the various comparisons can be found in Table IX.

Table IX The Comparisons of Pre-Test and Post-Tests I and II for Students Using AAAS Science Instruction

a. Pre-test comparison with Post-Test I

			Means of test scores					
Test Time	n	WVEC Test	1	2	3	4	5	6
Pre	88	45.48	6.89	9.59	5.51	8.35	5.80	4.58
Post I	66	52.30	7.73	11.44	5.64	9.61	6.08	6.05
Gains		6.82***	.84ns	1.85*	.13ns	1.26ns	.28ns	1.63*

df = 152
ns = Non-Significant
*** = P ∠ .001
** = P ∠ .01
* = P ∠ .05

b. Pre-test comparison with Post-Test II

			Means of test scores					
Test Time	n	WVEC Test	1	2	3	4	5	6
Pre	88	45.48	6.89	9.59	5.51	8.35	5.80	4.58
Post II	67	54.42	8.43	12.16	6.06	10.18	6.63	5.99
Gains		8.94***	1.44*	2.57**	.55ns	1.83**	.83ns	1.57*

df = 153
ns = Non-Significant
*** = P ∠ .001
** = P ∠ .01
* = P ∠ .05

c. Post-Test I comparison with Post-Test II

			Means of Test Scores					
Test Time	n	WVEC Test	1	2	3	4	5	6
Post I	67	52.30	7.73	11.44	5.64	9.61	6.08	6.05
Post II	66	54.42	8.43	12.16	6.06	10.18	6.63	5.99
Gains		2.12ns	.70ns	.72ns	.42ns	.57ns	.55ns	.06ns

df = 131
ns = Non-Significant
*** = P< .001
** = P<.01
* = P<.05
+ = Mastery

Evidence of highly significant learning was found between the pretest and post tests (I and II) for the overall test on the concept energy. No significant learning was found between Post test I and II. None of the subtests were significantly different between Post test I and II, but significant differences were found between the pretest and post test (I and II). The subtests of basic forms of matter and basic energy interactions demonstrated significant (P<.05) increases in learning for the pretest and post test I comparison. All other subtests were found to be not significant. In the Pretest and Post test II comparison the number of subtests demonstrating significant (P<.05) learning increased. Besides the basic forms of energy and basic energy interactions, there was recorded increases in basic forms of energy, and biological energy interactions. The subtest for secondary forms of energy was not significant in either comparison.

Highly significant learning of the concept energy did occur during the use of AAAS science instruction. The overall learning was most powerful seen by the significant (P .001) increase in the WVEC Science Test. Significant learning (P<.05) also occurred in several of the subtest of the conceptual levels of the concept energy.

Objective 6. To measure if learning occurs with contemporary classroom science by comparing the responses of students before and after they received the instruction.

Evidence of learning for the concept energy can be found by comparing the Pretest and Post Test (I and II) for contemporary classrooms and the science instruction that takes place in them. Table X reports the raw scores and the indications of significant differences in the test scores.

Table X The Comparison of Pretest and Post Test (I and II) for Students Using Contemporary Classroom Science Instruction

a. Pretest Comparison with Post Test I

			Means of Test Scores					
Test Time	n	WVEC Test	1	2	3	4	5	6
Pretest	89	46.36	6.94	9.70	5.33	8.33	5.62	4.69
Post Test I	90	52.32	7.98	10.76	5.84	9.81	6.26	6.04
Gain		5.96**	1.04ns	1.06ns	.51ns	1.48*	.64ns	1.35ns

df = 177
ns = Non-Significant
*** = P<.001
** = P<.01
* = P<.05

b. Pretest Comparison with Post Test II

			Means of Test Scores					
Test Time	n	WVEC Test	1	2	3	4	5	6
Pretest	89	46.36	6.94	9.70	5.33	8.33	5.62	4.69
Post Test II	61	56.95	8.97	12.26	6.25	10.31	6.90	6.92
Gain		10.59***	2.03**	2.56***	.92ns	1.98**	1.28*	2.23***

df = 148
ns = Non-Significant
*** = P<.001
** = P<.01
* = P<.05

c. Post Test I Comparison with Post Test II

			Means of Test Scores					
Test Time	n	WVEC Test	1	2	3	4	5	6
Post Test I	90	52.32	7.98	10.76	5.84	9.81	6.26	6.04
Post Test II	61	56.95	8.97	12.26	6.25	10.31	6.90	6.92
Gain		4.63***	.99ns	1.50ns	.41ns	.50ns	.64ns	.88ns

df = 149
ns = Non-Significant
*** = P<.001
** = P<.01
* = P<.05

Evidence of highly significant (P<.001) learning was found between the three comparisons for pretest and post tests (I and II) on the WVEC Science Test. The overall learning of the concept energy was promoted by the science instruction received in the contemporary classrooms. However, no significant differences were found for the various subtests on energy for the post test I and post test II comparison and only one significant (P<.05) increase on the pretest and post test I comparison, the subtest of biological energy interactions. The comparisons of subtests of the pretest to post test II however, found many significant increases in learning. The subtests of basic forms of matter and basic energy interactions was highly significant (P<.001). The subtests of basic forms of energy and biological energy interactions was significant (P<.01) different. The subtest on physical energy interactions was only P .05 different while the subtests on secondary forms of energy was not significant.

Objective 7. To compare the learning of science that occurs with AT, AAAS and contemporary classroom science by comparing the learning recorded by the various forms of science instruction.

To compare the learning promoted by audio-tutorial programmed science instruction in individual classes to AAAS and contemporary classroom science the pretests and the post test recorded by the various forms of science instruction must be compared. Table XI and XII lists the raw test scores and the indications of significant differences in the test scores.

Table XI Comparison of Pre-Test Scores for AT in Classroom, AAAS and Contemporary Classrooms, Science Instruction

Forms of Instruction	n	Means of Test Scores WVEC	1	2	3	4	5	6
AT	99	43.33ns	6.87ns	8.86ns	5.28ns	8.28ns	5.52ns	4.34ns
Cont-AAAS	88	45.48ns	6.89ns	9.59ns	5.51ns	8.35ns	5.80ns	4.58ns
Cont--Comt	89	46.36ns	6.94ns	9.70ns	5.33ns	8.33ns	5.62ns	4.69ns

ns = Non-Significant
* = P <.05
** = P <.01
*** = P <.001

A comparison of the post test scores for the WVEC Science Test and it's subtests found two significant differences existing between the various instructional groups. The scores on the WVEC test for the audio-tutorial classrooms were significantly (P <.01) higher than the control classrooms using Science, A Process Approach (AAAS) science instruction. AT science instruction, however, was not different from control classrooms using contemporary classroom science instruction. A significant (P <.05) difference was also found between the audio-tutorial forms of instruction and the AAAS control group for the subtest of basic energy interactions. The audio-tutorial science instruction promote more learning of the higher level conceptual basic energy interactions than did the AAAS form of instruction. No differences were reported between the subtests of basic forms of energy and matter, for secondary forms of energy and for biological and physical energy interactions.

To compare the learning promoted by audio-tutorial programmed science instruction used during a learning center to AAAS and contemporary classroom science the pretest and post test recorded by the various forms of science instruction must be compared. Table XIII and XIV list the raw test scores and the indications of significant differences in the test scores.

Table XIII Comparison of Pre Test Scores for AT in A Learning Center, for AAAS Classrooms, and for Contemporary Classroom Science Instruction

Forms of Instruction	n	Means of Test Scores WVEC	1	2	3	4	5	6
AT (LC)	41	51.71ns	7.98ns	10.59ns	5.83ns	9.56ns	6.22ns	5.76ns
Cont (AAAS)	66	52.30ns	7.73ns	11.44ns	5.64ns	9.61ns	6.08ns	6.05ns
Cont (Contemp)	90	52.32	7.98ns	10.76ns	5.84ns	9.81ns	6.26ns	6.04ns

ns = Non-Significant
* = P <.05
** = P <.01
*** = P <.001

A comparison of pretest scores for the WVEC Science Test and its subtest found that no significant differences existed between the various instructional groups at the beginning of the study. The populations of students who were to use the various forms of science instruction were essentially the same at the beginning of the evaluation program.

Table XIV Comparison of Post Test Scores for AT in a Learning Center and AAAS in a Classroom, and for Contemporary Classroom Science Instruction

Forms of Instruction	n	WVEC	Means of Test Scores 1	2	3	4	5	6
AT (LC)	125	58.21	9.36	12.36	6.50	11.38	6.89	7.59
Cont (AAAS)	67	54.42**	8.43ns	12.16ns	6.06ns	10.18ns	6.63ns	5.99**
Cont (Comt)	61	56.95	8.97ns	12.26ns	6.25ns	10.31ns	6.90ns	6.92

ns = Non-Significant
* = $P < .05$
** = $P < .01$
*** = $P < .001$

A comparison of the post test scores for the WVEC Science Test and its subtest found two significant differences existing between the various instructional groups. The scores on the WVEC test for the audio-tutorial classrooms were significantly ($P < .01$) higher than the control classrooms using Science, A Process (AAAS) science instruction. AT science instruction, however, was not different from the contemporary control classroom. A significant ($P < .01$) difference was found between the audio-tutorial science instruction group and the AAAS control group for the subtest of basic energy interactions. The AT instruction seem to promote more learning of the higher level conceptual area of basic energy and matter, secondary forms of energy, and for biological and physical energy interactions.

CONCLUSION

The evaluation of learning for audio-tutorial programed science instruction did in fact find highly significant levels of learning. The comparison of pretest and post-test scores on samples of students chosen randomly from the population of 24 classrooms using audio-tutorial science found an average gain of 14.7 questions on the WVEC Science Test. The gain reflects an increased knowledge of the concept energy which is the major content of the A-T science lessons. Highly significant learning was also recorded for the subtests on basic forms of energy and matter and on biological, physical and basic energy interactions. The subtest of secondary forms of energy was found to be only partically learned.

A comparison of the various A-T lessons found that the first five lessons were the most powerful in promoting learning of the various concepts of energy. The last eight lessons of the thirteen lessons tested were successfull in promoting learning on the overall test on energy but not on the subtests.

Learning by students using the audio-tutorial lessons in a learning center environment proved to be highly significant in all areas studied. The learning reached mastery level (85% correct) in the subtest area of basic forms of matter. A comparison of learning between A-T lessons in individual classrooms and in the learning center found no significant differences. Effeciency of learning as measured by level of learning and time required for learning were remarkably similar. This would suggest that the A-T lessons are equally effective when used over a short or long period of time.

Comparisons of the pretest and post-test scores of the two control groups, AAAS science and contemporary classroom science also, found highly significant increase in learning for the overall test on energy, but not for all the subtests. The subtests measuring basic forms of energy and matter and biological and basic energy interactions were more significant than secondary forms of energy and physical energy interactions.

A comparison of the pretest scores for the audio-tutorial science and the two control groups, AAAS and contemporary science, found no significant difference. The populations of the three different instructional groups were essentially equal at the beginning of the evaluation period. A comparison of the post test scores found significant differences between the A-T groups, individual classes and learning center classes, and the AAAS control classrooms. The significant differences in learning were on the overall test, WVEC science test and for the subtest on basic energy interactions. The A-T students demonstrated more overall knowledge of the concept energy than did the AAAS students and the A-T students understood the basic, or more general, ideas of energy interactions than did the AAAS students. No differences were reported between the A-T groups and the contemporary classroom control group.

In summary, the audio-tutorial programed science instruction proved to be a powerful promoter of learning in individual classrooms and in a learning center. The first five lessons of the thirteen studies proved to be the most powerful in generating learning. The efficiency of learning for the individual classroom method and the learning center method were remarkably similar. The two control groups, AAAS science and contemporary classroom science, also demonstrated high levels of learning, although not as high as the A-T group. The A-T instructional groups were significantly higher in learning than the AAAS control group but not significantly higher than contemporary classroom control group. The only significant difference for the subtests on energy was in the basic energy intereaction where the A-T groups were higher than the AAAS control group.

Subtests of Wabash Valley Education Center
Science Test and the items for each subtest.

Subtest No. 1 - Basic Forms of Energy

Item No.	Question	Correct Answer
8	Electric energy can change to heat energy	T
9	Food energy changes to heat energy in your body	T
13	Plants get light energy from dirt	F
18	Heat energy makes things get warm	T
19	Electric energy changes to light energy in a light bulb	T
41	Which picture shows something that changes electric energy to moving energy? (an electric mixer)	D
44	Which picture shows something that changes electric energy to light energy? (a lamp)	A
45	What kind of energy does an iron make? (heat energy)	D
47	What kind of energy do we see coming from a lamp? (light energy)	B
48	What kind of energy do we see coming from the light bulb? (light energy)	D
49	Which picture shows something that changes electric energy to heat energy? (a toaster)	C
54	When the fan turns, what kind of energy do we see? (moving energy)	A
58	Which picture shows something that does not make light energy? (a camera)	A

Subtest No. 2 - Basic Forms of Matter

4	Water is a living thing.	F
14	All living things need water to stay alive.	T
15	Not living things use energy to grow.	F
16	All living things need air to stay alive.	T
24	Small rocks use energy to grow.	F
64	A tree, a girl, a bird, and boots are living things?	3-T, 1-F
65	A tree is a living thing?	T
66	A girl is a living thing?	T
67	A bird is a living thing?	T
68	Boots are a living thing?	F
69	A log, a car, a loaf of bread and a flower are non-living things.	3-T, 1-F
70	A log is a non-living thing?	T
71	A car is a non-living thing?	T
72	A loaf of bread is a non-living thing?	T
73	A flower is a non-living thing?	F

Subtest No. 3 - Secondary Forms of Energy

Item No.	Question	Correct Answer
6	Water has food energy?	F
7	Electric energy never changes to other kinds of energy?	F
8	Electric energy can change to heat energy?	T
9	Food energy changes to heat energy in your body?	T
19	Electric energy changes to light energy in a light bulb?	T
20	Electric energy can come from a bettery?	T
23	Food energy comes from a battery?	F
41	Which picture shows something that changes electric energy to moving energy? (a electric mixer)	D
44	Which picture shows something that changes electric energy to light energy? (a lamp)	A
46	What kind of energy comes from the battery? (electric energy)	B
49	Which picture shows something that changes electric energy to heat energy? (a toaster)	C
76	Do animals need food to stay alive and grow?	T
Subtest No. 4 - Biological	Energy Interactions	
5	Plants and Animals need energy?	T
9	Food energy changes to heat energy in your body?	T
10	Living animals never need energy to move?	F
12	Some animals eat other animals to get energy.	T
13	Plants get light energy from dirt.	F
16	All living things need air to stay alive.	T
21	Plants get energy from water.	F
24	Small rocks use energy to grow.	F
25	Living plants use most of their energy to move.	F
38	What do plants need to stay alive and grow? (water)	D
40	Where do all the animals get their energy to live? (plants)	A
42	What do animals do with most of their energy that plants do not do? (move from place to place)	B
50	Where do plants get their energy?(from the sun)	B
57	Which picture shows something that does not use most of its energy to move? (a plant)	C
74	Animals need water, food, plants and the sun to stay alive and grow.	T

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Subtest No. 4 - Biological Energy Interactions con't.

Item No.	Question	Correct Answer
75	Animals need water to stay alive and grow.	T
76	Animals need food to stay alive and grow.	T
77	Animals need plants to stay alive and grow.	T
78	Animals need the suns energy to stay alive and grow.	T

Subtest No. 5 - Physical Energy Interactions

Item No.	Question	Correct Answer
7	Electric energy never changes to other kinds of energy.	F
8	Electric energy can change to heat energy.	T
15	Not living things use energy to grow.	F
19	Electric energy changes to light energy in a light bulb.	T
20	Electric energy can come from a battery.	T
23	Food energy comes from a battery.	F
41	Which picture shows something that changes electric energy to moving energy? (electric mixer)	D
44	Which picture shows something that changes electric energy to light energy? (a lamp)	A
49	Which picture shows something that changes electric energy to heat energy? (a toaster)	C
58	Which picture shows something that does not make heat energy? (a thermometer)	B

Subtest No. 6 - Basic Energy Interactions

Item No.	Question	Correct Answer
5	Plants and animals need energy.	T
11	The sun is not important for living things.	F
12	Some animals eat other animals to get energy.	T
22	Animals need plants to get energy.	T
40	Where do all the animals get their energy to live? (from plants)	A
42	What do animals do with most of their energy that plants do not do? (move from place to place)	B
50	Where do plants get their energy? (the sun)	B
51	What do all living things need to grow and stay alive? (energy)	C
53	What do the mixer, the boy, and the automobile need to move? (energy)	C
74	Do animals need water, food, plants and energy to stay alive and grow?	T
76	Do animals need food to stay alive and grow?	T
77	Do animals need plants to stay alive and grow?	T
78	Do animals need the suns energy to stay alive and grow?	T

Subtest No. 7 - Example Items

Item No.	Question	Correct Answer
1	We can use scissors to cut paper.	T
2	Boys and girls never use books in school.	F
3	You are in kindergarten.	F
36	What will the boy use to write his name? (a pencil)	C
37	Where will the girl learn to read? (in the school)	D
55	Which picture shows something that does not have wheels? (the ear of corn)	D
59,60,61,62,63	Make a circle around the pictures that show things we use in school (a pencil, a book and scissors)	A - B - C

Subtest No. 8 - Test Taking Ability Items

Item No.	Question	Correct Answer
1	We can use scissors to cut paper.	T
2	Boys and girls never use books in school.	F
3	You are in kindergarten.	F
26	Most dogs have three legs.	F
27	Fish swim in the water.	T
28	Most dogs have four legs.	T
29	We use our eyes to see.	T
30	Teachers write on the blackboard.	T
31	You are three years old.	F
32	You are eating your lunch now.	F
33	Blue and red are the same class.	F
34	Water is wet.	T
35	It snows in the summer.	F

Subtest No. 9 - Items in Wabash Valley Education Center Science Test that were not used in study.

Item No.	Question	Correct Answer
39	If a gooch lives on the land, what does a gooch use to get its air? (lungs)	B
43	If a shmoo lives in water, what does a shmoo use to get its air? (gills)	A
52	What does the boy do in science to list his ideas? (do an experiment)	C

WABASH VALLEY EDUCATION CENTER SCIENCE TEST

7-23-69

Part I	Correct Answer
1. We can use scissors to cut paper.	T
2. Boys and girls never use books in school.	F
3. You are in kindergarten.	F
4. Water is a living thing.	F
5. Plants and animals need energy.	T
6. Water has food energy.	F
7. Electric energy never changes to other kinds of energy.	F
8. Electric energy can change to heat energy.	T
9. Food energy changes to heat energy in your body.	T
10. Living animals never need energy to move.	F
11. The sun is not important for living things.	F
12. Some animals eat other animals to get energy.	T
13. Plants get light energy from dirt.	F
14. All living things need water to stay alive.	T
15. Not living things use energy to grow.	F
16. All living things need air to stay alive.	T
17. A baby plant in a seed uses most of its energy to grow.	T
18. Heat energy makes things get warm.	T
19. Electric energy changes to light energy in a light bulb.	T
20. Electric energy can come from a battery.	T
21. Plants get energy from water.	F
22. Animals need plants to get energy.	T
23. Food energy comes from a battery.	F
24. Small rocks use energy to grow.	F
25. Living plants use most of their energy to move.	F
26. Most dogs have three legs.	F
27. Fish swim in the water.	T
28. Most dogs have four legs.	T
29. We use our eyes to see.	T
30. Teachers write on the blackboard.	T
31. You are three years old.	F
32. You are eating your lunch now.	F
33. Blue and red are the same colors.	F
34. Water is wet.	T.
35. It snows in the summer.	F

Part II

Correct Answer

36.	What will the boy use to write his name?	C
	A. A hammer?	
	B. A pencil sharpener?	
	C. A pencil?	
	D. scissors?	
37.	Where will the girl learn to read?	D
	A. In the doghouse?	
	B. In the birdhouse?	
	C. In the fish tank?	
	D. In the school?	
38.	What do plants need to stay alive and grow?	D
	A. A flower pot?	
	B. A boy	
	C. A hoe?	
	D. water?	
39.	If a gooch lives on the land, what does a gooch use to get its air?	B
	A. Liver?	
	B. Lungs?	
	C. Heart?	
	D. Gills?	
40.	Where do all the animals get their energy to live?	A
	A. From the plants?	
	B. From the water?	
	C. From the air?	
	D. From the dirt?	
41.	Which picture shows something that changes electric energy to moving energy?	D
	A. A tricycle?	
	B. An airplane?	
	C. A canoe?	
	D. A mixer?	
42.	What do animals do with most of their energy that plants do not do?	B
	A. Have babies?	
	B. Move from place to place?	
	C. Grow?	
	D. Get energy?	

Part II con't.

	Correct Answer
43. If a shmoo lives in water, what does a shmoo use to get its air?	A

A. Gills?

B. Heart?

C. Liver?

D. Lungs?

44. Which picture shows something that changes electric energy to light energy?	A

A. A lamp?

B. A lantern?

C. A candle?

D. A match?

45. What kind of energy does an iron make?	D

A. Light energy?

B. Electric energy?

C. Moving energy?

D. Heat energy?

46. What kind of energy comes from the battery?

A. Heat energy?

B. Electric energy?

C. Moving energy?

D. Light energy?

47. What kind of energy do we see coming from the lamp?

A. Moving energy?

B. Light energy?

C. Heat energy?

D. Electric energy?

48. What kind of energy do we see coming from the light bulb?	D

A. Electric energy?

B. Heat energy?

C. Moving energy?

D. Light energy?

49. Which picture shows something that changes electric energy to heat energy?	C

A. The sun?

B. A fire?

C. A toaster?

D. A boy?

Part II con't. Correct Answer

50. Where do plants get their energy? B

A. From the soil?

B. From the sun?

C. From the water?

D. From the flower pot?

51. What do all living things need to grow and stay alive? C.

A. A car?

B. A house?

C. energy?

D. clothers?

52. What does the boy do in science to test his ideas? C.

A. Learn about plants?

B. Learn about animals?

C. Do an experiment?

D. Separate things?

53. What do the mixer, the boy, and the automobile need to move? C.

A. Food?

B. Gas?

C. Energy?

D. Electricity?

54. When the fan turns, what kind of energy do we see? A

A. Moving energy?

B. Light energy?

C. Heat energy?

D. Electric energy?

55. Which picture shows something that does not have wheeels? D

A. A car?

B. A train?

C. A truck?

D. An ear of corn?

56. Which pictures shows something that does not make light energy? A

A. A Camera?

B. The sun?

C. A lamp?

D. A movie projector?

Part II con't. Correct Answer

57. Which picture shows something that does not use most of its energy to move? B

A. A fan?

B. A bear?

C. A plant?

D. A bus?

58. Which picture shows something that does not make heat energy? B

A. A coffee pot?

B. A thermometer?

C. A candle?

D. A stove?

59. Make a circle around the pictures that show things we use in school.

60. A dog F

61. A pencil T

62. A scissors T

63. A book T

64. Make a circle around the pictures that show living things.

65. A tree T

66. A girl T

67. A bird T

68. Boots F

69. Make a circle around the pictures of things that are not living.

70. A log T

71. A car T

72. A loaf of bread T

73. A flower F

74. Make a circle around the pictures that show what animals need to stay alive and grow.

75. Water T

76. Food T

77. Plants T

78. Sun's energy T

Report XIII

One aspect of an individualized form of instruction, like A-T science, is its ability to be utilized in Learning Centers, A pilot project was initiated to discover the relevance of A-T science lessons as they effected the use and operation of a learning center. The pilot study demonstrated the great flexability inherent in the A-T form of instruction as well as pointing out some of the pitfalls and problems associated with individualized forms of instruction. Based on information garnered from the pilot study we are now aware of the efforts needed to introduce an innovative for of instruction (A-T instruction) into an innovative style of learning, a learning center.

SUMMARY OBSERVATIONS OF AN
AUDIO-TUTORIAL SCIENCE LEARNING CENTER
FOR FIRST GRADE STUDENTS

A pilot project conducted through the Elementary Science Project of the Wabash Valley Education Center in cooperation with the Tippecanoe School Corporation.

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June 30, 1970

Acknowledgements:

Our appreciation to Mr. Mikels, Superintendent, Mr. Thayer, Assistant Superintendent, Mr. Minneman, Elementary Curriculum Coordinator, and Mr. Bohs, Principal, Tippecanoe School Corporation for allowing us the privilege to conduct the pilot study. Also, Mrs. Boggs, Mrs. Ellsberry, Mrs. Odle, Mrs. Hoover, and Mrs. Maddox for their aid and cooperation in helping us successfully operate the learning center.

I. Purpose

Wabash Valley Education Center, as part of its research and development, established an experimental audio-tutorial science center in an elementary school in Tippecanoe County, Indiana. The purpose for establishing the experimental learning center was to determin whether or not the AT materials could operate effectively in a learning center situation and, if so to determine how such a center could be operated most efficiently. The project was designed to explore what problems, disadvantages and/or advantages an AT learning center would encounter. The learning cneter began as a free unstructured experiment so that limitations and restrictions would be placed upon the learning center only after these limits were deemed necessary.

The AT learning center concept will be evaluated by the observations and data collected during the learning center pilot study. These observations will be made by the director of the pilot AT science learning center, and the observations will include student reactions, teacher reactions, and reactions of the school as a whole. The following statements are the objectives to be considered during the pilot learning center study.

1. An AT learning center can be an effective method of presenting instruction in today's elementary schools.
2. One person can organize and operate an AT learning center for one hundred and fifty students.
3. An AT learning center will not interfere with the schedule and activities of a self-contained classroom.
4. The AT learning cneter will not interfere with the routine of the school as a whole.
5. A first grade student can learn to use an AT learning center.
6. An AT learning center can provide instruction quickly and efficiently.
7. An AT learning cneter can provide the students with individualized instruction.

II. A-T Learning Center Description and History

A. Brief Overview

The Wabash Valley Education Center received permission to use a small room (8 x 15 ft.) at an elementary school in order to set up a demonstration AT science learning center. Four first grade classrooms with thirty students each and a special education class of fifteen students made up the population of 150 students who were to use the learning center. The 150 students were to use thirteen AT science lessons developed by the Wabash Valley Education Center. The science lessons were given in specially designed study carrels. The number of AT carrels used during the study, varied between three and nine. For the major portion of the project there were eight booths in the learning center.

The school building used in the study is an attractive, new building which has been operating for three years. It presently has an enrollment of eight hundred students with 25 self-contained classrooms. There are four classes at each grade level and one special education class. The school has a full-tim principal, secretary, librarian, music teacher and art teacher. All the students except the kindergarteners are bused to the school from areas around the city of Lafayette, Indiana. The socio-economic make up of the community is generally lower or lower-middle class. The community, in general, has been classified by the U.S. Government as culturally deprived. About ten per cent of the students live on farms. Many of the parents have construction jobs and a large number work in factories, Before the pilot AT science learning center was established, a meeting was held with the principal and the four first grade teachers. At that time the study was explained and students were selected for pre-testing. After pre-testing of the selected students, carrels were set up in the learning center and the AT materials were introduced to the first class, (Class I). Three days later, the AT materials were introduced and started in a second class (Class II). The special education students began using the learning center at times when the first grade classes weren't using the carrels. A week after Class II began using the AT learning center, the AT materials were introduced and started in Classes III and IV. As soon as all the classes were involved in the learning center, a meeting was held with the first grade teachers to discuss any problems that had evolved or might evolve. To solve the problem of too many students coming to the learning center to do lessons, two carrels were temporarily removed from the learning center. One carrel was placed in Class III, and the other carrel was placed in Class IV. Classes I and II continued to use the AT learning center while changes, such as setting a schedule and making science passes, were being designed. A week after Classes III and IV had stopped using the learning center, a meeting was held with the first grade teachers in order to introduce the new schedule and the science pass concept. The next day the learning center began operating with eight booths, using science passes on a scheduled basis. In each class, the students who were behind the rest of the class, in the number of lessons they had done, were given an opportunity to catch up. The special education students did the lessons during the times that the other classes were not scheduled to use the learning center. In order to let the students know which lessons were available, the first grade teachers started matching the appropriate science lesson numbers with the science passes.

Using this system the four classes completed the thirteen AT lessons after using the learning center for varied lengths of time. All the students who completed the thirteen lessons were given post-tests. A week after the pilot learning center was terminated, there was a meeting with the teachers to get reactions and opinions about the learning center. Also, toward the end of the pilot study there was an open house during which parents visited the learning center, examined the lessons, asked questions, and gave their reactions.

B. Detailed History

The initial meeting with the first grade teachers and the principal was to get permission to carry on the study. Permission was granted on the basis that the study would not interrup the classes schedule of the participating teachers. After the permission agreement was reached the AT science materials and the teachers' role in the study were explained. By the end of the meeting the teachers basically knew what would be required of them. At the close of the meeting arrangements were made to pre-test all the students in Class I.

The pre-tests were given at tables which were expecially designed for giving tests with earphones and a tape recorder. Each table had seats for six students with earphones, and dividers which provided a shield around each student. All the students in Class I took parts I and II of the WVEC Science Test, the pre-test instrument. The WVEC Science Test is designed to measure students knowledge of the concept of energy. The test closely parallels the science concepts taught in the 13 AT lessons which were used in the study. Part I is a 22 minute test which contains 25 true-false science items and 10 true-false test taking ability items. Part II is a 30 minute science picture test which is composed of 43 multiple choice science questions.

After the pre-testing was completed, three AT carrels were set up in the pilot learning center. The carrel, the earphones, the tape recorder, and the science materials for the first lesson were introduced to Class I. The procedure for coming to the learning center was carefully explained and then acted out by one the students. A student would get his chair, come to the learning center, tell the director his name and what number lesson he wanted to do and sit down at the booth that the director assigned. He would then put his earphones on and push down button number one on the tape recorder. After the introduction of the AT lesson Class I began using the learning center, which was usually open from 9:00 AM until 3:00 PM during the school day. Any student in Class I could come to the learning center to do an AT lesson. There was no limit on how many times a student could come to do the same lesson, and there was no limit on how quickly a student could go from one lesson to the next. Certain students came in often while the other students either came in rarely or not at all.

After several days, the AT materials were introduced in the same way to Class II. Class II and I began using the carrels in the learning center together. Two additional AT carrels were added, raising the total number to five. Most of the students in Class II were coming to the learning center at a regular rate, since the teacher was scheduling her students so that they would take turns. A few, however, used the center at an expanded rate. Class II used the learning center more often than Class I, but there were still many times when the learning center was not being used at all.

When the first grade classes were not using the carrel, the director of the learning center would take a student out of special education class to come to the learning center to do an AT lesson. At first the director listened to the lessons along with the special education students to make sure they would be able to do the lessons by themselves. After each student had done at least one lesson with the director listening in, the students were brought in several at a time to go through the lessons by themselves with the director watching for possible problems.

A week after the AT materials were introduced in Class II, the AT materials were introduced and started in Classes III and IV. Although there were 9 carrels in the learning center, at this time, it became very busy and over-crowded. Many students' were being turned away and sent back to their classes because the carrels were already in use. Since all the first grade classes were using the learning center, a meeting was called with the first grade teachers to discuss any problems that the learning center was creating. The confusion in the halls and the classroom distractions caused by students using the learning center were discussed. The times that the learning center tended to be most and least busy and the possibility of having the students take "turns" within each class were discussed. Some of the teachers planned to send their students at the times which the learning center was not crowded, and some of the teachers planned to schedule the students within their classes. Although the teachers expressed an interest in scheduling class times for using the learning center, they agreed to wait and see if the problems could be solved without resorting to a scheduled system. During the meeting, the teachers' weekly schedules were requested.

Despite the changes by the teachers, the learning center became more crowded and confused. Large numbers of students were being sent back to their classes because of over crowding. Students were bunched around the door to the learning center in such a manner that it was difficult to find out which students were ready for the lessons that were available at the time. To remedy the problem, two booths were removed from the learning center. One booth was placed in Class III, and the other was placed in Class IV. Only Classes I and II were to continue using the 7 booths remaining in the learning center until some of the problems could be worked out and the learning cneter would be reorganized. Because of the extensive problems the learning center was completely restructured, and a meeting was held to explain these changes to the first grade teachers. A schedule was developed in which each class could use the learning cneter for about 2 hours per day (see the weekly schedule in the appendix). Since there were to be 8 carrels in the learning center and since there were usually two classes at a time using the learning center, each class would have four carrels reserved during its learning center time. Each teacher was given four cardboard science passes that corresponded to the four carrels she had reserved for her room in the learning center. Each student would have to bring a science pass with him in order to do a lesson in the learning center. By using these passes, only four students at a time could leave a classroom to come to the learning center. Each class's passes were a different color so that students could be quickly recognized if they accidentally came to the learning center science at the wrong time. The director continued to keep records of every lesson that each student did. However, the students were no longer allowed to do the same program more than once. The director sent notes to the teacher to give the names of any students who had fallen behind the rest of the class, so that the students who were on higher lessons could not do any more programs until the rest of the students in the class had caught up. Students were not allowed to do a program unless they had at least 15 minutes of time before recess or lunch.

The day after the meeting with the teachers, the learning center began operating again with new rules and a new organization. After the reorganization students were rarely sent back to their classes without doing a lesson. When the students who had fallen far behind in the number of lessons they completed caught up all the students were able to advance at about the same pace. Whenever a student fell behind the rest, a note with the student's names would be sent to his/her teacher.

Special education students used the learning center during the times that none of the first grade classes were scheduled to use the learning center. The director continued to take several students at a time out of the special education class so that they could do the AT lessons.

Before each class's learning center time, the director would set up the appropriate lessons in the four carrels reserved for that class. In order to let the students know which lessons were free, the director would send a note to the teacher with the numbers of the lessons that would be available during the learning center period. (See the sample of a daily schedule and the sample note to a teacher in the appendix.) The teacher wrote the lesson numbers on the chalkboard above the science passes so that the students would know which lessons were free. When a student wanted to come to the learning center to do a lesson, would pick up a science pass under the number of the lesson he was ready to do, would come to the learning center and tell the director what number lesson he was ready to do. After he completed the lesson, he would go back to his room and put the pass back under the number of lesson that he just did.

Some classed finished the 13 AT lessons more quickly than others. Class I completed the 13 lessons after 11 weeks of using the learning center. Classes II and III only took 8 weeks to complete the 13 AT lessons. Class IV and the special education class took 9 weeks to complete the AT lessons.

All 5 classes were given post-tests at the end of the study. The post-test is composed of a Mental Abilities Test and the WVEC Science Test. The mental abilities is a modified form of the California Short-Form Test of Mental Maturity. It contains items of identifying opposites, similarities, and comparisons. This 20 minute test also contains a memory test on questions about a story which the students hear at the beginning of the test.

Parts I and II of the WVEC Science Test were given again in order to evaluate the extent of learning. All parts of the post-test were given through earphones at the WVEC testing tables. The total post-testing time was generally an hour and a half.

In summary, the study began with a meeting and pre-testing. The learning center was set up and the classes began using it one at a time until 5 classes were involved. The learning cneter was reorganized by changing to a schedule and science pass concept and by placing limits upon the learning center's use. After the 5 classes completed the 13 lessons the students were all post-tested.

III. Discussion

In order to more fully explain the problems and attitudes associated with the learning center the interactions that occured during the study will be explored. First, the student encounters with the learning center will be discussed; then the teachers interactions with the learning center will be studied. The problems which confronted the director of the learning center will also be explained and will be followed by a review of the problems which were realted to the AT lessons, the equipment, and school as a whole. The discussion will be concluded with a brief report of the parents' reactions to the learning center.

A. Students' Interactions with the Learning Center

At the beginning of the learning center study, the students were quite excited, by the novelty of the AT lessons and by the opportunity to leave the classroom to come to the learning center. The excitement was probably greater because the learning center began in an unstructured form but, such excitement could also be expected in a beginning structured learning center. To solve the novelty problem, the teachers suggested that a learning center should not be introduced to the students at the beginning of the school year. This would allow several weeks for the students to adjust to their new teachers and classrooms. After several weeks of delay, the students could then be introduced to the AT materials and could begin using the learning center on a scheduled basis with science passes.

In the beginning of the study, many of the students had to be stopped in the middle of the AT science lessons due to the fact that it was time for recess, lunch, art or music. The director easily solved this problem by getting a copy of each teacher's schedule and by not allowing a student to begin an AT lesson unless he had at least 15 minutes before recess, lunch, music or art.

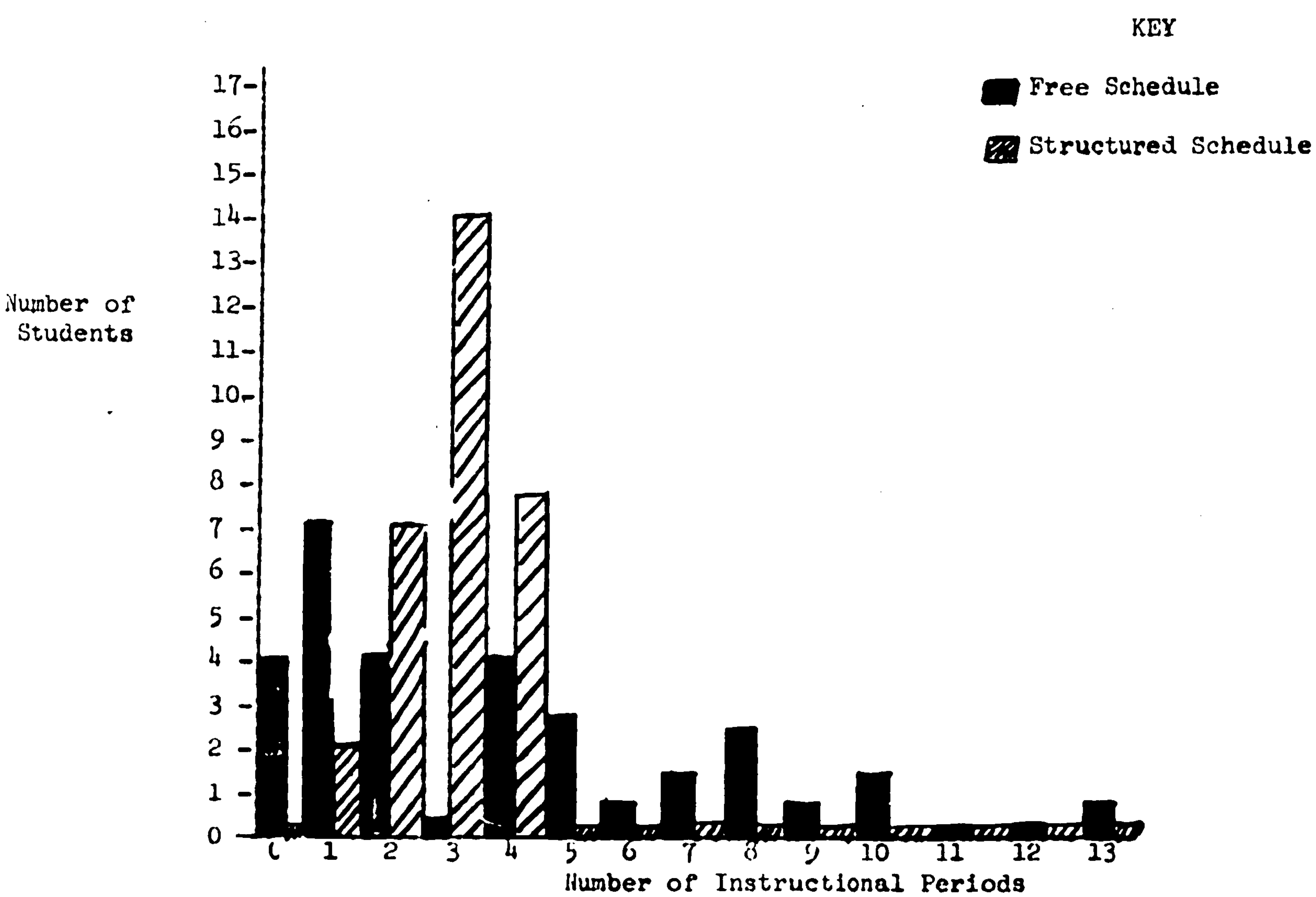
Another closely related problem was having to stop students in the middle of a tape so that they could go back to class for a reading group or for a special class lesson. Since it is important that the students should not be interrupted in the middle of a tape, teachers using a learning center were asked to find ways to solve this problem. For example, the teachers frequently told the students when their reading groups would meet, so the students would not leave the classroom at the wrong time. If the students were in the learning center when it was time for their reading group, three out of four of the teachers would wait until the students got back to the class and would, then, hold that reading group. Since Class I was quite near the learning center, the teacher in Class I would more frequently take her students out of the learning center in the middle of tapes when the students were wanted in the classroom for a reading group.

At the beginning of the study when there were no limits on the learning center, several students kept coming to the center, continually asking to do higher and higher lesson numbers. These same students kept doing the lessons, which they had already done, over and over again. Because these aggressive students and the students who finished their work quickly came into the learning center quite frequently, they prevented many of the less aggressive or the slower students from getting a chance to do any of the AT science lessons. This resulted in a very large spread in the lesson that the students were ready to do. It became impossible to be constantly changing the lessons for each student. For example, in Class I some students were ready to do lesson #1 while other were ready to do lesson #6.

In order to keep the aggressive students from monopolizing the learning center, the following changes were initiated: 1) these aggressive students were not allowed to do any AT lessons beyond #4 until the rest of the class had caught up, 2) after all the students had caught up with the rest of their class, only several lessons would be available at one time so that the lessons would not become too spread out again, 3) notes with the names of the students who were behind were sent to the teacher, so that all the students could have a chance to do all 13 AT lessons by the end of the study, and 4) each student was limited to doing each lesson only once. All these changes, which ensured that each student would be given an equal opportunity to use the learning center. To illustrate the problem of inequality in using the learning center the following table is presented. (See Table I). Table I shows the frequency of carrel use during a two week period when Class I had a free schedule and during a two week period when Class I had a structured schedule. The vast range in the number of times each student in Class I did a lesson during the two weeks of the free scheduled period contrasts greatly with the much more uniform student use of the carrel during the two weeks of the structured schedule period. The range for the free scheduled period went from a student who used the learning center 13 times to four students who did not use the center at all. When a structured schedule was initiated the range of student uses went from 1 to 4 times, with all students getting at least one use of the cente

Table I

Frequency of student use of the A-T science learning center instructional periods for Class I during different two week periods.



Another problem confronting the students was that they had no way of knowing if any carrels were free or of knowin which lessons were available. Consequently, the students had to come to the learning center in order to find out which lessons were available. This haphazard technique of using the learning center resulted in a high probability that they would have to be sent back to their class without doing a lesson. The more aggressive students would keep coming back to the learning center until they got a chance to do a lesson. Other students might have become discouraged if this practice had continued to occur. For the most part, however, students were over-anxious about getting an opportunity to come to the learning center and would frequently peek out of their classroom doors, trying to determine whether or not there was a free carrel at the time. In order to solve this problem, each class was given four cardboard science passes. A student could pick up one of the passes and come to the learning center when it was his class's scheduled time to use the learning center. This way no more than four students from a room could come to the learning center at the same time. Since classes were generally scheduled for each learning center period, no more than eight students could be in the learning center at a time. Each class had different colored science passes, so it would be very easy to recognize a class that accidentally started coming at the wrong time. Notes were sent to the teachers to tell them which lessons and how many of each lesson would be available for their scheduled periods. (See the sample notes in the appendix). The teacher put numbers on the chalkboard over each pass, so that, for example, a student who was ready for lesson #5 could pick up the pass underneath the number 5, and could come to the learning center and tell the director that he was ready to do number 5. An attendance chart was checked occasionally to be sure that none of the students did the same lesson more than once. Notes were sent to the teachers with the names of students who were behind the rest of the class. (See sample note in appendix). The teachers wrote these names on the chalkboard and made certain that these students would get an opportunity to go to the learning center. It was very rare that a student would have to be sent back to his room without doing a lesson. One of the few times students were sent back was when it was too close to recess or lunch time. One of the teachers had a system for solving this problem. Fifteen minutes before recess, she merely tacked a cardboard stop sign on the bulletin board. With this science pass system operating the students knew that they would all get a turn to do each lesson, and they knew which lessons were available during their learning center time by looking at the numbers on the chalkboard above the passes in their own room. Thus, the sutdents were no longer anxious or worried about missing their chance to come to the learning center.

The students enjoyed coming to the learning center to do the AT science lesson. The excitement of the AT lessons did not decrease. In fact, the students were very dissappointed when they found out that lesson #13 was the last lesson. The students liked learning with tape recorders, science materials, and film loop movie projectors. Many of the students would even answer and talk to the voice on the tape. The students also enjoyed getting a change of scenery, leaving the classroom to come to the science room. The students pretended that when they put on their earphones and sat down at the carrel they were becoming jet pilots and were flying into the fascinating world of science.

During the study, these first grade students adapted very well to the procedures and the changes. They rapidly learned how to operate the tape recorders and could usually do the lessons without any problems or asking for help. In fact, most of the students were even able to remember the lesson number that they were ready to do. The students used the free, unstructured learning center without becoming very concerned by the over-crowdedness and without becoming very upset when they were turned away. When the learning center was completely reorganized, the students quickly learned the new procedures and rules. The students were generally able to use the science pass system without any problems, and the students were also able to quickly adapt to the special rules for lessons #7 and #8, in which they had to keep a dated ticket for lesson #8 and had to come back on the correct date. After using the schedules for a while, the students began to learn the times that they were supposed to use the learning center. It would have been quite easy for the students to learn their scheduled time if each class has used the learning center at the same time each day.

Students learning was validated during the learning center pilot study by use of a pre-post test research design using the Wabash Valley Education Center Science Test. The pre-test represented a sample of one classroom (41 students) out of the total of four classrooms. The post-test represented the total population of students (125 students) fr[illegible] all four classes. Evidence of learning was obtained by comparing the mean test scores o[illegible] the pre-post testings. A summary of the scores on the WVEC Science Test and its sub-tests can be found in Table II.

Table II

Comparison of Test Scores for Pre-Post Tests on Students in an AT Science Learning Center

			Mean Scores on Learning Measures					
	N	WVEC Test	1	2	3	4	5	6
Pre-Test	41	51.71	7.98	10.59	5.83	9.56	6.22	5.[illegible]
Post-Test	125	58.21	9.36	12.63	6.50	11.38	6.89	7.59
Gain		6.50***	1.38***	2.04***	.67***	1.82***	.67**	1.[illegible]

NS = Not Significant
* = p .05
** = p .01
*** = p .001

The test and subtest score gains were all found to be highly significant (P .01). The significant gains is how that learning occurred in all areas and that mastery of learning (85% or higher of all questions answered correct) occurred in knowledge about Basic Forms of Matter (Subtest No. 2).

Learning was validated in the following areas:

Subtest

1. Basic Forms of Energy
2. Basic Forms of Matter
3. Secondary Forms of Matter
4. Biological Energy Interactions
5. Physical Energy Interactions
6. Basic Energy Interactions

Additional support of learning can be seen in the thirty-six students who took both pre and post tests. The average gain in number of questions correctly answered was 6.69, which is very near the pre-post test gain of 6.50. Only two of the 36 students missed more questions on the post-test than pre-test. While two students greatly increased thei[illegible] score by 23 items.

B. Teachers' Interactions with the Learning Center

The five teachers involved in the study believe that the AT science lessons were very worthwhile and desirable learning experiences for their students. They like the idea of using tape recorders, special materials, and taped lessons in order to teach science to the students on an individual basis. The teachers agreed that they would wish to participate in a similar learning center again if given the opportunity. They said they would prefer to have their students use the AT science lessons in a learning center similar to the pilot learning center, but would settle for one AT carrel in each of their rooms if a learning center could not be provided. It was also reported by these teachers that the other teachers in the school were curious about the learning center and were anxious to participate in such a program. In fact, the first grade teachers felt that most teachers would gladly make the adjustments needed to participate in a learning center in exchange for the students' benefits from such a center. When the teachers were asked if they thought effective curriculums for other subjects could be designed by the same basic instructional methods of the AT science learning center and they said social studies could be taught effectively through an AT learning center but that reading at the first grade level could merely be enriched or supplemented by AT lessons.

During the beginning stages of the pilot learning center, the confusion of the free, unstructured learning center was desruptive and distracting to the teachers. After the learning center was totally reorganized and changed to a scheduled basis with science passes and notes to the teachers, the teachers felt that there were only a few problems still caused by the learning center. If each class could have the learning center scheduled at the same times everyday of the week, the teachers felt the problem of the students forgetting when to come to the learning center would have been solved. The teachers considered the "mess" created in the classroom by the materials from some of the AT lessons, such as a corn seed planted in a cup of soil, did not bother the teachers to significantly, since they felt the students enthusiasm for the project was well worth some spilled soil.

The teachers agreed that they would like to supplement the AT learning center lessons during their in class science time. By supplementing the AT lessons, the teachers would be able to gain feedback from the students and could become more of an instrumental part in the learning center instruction. In this way, AT science lessons could serve as a structure for the total science curriculum as long as the AT lessons were initiated near the beginning of the school year.

The teachers adapted quickly to the problem encountered and the changes initiated during the learning center study. They readily accepted tasks which aided the efficiency of the learning center. Although the overexcitement of the students, the noise and confusion in the halls, and the students' absent from the classroom created problems, the teachers accepted these distractions with the hope that these problems would be eliminated after a while. The teachers quickly adjusted to the structured schedule and assisted willingly by putting the appropriate numbers above the science passes and by giving the students, who were behind, an opportunity to come to the learning center. The teachers were willing to make adjustments in their teacher routines so that students would be able to use the learning center more often. The teachers had to adjust their reading group meetings and their lessons so that the student mobility which was caused by the learning center would present a minimum amount of interference to the total class work. For example, a teacher might have to postpone one reading group and have another group meet instead of some of the students from the first group were in the learning center. This type of flexibility would be quite beneficial in operating an efficient learning center. However, it would have been much simpler for the classes to utilize the learning center if the teachers had been given their scheduled learning center times at the beginning of the school year so that they could have planned their class schedules around their learning center times.

[illegible] learning center encountered the problem of being used very little or not at all [illegible] unstructured system [illegible] ... [illegible] its scheduled [illegible] learning center system.

At the beginning of the study, there were several ways in which the AT science learning center began to take on the role of a reward rather than acting as a science curriculum [illegible] the students. To begin with, the aggressive students in [illegible] their aggressiveness in the sense that they were allowed [illegible] [illegible] were able to finish their class work [illegible] being rewarded by getting a much greater opportunity to use the learning center. [illegible] hand, the slow students were for the most part being denied the reward of [illegible] AT science lessons. For several days, in Class II, the learning center was used [illegible] of disciplining students. The teacher would not permit the students who were causing disciplinary problems to use the learning center. This was an attempt to deny these students the reward of doing AT science lessons. However, after the learning center was operating on a scheduled basis, each student was assured an equal amount of use of the learning center. Although a student could be denied the right to use the center for a day or so, each student would be rewarded an equal number of times overall.

The special education class was quite flexible. The director was permitted to take students out of this class at any time. The teacher would allow the students, who left class to do the AT science lessons, to find out what they had missed from the students, who had remained in class.

In conclusion, the teachers' overall attitude toward the pilot learning center and the AT science lessons was quite positive. Although the distractions, which were caused by the free, unstructured learning center during the beginning of the study, bothered the teachers, they were very cooperative. The teachers adapted quickly to the problems and the changes which had occurred during the study. They reacted quite favorably to the learning center after it was reorganized such that it became a structured, scheduled learning center.

C. <u>The Director's Interactions with the Learning Center</u>

At the beginning of the study when the learning center was on a completely unstructured basis, the director was confronted by many problems. After the unstructured learning center had been operating for ten days, some students were ready to do lesson #6 while others had not completed lesson #1 yet. This wide spread in the number of different lessons, which had to be made available each day, made it unlikely that a student could find the appropriate lesson available when he came to the learning center. Thus, the director had to take down and put away one of the lessons not being used in order to put up the appropriate lesson. This took a considerable amount of time. In fact, it was impossible to constantly change the lessons for each student who came to the learning center. During the first two weeks of the unstructured learning center, there was a trend toward a greater number of different lessons being needed each day by Class I, indicating that this problem would continue to get worse.

Table III shows the number of different lessons completed each day of the first two weeks of the unstructured learning center in Class I and the attendance of Class I on each day. On the last day of the two weeks, six different lessons were being switched back and forth in the carrels.

Table III

Lessons Completed by Class I During the First Two Weeks of the "Free" Learning Center

Days	2-4-70	2-5-70	2-6-70	2-9-70	2-10-70	2-11-70	2-12-70	2-13-70	2-16-70	2-17-70
Attendance	10	11	20	11	12	13	13	15	16	17
No. of Different Lessons Used	1	1	3	3	3	4	3	4	4	6

* * * * * * * * * *

Table IV

Lessons Completed by Classes I and III During Two Weeks of the Structured Learning Center

Days	3-23-70	3-24-70	3-25-70	3-26-70	3-27-70	4-6-70	4-7-70	4-8-70	4-9-70	4-10-70
Class I Attendance	15	13	9	9	7	12	8	4	2	13
Class III Attendance	17	10	9	14	7	18	11	15	21	15
No. of different lessons used in Class I	3	4	2	3	2	3	3	3	1	3
No. of different lessons used in Class III	2	3	2	2	2	2	2	2	3	3

* * * * * * * * * * *

After the learning center was reorganized, the number of different lessons used in one day never reached the excessive number of different lessons reported on the last day of the unstructured learning center. Table IV shows the number of different lessons used each day in Classes I and III during a two week period of the structured learning center. The two weeks of the structured learning center in Table IV can be compared with the two weeks of the unstructured learning center in Table III. This comparison is made in order to illustrate the smaller number of different lessons used each day in the structured learning center. The smaller number shows why the director did not have to switch the lesson materials as often under the structured system as under the unstructured system.

During the time that the learning center was "free" and unstructured, there were a number of students in Class I who failed to complete any of the lessons. Table V demonstrates the number of days each lesson was used during the unstructured learning center and during the structured learning center. If the learning center had not been restructured it appears that there would have been students in Class I who would not have completed all or any of the lessons by the end of the study. This is suggested because during the unstructured learning center some of the students in Class I had not begun to use the learning center at all.

Table V

Number of Days Class I Used Each Lesson

Lesson numbers	1	2	3	4	5	6	7	8	9	10	11	12	13
No. of days lesson used in free L.C.	[illegible]	12	14	8	4	3	0	0	0	0	0	0	0
No. of days lesson used in structured L.C.	2	3	4	5	4	4	7	8	8	10	9	11	13
Total No. of days that lesson was used	10	15	18	13	8	7	7	8	8	10	9	11	[illegible]

* * * * * * * * * * *

Total number of days Class I used lessons in the free learning center = 16

Total number of days Class I used lessons in structured learning center = 37

Total = [illegible]

Table VI is very similar to Table V and explains how many days Class III used each lesson. Table VI can be contrasted with Table V to illustrate that Class III was able to complete each lesson in fewer days than Class I. The total number of days that each classroom used the 13 AT lessons also illustrates the difference in required total time for completing the lessons in the AT Learning Center. The difference in time seems to reflect the difference in the individual class as it responded to the learning center.

Table VI

Number of Days Class III Used Each Lesson

Lesson Numbers	1	2	3	4	5	6	7	8	9	10	11	12	13
No. of days lesson used in free L.C. or classroom	5	4	0	0	0	0	0	0	0	0	0	0	0
No. of days lesson used in structured L.C.	0	1	5	6	4	4	5	4	7	6	5	5	7

* * * * * * * * * * * *

Number of days Class III used lessons in unstructured learning center and classroom = 7

Number of days Class III used lessons in structured learning center = 33

Total = 40

Another major problem of the learning center director was the need to send students back to their rooms because the learning center was over-crowded. During the days that all four first grade classes were using the learning center on an unscheduled basis, the center became a scene of confusion and chaos. Groups of students would gather around the learning center door, trying to find out if any lessons were available. Many times whole groups of students would have to be sent back to their classes because there weren't any lessons or space available. Since many disappointed students were being sent back to their classes, it was feared the students might begin to loose interest in doing the lessons. Since the center was continually flooded by students trying to get a turn to do an AT lesson, the director had trouble keeping correct attendance records and keeping the lesson materials in proper order. These problems resulting from over-crowding were solved by the reorganization of the learning center.

After the structured learning center began operating, the director was confronted with a scheduling problem on rainy days. Whenever it rained, the first graders had a gym period at a different time than their usual recess period. This cut out a portion of the learning center time because the teachers did not know when their students should come to the learning center that day. This problem could have been solved if a rainy day learning center schedule had been made in addition to the regular schedule. In this way the time after the classes returned from gym could have been utilized.

One of the director's responsibilities during the pilot learning center study was to keep attendance records. Throughout the study, daily attendance was recorded on index cards. Each student had an index card with the number of each lesson that he did and the date that he did it. After the reorganization of the learning center, attendance was recorded on wall charts in the interest of not wasting time on attendance while the learning center was operating. Next to each student's name on the chart there were squares representing each lesson number. As soon as a student began a lesson, the director checked the appropriate square. By looking at this chart, the director could tell which lesson every student was ready to do. In order to preserve the attendance data for the evaluation of the study, the attendance records were transferred to the index cards at the end of each day.

Another responsibility of the director was to keep the teachers informed about which lessons would be available during each learning center period and about which students were behind the rest of the class. The director informed the teachers by placing notes in message holders directly outside each teacher's room. The note always included the next time the class would use the learning center and would tell which lessons and how many of each lesson would be available for that class. Sometimes the notes would include the names of students who were behind the rest of the class and the lesson numbers that these students were ready to do. (See sample notes in the appendix). When a teacher received a note she would write the appropriate lesson numbers on the chalkboard. If the director had listed some students' names in the note, the teacher would also, write these names on the chalkboard.

The director of the learning center had some problems with the special education students. Even though these students were generally capable of handling the equipment and of following the directions, they tended to play with the equipment more than the first grade students, and whenever there was a pause in the instructions, many of these students started playing with the blocks or batteries or started twisting the lens or knobs on the film loop projector. Although they liked to do the AT lessons they also tended to distract one another more than the first grade students. Some responded to the voice on the tape so loudly that it distracted the other students, and some even shouted comments to their friends about what they were seeing or doing.

Student use of the AT lessons varied each day when the center was unstructured and later when it was structured. Table VII shows the student attendance during a five week period when all classes were using the learning center on a scheduled, structured basis. For this five week period, an average of 47.56 lessons were done a week. The number of lessons done each day ranged from 23 to 68, and the number of lessons done each week ranged from 198 to 261. Thus, attendance varied considerably from day to day and from week to week. Table VII gives the attendance for each day of this five week period.

Table VII

Five week attendance record for
A-T learning center on structured schedule

	Week 1	2	3 *	4	5	Day Total
Monday	36	35	50	65	59	245
Tuesday	42	55	38	50	54	239
Wednesday	52	53	36	37	43	221
Thursday	62	53	51	68	62	296
Friday	61	32	23	29	43	188
Week Total	253	228	198	249	261	1189 Grand Tot

* indicates approximate time when lessons # 7 and # 8 werebeing used

The efficiency of the structured learning center was figured for this same five weeks of operation. The efficiency index was figured by considering the number of carrels, the number of 15 minute periods the learning center was available and the number of students who had used the learning center. One hundred per cent efficiency would mean that every carrel was being used constantly while the learning center was open. The average daily and weekly efficiency index is 34.7_%. Table VIII gives the average efficiency index (% use) for each of the five weeks, for each day of the week, and for each first grade class. The daily range in the efficiency index varied from 50% to 18% efficiency. This shows that on some days the learning center was used much more efficiently than on other days. The table also illustrates that some weeks the efficiency was much higher than other weeks, that certain days of the week were much more efficient than other days and that some classes used the learning center more efficiently than others. The difference in efficiency for week #3 was affected by the required week's delay between lessons #7 and #8. Since lessons #7 and #8 were being done during week #3, this explains why the week has the lowest efficiency index. Monday also has a relatively low index since it was the first day of the week and the teacher tended to keep the students in the classrooms more. Friday may have had a low efficiency index because many special class activities tended to be scheduled for Friday, such as plays, puppet shows, and art projects. The teachers may have also high efficiency index because the class used its scheduled times efficiently. However, the teacher in Class IV had elected to surrender two of her class's scheduled times, since she felt the class would rarely use these times. Class IV consequently, used the learning center fewer hours each week, which increased its efficiency index. However, Class II and III finished the 13 AT lessons a week faster than Class IV. Class III has a higher efficiency index than Class II, since Class III had several more students to go through each lesson and since Class III was slowed down during the week that it had one booth in the classroom instead of being able to use the learning center.

Table VIII a

Structured Learning Center Data for Five Weeks

	1	2	3 *	4	5
Efficiency Index	34.97%	32.36%	29.41%	39.37%	40.16%
No. of Students	253	228	198	249	261
No. of 15 minute periods	17.2	16.6	15.6	15.6	16.0

* * * * * * * * * * *

Table VIII b

Structured Learning Center Efficiency Data for Individual Weekdays

	Monday	Tuesday	Wednesday	Thursday	Friday
Efficiency Index	32.79%	37.74%	38.02%	42.55%	27.03%
No. of Students	245	239	221	296	188
No. of 15 minut. periods	17.4	15.4	14.4	17.2	16.6

[illegible]

[illegible] Efficiency Data

	[illegible]	[illegible]	Class III	Class IV
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible] Efficiency Index

$$E = [illegible] \div \frac{\text{(No. of carrels) x (No. of [illegible] min. periods)}}{\text{No. of students}}$$

[illegible] before the learning center was restructed, [illegible] trying to switch lessons back and forth, handling the over-crowded [illegible] learning center, and keeping attendance during the unstructured learning center. [illegible] problems which continued after the learning center was restructured [illegible] day recess schedule and the special education students' tendency to become [illegible].

The [illegible] was also responsible for keeping attendance records and for sending notes [illegible]. The data which the director collected was used to figure efficiency indexes [illegible] aspects of the study and to create the tables included in the report.

D. The School's Interactions with the Learning Center

It had been agreed that the pilot learning center should not interfere with the overall functioning of the classrooms and the school. Since it was a school policy that all the students participate in recess unless they were ill, the learning center had to adjust to this school rule by making sure that students did not stay in the learning center during recess or during the rainy day gym periods. As mentioned before this problem was solved by not allowing students to start a lesson unless they had at least 15 minutes before recess, lunch, music, art, or the end of the school day. Another problem which had to be solved was the confusion and noise which the learning center created in the halls. The large groups of students which gathered around the door to the learning center during the free system, were distracting and disruptive to the general functioning of the school. This problem was solved by the scheduled system and the science passes. The problem of the noise caused by students dragging their chairs down the hall to the learning center was never totally solved. The students were told to pick up and carry their chairs so that the noise would not distract the students in the library and other classrooms. This was generally effective when the students remembered to carry their chairs. However, this noise problem could have been much more adequately solved if chairs had been permanently placed in the learning center. The learning center did not create any significant problems for the principal or the other teachers in the school. In fact, after its reorganization, the learning center did not create any important problems or disruptive influences for the school as a whole.

E. The Lessons' and Equipment's Interactions with the Learning Center

The room which housed the AT science learning center was too small to comfortably hold the eight AT carrels. The small size of the room created a crowded and cramped atmosphere for the learning center. The closeness of the learning center made it difficult for the students to avoid distracting one another. A larger room would have permitted the carrels to have been arranged in such a manner that the students would rarely have distracted one another while they were doing the AT lessons. In a larger room, instead of being placed side by side, the carrels could be placed in groups of four with each carrel in the group facing a different direction.

There were several problems encountered while attempting to keep the equipment in order. The battery testers used in AT lessons #2 and #3 were easily broken and were continually having to be repaired during these first several lessons. Another problem was supplying and replacing batteries for the eight different tape recorders which were being used extensively each day. This problem could have been eliminated if the learning center had only used tape recorders which could be plugged into the electric outlets. During the study, a couple of the tape recorders were broken and had to be repaired. While these tape recorders were being repaired, they had to be temporarily replaced by other tape recorders. One set of earphones had to be permanently replaced, since it would no longer operate properly. Also, one of the film loops was broken and had to be replaced. There was another problem with the film loops. Some students would stop these films in the wrong place, causing the next student to start the film in the wrong place and to see different pictures than the tape was discussing.

Since there were only three copies of each of the lessons 6 - 13 in the learning center, shortage of these particular lessons sometimes made it difficult to ultilize the learning center to its fullest capacity. For instance, if two classes, which were scheduled for the learning center at the same time, and were both ready to do the same lesson, then the three lessons would have to be divided between the two classes and the next higher lesson or two would have to be substituted in the remaining carrels for each class. This problem was not very significant until the last lesson, the three classes that were still using the learning center all needed lesson #13, and there were no higher

[illegible] the [illegible]
at a high efficiency, there [illegible]

Days	1	2	3	4	5	6	7	8	9	10
Class I Attendance	9	9	3	3	3	2	7	0	4	4
number of different lessons used	3	3	2	2	2	2	2	0	1	1
Class II Attendance	9	11	3	5	0	3	-	-	-	-
number of differen lessons used	2	2	1	1	0	1	-	-	-	-

The [illegible] science lessons #7 and #8 caused several problems when they were used in the learning center. Since there is supposed to be a week's delay between the day a student does lessons #7 and #8, this delay slowed down the attendance and the efficiency of the learning center. Table VII illustrates the decrease in student attendance during the week that the classes were doing lessons #7 and #8, and Table VIII demonstrates a significant decrease in the efficiency index during this same week. Table X illustrates the decrease in attendance in Classes I and III during the two week period when these classes were completing lessons #7 and #8. The days when only a few students were able to attend the learning center should be particularly noted.

Table X

Two Weeks of the Structured Learning Center
in Classes I and II During Lesson #7 and #8

Days	1	2	3	4	5	6	7	8	9	10
Class I Attendance	18	6	15	9	3	3	7	12	7	12
number of different lessons used	3	2	2	1	1	1	2	3	2	3
Class II Attendance	20	10	12	7	1	13	15	1	17	10
number of different lessons used	2	2	2	1	1	1	2	1	2	3

Lessons #7 and #8, also, presented the problem of having to find a way to let the first grade students know when it would be their turn to come to the learning center to do lesson #8. In order to solve this problem, a dated ticket for lesson #8 was given to each student as soon as he completed lesson #7. Each day during these lessons the date was posted on the wall outside the learning center. A student could figure out when it was his turn to come back to do #8 by comparing the date on his ticket with the date on the wall. For the most part, the students were able to understand and follow this ticket system very well.

There was one more problem created by lessons #7 and #8. Water, soil, corn seeds, and petri dishes were dropped and spilt in the learning center, in the halls and in the classrooms. However, this additional litter did not create any problems with or resentment from the janitor. The teachers accepted the mess, since they felt that the enthusiasm which the students had for lessons #7 and #8 was worth a little extra mess in the classroom.

F. The Parents' Interactions with the Learning Center

During the school open house, many parents came into the learning center, looked at the AT lessons and equipment, asked questions, and gave their reactions. They seemed to be glad that their children were participating in such a program. They indicated that the AT science learning center seemed like a marvelous new teaching idea and that they approved of such programs becoming a part of the school.

One of the major factors that the parents used to evaluate the worth of the AT learning center was their children's reactions to it. Many parents mentioned how often their children talked about "going to science" and about how much their children enjoyed it. Some parents said that when they asked their child what he had done in school, he would only talk about what he got to do and see in science. Some of the parents had been anxious to come in and see what their children had been talking about.

The [illegible] attitude of the parents was quite positive toward the AT learning center. [illegible], none of the parents expressed any negative reactions or doubts about the [illegible].

[illegible]. Conclusion

The original objectives will be used as criteria for evaluating the outcome and effectiveness of the pilot learning center.

<u>Objective 1:</u> An AT learning center can be an effective method of presenting instruction in today's elementary schools.

The pilot AT science learning center was an effective means of presenting instruction in a present day elementary school. The WVEC Science Test results provide evidence to show that learning did occur between the time the students began and completed the 13 AT lessons. Also, the students enthusiasm for using the AT learning center suggests that it was an effective means of involving the students in their science instruction. When a student sat down at an AT carrel and put on the earphones, he was momentarily transformed into a jet pilot on a fascinating trip into the world of science. This student excitement about the AT learning center serves as a testimony of its effectiveness in actually reaching the students, instead of merely talking <u>at</u> them. After its reorganization, the pilot AT learning center did not cause any significant problems with the teachers, the parents, or the overall operation of the school.

<u>Objective 2:</u> One person can organize and operate an A-T learning center for one hundred and fifty students.

One person was generally capable of organizing and operating the pilot AT learning center for 150 students. However, the director of the learning center did need aid in maintaining and repairing the equipment. Thus, an AT learning center would require a maintenance budget and association with an agency which could service and restock the equipment.

<u>Objective 3:</u> An A-T learning center will not interfere with the schedule and activities of a self-contained classroom.

The AT learning center did partially interfere with the schedule and activities of the self-contained classrooms. In order to use the learning center regularly, the teachers had to make adjustments and changes in their scheduling of classroom activities. Although these adjustments did not have to be extensive, a greater degree of teacher flexibility was required. Also, the movements of students in and out of the classroom did cause some distractions. However, the teachers willingly accepted these minor distractions in exchange for the many beneficial aspects of the learning center. Besides, the student mobility involved in the study had positive aspects as well, since this mobility gave the students an opportunity to vary their learning environments.

<u>Objective 4:</u> The A-T learning center will not interfere with the routine of the school as a whole.

After its reorganization, the pilot AT learning center did not interfere with the routine of the school as a whole. As soon as it was ensured that students would not miss their recesses and that the noise and confusion in the halls would be slight, there was no area of conflict between the operation of the learning center and the overall operation of the school.

Objective 5: A first grade student can learn to use an A-T learning center.

The first grade students in the study were quite capable of learning to use the pilot AT learning center. In fact, the students rapidly adapted to all the changes and modifications which occurred during the study. Even the structured system with a schedule and science passes was easy for the students to understand and to follow.

Objective 6: An A-T learning center can provide instruction quickly and efficiently

The AT learning center did provide instruction much more quickly than one AT carrel placed in each classroom could. The efficiency of the AT learning center was not as high as had been hoped and expected. However, the efficiency could have been higher if the teachers had known their learning center times at the beginning of the school year so that they could have planned their class schedules accordingly.

The teachers could have planned individual and group work for each of their learning center periods. This type of scheduling would have been more conducive to high utilization of the learning center.

Objective 7: An A-T learning center can provide students with individualized instruction.

The AT learning center provided the students with individualized instruction only in a very limited sense. Students were not able to set their own paces, to work at their own unique levels, or to branch out into their individual areas of interest. Instead, every student was required to complete the same 13 AT lessons. The only aspect of the pilot learning eneter which provided any individualization was the opportunity that each student had to choose when he would come to the learning center to do his next AT lesson. A student could make this choice by taking the appropriate science pass when it was available and by then coming to the learning center. A student who got behind the rest of his class even lost this choice, since he would be required to do a particular AT lesson as soon as almost all of the students in his class had completed that lesson.

In summary, the pilot learning center was confronted by many problems after its establishment. Many of these problems were solved by the reorganization of the learning center. The pilot AT learning center suggests a need for expanded future studies and implies many future possibilities for approaching changes in the educational system.

V. Looking Ahead to Future Learning Centers.

To explore future possibilities an expanded AT science learning center, which would be similar in operation to the pilot AT learning center, will be designed as a model. The model future school would have six grades with four classrooms of 25 students at each grade level, giving the school a total enrollment of 600 students. Two normal size classrooms would be needed in order to comfortably house 48 AT carrels, the AT lessons, the AT equipment and any supplementary learning materials. The AT learning center would serve as the total science curriculum for the entire school. Since there are 24 classes in the school, there would have to be two carrels in the learning center for each class in the school. These 48 AT carrels would be arranged in groups of four with each carrel in a group facing a different direction. This arrangement of the carrels would help to minimize distractions. Since this learning center is being designed in a similar manner to the pilot learning center, each class in the school would have four carrels reserved for approximately two hours each day or total of ten hours of learning center time per week. One trained person, who would not necessarily be a teacher, would be the director in charge of operating this AT learning center. In this expanded learning center, the director would not set up the lessons but would check out boxes containing the lessons. The director would need fifth and sixth grade students or aides to help check out and organize the lessons. The students would set up the lessons themselves with the help of the director when it would be needed. The first grade students would do 30 lessons since they would not start using the AT learning center at the beginning of the year. All the other grades would have 48 lessons to do in a year. Thus, after six years of AT science, a student will have done 270 lessons. There would be five copies of each lesson, which would make a total of 1,350 lesson copies for the whole school. The lesson checkout system would have to be organized such that attendance would be recorded quickly and efficiently. Also, a feedback system would have to be worked out so that each teacher have receive a record of her class's attendance at least once a week.

The AT learning center just described would cost approximately $70,000. A brief breakdown of this cost can be found in Figure 1.

Figure I

Estimated Cost of Model AT Learning Center

Hardware for 48 carrels	$32,000	$250/carrel
Software for 1,350 lessons	$20.250	$15/lesson
Budget for consumable items and repairs	$5,000	budget/year
TOTAL	$67,250	

In the model learning center each student would have to spend only about 1.2% of his total class time doing the 270 AT lessons which would compose his science curriculum. The teachers would easily be able to find time to supplement these AT lessons during the 98.8% of the student's remaining class time.

Another more complex future possibility would be to create AT lessons for the other grade school curriculums, such as social studies, math, reading language arts. (if each of these new curriculums would also consist of 270 fifteen minute lessons for six grades) For each subject area, another 48 carrels, another 1,350 lesson copies, and another two classrooms would have to be added to the AT instruction center. In order to put all five curriculums into operation it would cost approximately $350,000 for materials and personnel. Extra costs for modification of the school and for construction of the learning center areas would be needed.

A school using five curriculums of AT instruction would also have to undergo other basic organizational changes that were not experienced during the pilot study using only first grade science materials. A school using extensive learning center instruction would have to be more thoughly experimented with before all problems could be solved. The projections that have been made are only an attempt on our part to look into the future from our point of reference using the information obtained during the pilot AT learning center study conducted by the Elementary Science Project.

Weekly Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
9:00 - 10:00	Class I Class IV	Class I Class IV	Class I Class IV	Class I Class IV	Class I Class IV
Recess	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
10:15 - 11:00	Class II Class III		Class II Class III	Class I Class III	Class II
Lunch	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
2:00 - 1:00	Class I Class IV	Class I Class IV	Class III	Class II Class IV	Class I Class III
Class and Recess	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
1:40 - 2:55	Class II Class III	Class II Class III		Class II Class III	Class II Class III

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Sample Daily Schedule

Monday

9:00 - 10:00	Class I Class IV	one 10, two 11's, one 12 one 9, two 10's, one 11
10:15 - 11:00	Class II Class III	one 11, three 12's two 10's, two 11's
12:00 - 1:00	Class I Class IV	one 10, two 11's, one 12 one 9, two 10's one 11
1:00 - 1:30	Class V Special Education class	9 and 10
1:40 - 2:55	Class II Class III	one 11, three 12's two 10's, two 11's

Sample Notes to the Teachers

1

There will be one 10, two 11's and one 12 for your class from 9:00 to 10:00 Monday morning.

2

There will be one 11 and three 12's for your class from 10:15 to 11:00 this morning. Jim, Mike, Linda, Susan and Bill have not done lesson # 11 yet.

Report X

One of the unique and wonderful aspects of research and development are the spontaneous activities that researchers and developers become embroiled. Many of these "spontaneous" activities were adopted and followed through by staff members. Some dried up and failed, while others grew into whole projects, Examples of some of the projects that evolved are: test development; learning center pilot studies; special education pilot studies and so forth. Some of the projects which were not specifically germane, were terminated before they were close to culmination so that other major ideas could get the bigger share of staff attention. Some of these spontaneous projects are still valid ideas that will require more consideration for future research and evaluation. An example of one of the spontaneous activities, the following report, is included in this report.

WHAT'S NEW PUSSYCAT?

(A PROGRESS REPORT ON THE
A-T SCIENCE PROGRAM AT THE
WABASH VALLEY EDUCATION CENTER)

CAMILLE CARDOZA
PROJECT ASSOCIATE
ELEMENTARY SCIENCE PROJECT
WABASH VALLEY EDUCATION CENTER

NOVEMBER, 1969

The following will attempt to summarize observations made in the time period between September 1, 1969 to November 4, 1969, with the work of the Elementary Science Project at the Wabash Valley Education Center, in relation to the Audio-tutorial Science Program,

Brief History

In Septemoer of 1968, a science option was accepted by the school superintendents whose corporations were enrolled in the Wabash Valley Education Center, This option consisted of placing two science programs in each of the participating corporations. One of these programs is the first grade level A-T science instruction - lessons 1-13.

By December 1, 1968, the program lessons were packaged and ready for the classrooms. Prior to the introduction of the use of the A-T program, a workshop was held for the teachers involved. Then the program was introduced to the children. Most of the classes were introduced to A-T by one of the Elementary Science Project staff members. And these same staff members serviced and consulted with the teachers throughout the school year.

During this time an evaluation program was also initiated. Part of the evaluation program consisted of two forms which the teachers were asked to complete weekly. Both forms (See appendix) relied upon teacher estimates and opinions for the data. The data pertinent to my point from those forms will be discussed later,

Present Work

This year we are continuing the science option program initiated last September in that we are continuing a servicing program, but primarily our work is in the continuation of the evaluation program. The two forms that the teachers were asked to complete were incorporated into one - (See Appendix) though the questions are essentially the same.

Observations

Even at this early time there are some important things that are quite evident which may warrent a change in the plans for A-T science - at least at the first grade level.

The first part of our schedule for this year was as follows:

EVALUATION SCHEDULE

Sept. 1 - Sept. 15

Contacting participating teachers and arranging science materials and testing dates.

Sept. 15 - Oct. 1

Random selected testing of students in all classrooms.

Oct. 1 - Oct. 10

First week of field evaluation

Oct. 11 - Oct. 17

Second week of field evaluation

Oct. 18 - Oct. 24

Third week of field evaluation

Oct. 25 - Oct. 31

Fourth week of field evaluation

*Nov. 1 - Nov. 7

Fifth week plus testing of randomly selected students in A-T classrooms.

This report is being prepared during the first week of November therefore, according to the schedule the 31 classes using A-T science should be participating in the intermediate testing and then be ready to proceed to lesson #5. *(See above schedule.)

My classroom visitations during this first week of November show that of the 31 classrooms:

6 or 19.3%	are on program #4
13 or 41.9%	are on program #3
10 or 29.0%	are on program #2
2 or 6.4%	are on program #1

This means that all classes are at least one week behind - and most (81%) are two or more weeks behind.

What the major implication is, is that perhaps, it is not appropriate to begin A-T science instruction in the first semester of the first grade. I will attempt to provide some justification for these observations.

The returned evaluation forms for 1969-70 show that the student interest in repeating the program lesson is moderately high, but it also shows that the number of students that repeat the lessons at least a second time is low. (See table on next page.)

From last year's (1967-68) evaluation forms we see that the average time the program was available in the classroom was about three school days and the average percent of pupils to repeat was 32.7%. This year we have an average of 25.9% of the children repeating only in those classes when the program is set up for an average of 11.8 days, and only 14.6% of the children repeat the lesson if it is set up for five days. (See table on next page.)

Table I

Question	School Year 1968-69	1969-70	1969-70	
	Data from Evaluation form from prog. 1-4			
Total classroom time program lesson was made available for student use.	17.89 hours or three school days.	Total average 6.77 days	Classes with A-T set up for 5 days	Classes with A-T set up for 6 or more days
Number of students using programed lessons more than once.	32.7%	17.3%	14.6%	25.9%
Student interest in repeating program lesson 1 Low 3 Average 5 High	4.71% (high)	3.38% (average)	3.40 (average)	3.78% (high average)
Total Number of classrooms	27	31	14	15
Total number of evaluation forms	75	44	21	23

To further support my observations the following comments from the teachers indicate very strong and common reasons as to why this is occuring. These are direct quotes from the 1969-70 evaluation forms. The following quotes show that beginning reading skills take priority. Most teachers work with their class as a whole during this time.

	Teacher Number
"Mo.e wanted to do it but our beginning reading skills don't permit as much time as later in the year."	5
"I find it somewhat disconcerting to have a program in which only one can participate in at a time." (I asked her about this and she said it was because of beginning reading and its demands.)	3
"The lesson was so well done-they had a feeling of accomplishment. Time wasn't available to offer repetitions. Because of beginning reading skills the A-T program was only for use after the last recess."	5
"I'm starting divided reading classes so the children will now have more time individually to enjoy science."	10

Another common reason that appears on the evaluation forms concerns the time element. The following are some quotes which indicate this.

"They have enjoyed the lesson and are anxious for their turn but we have been limited these last two weeks." (This teacher had lesson #1 set up for seven days so that her 24 children could hear the lesson only one time each.)	4
"It was new. All wanted to hear it again even before others had listened the first time. They (children) wanted to repeat but no time."	31
"Time did not permit students to listen a second time."	16

During the first weeks of school there is a time period when the children become familiar with a new day. They go to school for the entire day, whereas in kindergarten it was just a half day, or for those that had no kindergarten it is the first experience in the school setting. The learning situations for procedure, etc. are taug[illegible] to the group thereby limiting time available for use of the A-T science carrel.

One other important factor that has become evident is the maturity or readiness level of the children during the beginning of first grade. I have chosen some quotes which illustrate this.

	Teacher Number
"I did have to ask about eight children to go to the carrel. This is quite a different situation than I had last year."	2
"The listening habits of some are so poor that I feel this is their problem. There are some that ask, "What are we supposed to do here?" just after you've explained it."	11
"Many are so immature it has been hard to get them to move along. Also we work so much together just now. The readiness for first grade on the whole is very poor."	1
"We are running behind. My students are much more immature this year. They have trouble doing things on their own."	1
"The children are quite thrilled with this program and anxious to get to the table. I didn't think they were quite as enthusiastic as my last year's first graders."	12
"Somehow the children are not as excited over this as last year. Could it be because we started later last year?"	27

The three Elementary Science staff members have also received the same types of comments from most of the teachers during classroom visitations.

The above teacher remarks are just a sampling of teachers' reactions though they point out three major concerns; (1) not enough time for A-T in beginning weeks of first grade: (2) beginning reading skills take priority in the beginning of first grade and (3) that children may be immature to begin this type of instruction at the beginning of first grade.

I realize that the argument may be posed that A-T may be more flexible than in this situation where we have asked the teacher to maintain a one lesson per week program. Even if, as is evident, this one lesson per week did not fit in with her schedule. This may be true except that with thirty lessons for the first year, a teacher, if she would feel obligated to teach all thirty lessons would have to manipulate the A-T program and either rush the children through or not do all of the lessons. Let me further explain.

One of this mode of instruction's strongest points is that it provides an overall curriculum whereby "science" knowledge is presented as a whole - not in a topical fashion, therefore, the concepts formed at this primary level will serve as a foundation for what is to come. If a teacher is preoccupied with reading skills and maintains her class as a whole and very little time is left for the children to go to the carrel unit, several things may occur. Here are some that I have considered. First of all, at this beginning time, if the child can only go to the program once even though perhaps he should be going through two or three times we may fail, that is, the child is not getting any more than he would be if his teacher presented a lesson once and he missed the point. Secondly, if the teacher feels rushed for time she may just do as many lessons as she can and not complete all thirty of the programs. Another argument may be that eventually there will be A-T reading programs too, and this will eliminate the pressure of teaching beginning reading skills to the entire class at one time. But I think that if we fail to consider the teacher now and in the near future a great harm could be done in ruining teachers' attitudes toward A-T instruction by forcing them into an uncomfortable position. And it is known that a teacher's attitude can easily influence a child's attitude.

A-T people believe that the children should be able to repeat these lessons as often as they feel they need to,so that the material becomes a part of their cognitive structure and later used as subsumers for new and more advanced material presented in the later grade level programs. If the children are rushed through or if some lessons are omitted then the child's basic foundation or cognitive structure may be weak, therefore, later learning may not be as meaningful. We must, therefore, ask a very important question: <u>Will having thirty lessons for the first grade hinder a student's learning later in that year,as well as in the succeeding years?</u>

<u>Suggestions</u>

One of the ways we could alleviate some of the problems now found in first grade A-T classes is by having only fifteen lessons for the first grade level and to begin them in January. I believe this to be a sound suggestion because teachers are preoccupied with reading, there is not enough time to do the lessons justice and the children may not be mature enough at the early part of the year. (See quotes and table.)

Another suggestion to be considered is the method of teacher exposition to A-T instruction. My personal experience with this area began during the 1968-69 school year when we were able to hold a workshop. It was ideal. We could "show and tell" the teachers all about A-T.

We found that this workshop proved to be successful in that it introduced teachers to the basic philosophy behind this program, as well as telling them a little about A-T. This year a workshop was not feasible even though we had seventeen teachers using the A-T instruction who had never been exposed to it before. In order to inform these teachers I personally, attended to their needs and assisted them in the initial introduction of the A-T program to their classes. A one-to-one situation such as this is ideal - as the workshop was ideal, but what will happen when neither is possible? My concern is for when A-T is a purchasable program much as a text book series. Will A-T loose its effectiveness because the teacher will not be well informed? My suggestion for the future when workshops or one-to-one situations are not appropriate or feasible is the development of an A-T program for teachers.

This program would contain the necessary information and organizers for teachers. In a sense, this program will be to teachers what lesson #1, level one is to children.

In accordance with the above comments, I am presently involved in the preparation and development of such an A-T program for teachers as an introduction to A-T instruction.

Summary

It is evident from the above observations that the A-T instructed science program is not as effective (as indicated in the data) as it was last year in the area serviced by the Wabash Valley Education Center. Several suggestions have been made to alleviate the problems which, if they are not attended to or accounted for, could injure the entire A-T system. The suggestions are:

A) Provide only 15 lessons for first grade and begin these lessons in January.

B) Provide extensive teacher instruction in a convenient manner.

This information is presented for present and future developers of A-T programs. It is presented in hopes that A-T will not become, in the eyes of the teacher, another one of those programs prepared by those "giants" sitting in their ivory tower - the university, who are insensitive to the needs and problems of the elementary school classroom.

Form 1 (10-22-68) 1968-69 Form

AUDIO-TUTORIAL CLASS EVALUATION FORM

Directions: After your class has completed a programmed lesson, please fill out this evaluation form. The information you give below aids us in revaluating the program, in designing new programs, and in servicing and helping you with the programs in operation in your school. We would appreciate any additional opinions and suggestions you might have regarding this particular programed lesson or all the programmed lessons as a science unit.

A. Specific Information (Please fill in the appropriate information)

Teacher's Name____________________School____________Lesson Number_

1) Your class size - (Total Number) ______
2) Number of students using programed lesson at least once (See Program Roster) ______
3) Number of students using programed lesson more than once. (See Program Roster) ______
4) Number of students needing help in going through programed lesson. (Students you helped in some way) ______
5) Number of days required for class to complete programed lesson. ______
6) Total classroom time programed lesson was made available for student use. ______
7) Total time spent by the teacher to set up and maintain programed lesson. ______
8) Total time spent in class on additional science activities ______
9) Number of students that said they could not understand tape directions. ______
10) Number of students that would not go through programed lesson after encouragement. ______
11) Number of times it was noticed by teacher or student that equipment had been disarranged or removed from carrel. ______

B. Equipment Breakdown or Failure (explain failures)
Hardware: (tape recorder, movie machine, etc.)

Software: (materials in lessons)

C. <u>General Information</u> Please circle the one answer which represents your evaluation of the audio-tutorial programed lesson.

1) Student <u>interest</u> in the audio-tutorial/programed lesson

Low Moderately Low Average Moderately High High

2) Student <u>interest</u> in repeating programed lesson.

Low Moderately Low Average Moderately High High

3) Student <u>desire</u> to engage in other related science activities

Low Moderately Low Average Moderately High High

4) Student preoccupation with the novelty of the hardware (i.e. tape recorder, movie machine, etc.)

Low Moderately Low Average Moderately High High

5) Amount of distraction caused to other students while carrel unit was in use

Low Moderately Low Average Moderately High High

6) Ability of students to apply information gained in the programed lessons to other science activities

Low Moderately Low Average Moderately High High

7) Student motivation to learn in other subject areas generating from the programed lessons

Low Moderately Low Average Moderately High High

8) Your opinion of the programed lesson for helping teachers increase their understanding of science

Low Moderately Low Average Moderately High High

The preceding information is needed for revaluation, and we would appreciate additional opinions and suggestions you might have regarding the program.

<u>COMMENTS</u>

1968-69
Form

Audio-tutorial First Grade Evaluation Form

Directions: Each week one student will be randomly selected from your class for observation and evaluation of his (or her) completion of the audio-tutorial programed lesson. Below you will find questions pertaining to the student's evolvement with the programed lesson. Please answer these questions to the best of your ability. The information from these questions will be used for revaluation, and we would appreciate any additional opinions and suggestions you might have regarding the program and this particular student.

Student Information: Student Name_______________

Teacher Name_______________School Name_______________Lesson No._____

Specific Information (Please circle yes or no to the following:)

Yes	No	Did the student go through the programed lesson? (Please explain on the back if he did not go through the program.)
Yes	No	Did the student need to be encouraged to go through the programed lesson?
Yes	No	Did the student need help while going through the programed lesson?
Yes	No	Did the student request to go through the programed lesson more than once?
Yes	No	Was the student preoccupied with novelty of the hardware (i.e. tape recorder)
Yes	No	Did the student request additional science activities related to the programed lesson?
Yes	No	Was the student able to apply information learned in the programed lesson to other science activities?
Yes	No	Was the student motivated to learn in other subject areas after completing the programed lesson?
Yes	No	Was the student able to apply information learned in the programed lesson to other subject areas?

The preceding information is needed for revaluation, and we would appreciate any additional opinions and suggestions you might have regarding the program.

COMMENTS

AUDIO-TUTORIAL (A-T)
SCIENCE PROGRAM
INFORMATION FORM

Directions: After your class has completed a science lesson, please fill out this information form. The information you give below aids us in designing programs and in servicing and helping you with the science program operating in your room. We would appreciate any additional opinions and suggestions you might have regarding your particular science program.

A. Specific Information (Please fill in the appropriate information after each week of school.)

Teacher's Name____________________ School_______________ Lesson No._______

1. Your class size - (Total Number) _______

2. Total time required to prepare for science lesson to be taught ______ MIN.

3. Number of students needing extra help in understanding the science lesson. _______

4. Total time spent in class on additional science activities. (Do not include A-T lesson time.) ______ MIN.

5. Number of students using programed lesson more than once. _______

6. Number of days programed lesson was set up in your classroom. ______ DAYS

B. General Information (Please circle the one answer which represents your opinion of the science lesson you taught.)

1. Student interest in the specific science ideas in the lesson.

Low   Moderately Low   Average   Moderately High   High

2. Student desire to engage in other science activities related to the science lesson taught. (Bulletin boards, Show & Tell etc.)

Low   Moderately Low   Average   Moderately High   High

3. In your opinion, the equipment and materials availability for teaching your lesson was:

Poor   Fair   Average   Good   Excellent

4. In your opinion, the ability of the students to understand the specific science ideas in the lesson

Low   Moderately Low   Average   Moderately High   High

5. Your opinion of the programed lesson in helping teachers increase their understanding of science.

Low Moderately Low Average Moderately High High

6. Student interesting in repeating programed lesson.

Low Moderately Low Average Moderately High High

7. Number of students that said they could not understand tape instructions.

Low Moderately Low Average Moderately High High

COMMENTS:

DIVISION III:

Promotion of Elementary Science Instruction and Ausio-Tutorial Forms of Instruction

Introduction

Promotion of the elementary science A-T form of instruction started in the fall of 1968 when an Elementary Science Option was initiated by WVEC. The Elementary Science Option consisted of pilot classes in each school corporation for audio-tutorial programmed science and for AAAS, or Science - A process Approach, science instruction. The two forms of science instruction were to be field tested and introduced to the school corporations via the science option. A history of the science option explains the outcomes of these two programs.

Since audio-tutorial science instruction was being, in part, developed at WVEC there was a great incentive to promote it. Numerous meetings held and presentations were made to disseminate information about A-T in Indiana and across the country. A list of the major meetings can be found at the end of this division of the report.

One area that began as a side interest of the Elementary Science Project, but later grew into a full part of the activities, was the use of audio-tutorial forms of instruction with special education students. At the suggestion of the Indiana State Department of Public Instruction pilot studies were conducted to determine the fesiability and effectiveness of A-T instruction on small classes of special education students. From these pilot studies grew two proposals for the application of A-T in special education classes that are presently being considered for funding.

Report I

The Elementary Science Option was a unique effort by the WVEC to introduce and promote innovative elementary science curriculum in the schools served by WVEC. The materials included in the option were financed by the local school corporations and the Elementary Science Project. The staff of the elementary science project, as part of their research activities, kept a two year record of the use and effectiveness of the science materials. A report was then sent to the school corporations as evidence of the science programs' success and failures.

Summary of the Science Option
Offer by the Elementary Science Project
of the Wabash Valley Education Center

A Service Project
conducted by the
Wabash Valley Education Center

Camille Cardoza -
Project Associate
Howard Poole -
Research Associate

Acknowledgements

Our appreciation to the sixty-five elementary teachers and twenty-four school corporations who participated in the field testing activities.

INTRODUCTION

In September of 1968, a science option was accepted by the school superintendents whose corporations were enrolled in the Wabash Valley Education Center. This option proposed to put two different science programs in two of the corporations' first grade classrooms. The original plan said that beginning on or before January 1, 1969, one classroom would be supplied and outfitted with the completed Wabash Valley Education Center Elementary Science Program (Audio-Tutorial Instruction) materials and equipment and a second classroom in the same school corporation would be supplied with the American Association for the Advancement of Science (AAAS) elementary science program (Science, A Process Approach).

The classrooms and their respective teachers were selected by school administrators in each school corporation. They were not a randomly selected sample, however, it is felt that they are a representative sample of the first grade classrooms in the Wabash Valley Education Center area. The school corporations ranged in size from 1,000 students to 10,000 students from grades K through 12. For the most part the school corporations reflected a rural, social economic background. Several classes however were located in small cities in Northwestern Indiana. The socio-economic make-up of the students for the most part, reflects low or lower-middle class. Many live on farms, or in or near farming areas. Many have parents who work on construction jobs, in factories or in small businesses.

The Wabash Valley Education Center Elementary Science Program (A-T) included all the materials and equipment which was needed to operate the program. Among the items and materials was a Super 8 mm loop projector, a cassette taperecorder, a study carrel, the student instructional materials, and a teacher's manual. The AAAS materials included the materials supplied for the Part B (Grade One) package, and the teacher's manuals for both the Part A (Kindergarten level) and Part B.

Along with the instructional materials for each of the programs there was also an in-service instruction program in the form of workshops. The in-service training began prior to the implementation of each of the programs in the schools and continued with visitations during the period that the programs were utilized.

By December 1, 1968 lessons for the A-T program were pakcaged and ready for the classrooms. A workshop was held for the teachers involved in the program to introduce them to the new methods of instruction. While there was a slight delay in the delivery of the AAAS materials, the teachers received their materials in time to begin lessons by the second week in January. The lessons for both forms of science instruction were then utilized for the remainder of the 1968-69 school year and then again in the 1969-70 school year.

Also during this time an evaluation program was initiated as part of the Elementary Science Project's research and development program. The evaluation was focused on the A-T instruction and no evaluation was done on the AAAS program. The data from the A-T evaluation can be located in other reports from the Elementary Science Project. A second evaluation program was carried on for the 1979-70 school year. The 1969-70 program evaluated not only A-T instruction but AAAS and Control groups as well. The outcomes of both the 1968-69 and 1969-70 evaluation programs can be found in the remainder of the report.

1968-69 Evaluation Program

In the first year of th` science option program found valuable information and insights about the audio-tutorial form of instruction from the data collected. Approximately 600 pupils were in the study and they were in classrooms that averaged twenty-five students in size. Ninety-eight percent of the 600 students went through the lessons at least once and twenty-five percent more than once. Five percent of the 600 students needed help in some way going through the lessons and five percent said they could not understand the tape directions. Four students refused after encouragement to go through a lesson. These same four students, however, went through the other twelve lessons without problems. On the average, a lesson took three school days or eighteen actual classroom hours of availability to be completed. The teacher spent twenty-three minutes, on the average, to set up and maintain the programs. The teacher also spent thirty-five minutes per lesson on additional science. A gradual increase in additional science instruction on the part of the teacher was recorded.

Major equipment break downs were centered on the tape recorder and its durability. No software problems of any nature were recorded. Student desire to engage in other science activities and their availability to applv information from the programed lessons was high. Teachers reported the lessons had an above average ability for aiding them in their understanding of the science being taught. Overall, there were surprisingly few problems in the A-T instruction and only one major problem in the equipment, the rape recorder durability. The students were successful in going through the lessons and as reported by their teachers showed high interest, motivation, and an ability to apply the information they learned.

At the end of the 1968-69 school year the Elementary Science Project staff telephoned the principals of the teachers using the A-T science program concerning their desire to have more Audio-Tutorial Science Instruction in their schools - if it were available. The following is a summary of that information.

Table I - (Summary of telephone calls to principals using the A-T form of science instruction).

QUESTION	YES	NO
1. No. of Principals contacted	16	8
2. No. of Principals who liked A-T	13	3
3. No. who would use A-T as a science curriculum	13	3
4. No. who would buy it if there was money available	13	3

As can be seen from Table I of the sixteen principals contacted a majority were in favor of the audio-tutorial science instruction and expressed an interest in obtaining it for their elementary classrooms.

A brief evaluation letter was also sent during during the 1968-69 evaluation program to the teachers in the science option who were using the AAAS materials. The letter found that most of the teachers used the materials for the last ten weeks of the school year. They averaged seven lessons taught during those ten weeks and had a range of one teacher teaching fourteen lessons and one who taught only one lesson. The lessons reported averaged three days in length and the teachers averaged 1.61 hours preparing to teach each lesson. This information is similar to that reported by the publishers of the AAAS science materials.

1969-70 Evaluation Program

The 1969-70 program was a follow-up study on the first year's program. However, the program was enlarged and included not only a study on the use of the audio-tutorial form of science instruction but also on the use of AAAS materials and a control group (those classes which had no special program for science). The study involved 65 teachers and approximately 2000 pupils who were in classrooms that averaged 25 students per class. In the A-T group there were 26 teachers, the AAAS group had 14 teachers and the control group 25 teachers.

The evaluation program proved to be valuable in determining the effectiveness of the various forms of science instruction that were used in first grade classrooms. The teachers using the three forms of science instruction were all successful in teaching some science lessons. The A-T group reported teaching the largest number of lessons.

The study also found that the audio-tutorial form of instruction was less time consuming to the teacher, was as interesting to the students as the other forms of science instruction, was less difficult for the students to learn and provides more of the essential materials and equipment needed to teach a science lesson. The AAAS science instruction was reported as effective as standard classroom science instruction, required more teacher time, and had more of the essential materials and supplies needed to teach a lesson than did the control classroom scinece.

The conclusion, the evaluation program found significant differences between the operation and success of the three forms of science instruction studied. The forms of instruction varied from point to point, but were all successful in presenting some form of science instruction to the students. Based on the overall operational efficiency and success and on the quality and nature of the science instruction, A-T seems to have an advantage over AAAS, Science, A Process Approach and contemporary classroom science.

SUMMARY

The science option proved valuable in introducing several forms of innovative science into the elementary school population of the school corporations participating in the Wabash Valley Education Center. The first grade classrooms that obtained audio-tutorial programed science instruction and Science, A Process Approach science instruction, were visited by many teachers, principals and parents who came away more informed about innovative approaches to teaching. The materials and teachers using them also proved valuable as a field test situation in which many insights were gained and reported in this summary and in other reports produced by the Elementary Science Project.

The insights gained during the field testing have gone a long way in influencing the future development and testing of the audio-tutorial form of instruction. The basic philosophy of audio-taped forms of instruction has also been encouraged by the science option. The stimulation audio-taped instruction produces can be seen by the use of cassette tape recorders in reading, social studies and other curriculums with the elementary school. These activities were undertaken by the teachers in the science option because they had the basic instructional materials provided through the equipment and materials of the science option.

The concept of process and skills as important parts of any school curriculum have been expanded by the use of the AAAS science materials provided in the science option. The interest in inquiry and process approaches to teaching have greatly increased in the population of schools using the AAAS materials. Several large school corporations have, in fact, purchased AAAS science materials for all of their elementary classrooms.

As a method of stimulating the acceptance of innovative forms of science instruction, the science option of the Wabash Valley Education Center has proven to be very successful. As a field study situation, the science option has proven to be a successful evaluation program. As a promotion of innovative forms of instruction, the science option has been a success. Based on these three conclusions, we feel the science option, as a service project of the Wabash Valley Education Center, was a successful program in promoting creative and innovative forms of instruction.

Report II

A special pilot study was conducted to explore the utilization of A-T first grade science materials with special education students. The study was of limited size, but found that among the population of students tested there was sufficient individual student ability to handle the sophisticated requirements of the A-T form of instruction. These findings later stimulated additional pilot work which will not be completed in time for inclusion in this report. However, it can be obtained by contacting the WVEC special education consultant.

FINAL OBSERVATIONS
OF AUDIO-TUTORIAL SCIENCE
WITH SPECIAL EDUCATION STUDENTS

An on-going project conducted through the Elementary Science program of the Wabash Valley Education Center in cooperation with Oxford Elementary School and East Tipp Junior High School.

Howard R. Poole
Project Assistant - Elementary Science Program
Wabash Valley Education Center

July 22, 1969

Acknowledgements:
Our appreciation to Mr. Smith, Principal of Oxford Elementary School and Mr. Shoaf, Principal of East Tipp Jr. High School and to the participating teachers, Mrs. Early, Mrs. Toll, Mrs. Rassmussen, and Miss Axelrod at Oxford Elementary School and Mrs. Yarian at East Tipp Junior High School.

This observational study was undertaken to find the relevance of standard first grade audio-tutorial science programs to the learning abilities of special education students. The audio-tutorial science programs used in the study are part of a sequence of science programs developed at the Wabash Valley Education Center, West Lafayette, Indiana, by Dr. Joseph D. Novak, now of Cornell University, and Mr. Louis M. Giantris. The science programs are programed instructional lessons modelled after a conceptual science scheme devêloped by Dr. Novak and utilizing recently developed learning theories by Dr. David Ausubel. The special education students represent low mental ability students ranging in age from 7 to 17 and reflecting class standings in lower and upper elementary school and junior high school special education classes.

The study design has a pre-test for science concepts followed by a number of audio-tutorial programed science lessons. A post-test for science concepts will follow the science lessons to determine the level of science achievement. Each child will also be observed as he goes through the science lessons and a task evaluation check-list kept on his progress. The science achievement pre and post-tests and the task evaluation check list will act as qualitive evidence of the audio-tutorial science lessons' relevance to special education students.

The students in the study are from a rural farming area surrounding Lafayette, Indiana. They are all listed as slow or non-readers and have tested I.Q.'s below 70. A breakdown of their classes, ability and ages, can be found in the Initial Observation Report of March 24, 1969.

The students were described earlier by their performance as it relates to their ability description. Table I combines the performance and descriptive references of the special education students used in the study.

TABLE I - Special Education Performance Description

Performance	No. of Students	% of Students	Low Ability	Trainables
Successful	22	55%	21	1
Operational	8	20%	7	1
Non-Operational	10	25%	2	8

DEFINITIONS: Successful - Completes program without any major problems of following directions and scores above 75% on the Task Evaluation Check-List.

Operational - May or may not fully follow directions and/or faces only minor problems in following directions. Scores between 50% and 75% on Task Evaluation Check-List.

Non-Operational - Faces major problems in following content and directions of the programs and cannot function in the program beyond starting or stopping the tape recorder. Score below 50% on the Task Evaluation Check-List.

Low Ability - I.Q. below 70, or slow or non readers.

Trainables - Non-readers below 50 I.Q.

PERFORMANCE CONCLUSION

From Table I we can see that of the forty students included in the study 75% are operational with the audio-tutorial science programs and 55% are successful. This information is based on 10 science lessons completed by the East Tipp Jr. High students and 4 science lessons completed by the Oxford Elementary students. It would seem that roughly 50% of the students now listed as "special education" students could successfully handle the standard first grade audio-tutorial science lessons. Another 25 to 30% of the special education students could benefit from having the present science programs modified for their ability. The last 25% of the special education students would require new programs if they are to function with the audio-tutorial science instruction.

The special education students were pre-post tested utilizing the Science Picture Test developed at the Wabash Valley Education Center. The Science Picture Test is a test booklet containing multiple choice and multiple answer picture questions presented in various simple formats with one question per page. The test is in two parts, each requiring 20 to 30 minutes to complete. The test instructions and directions are all tape recorded and presented by tape to insure standard test presentation. The students were given the test at two settings of one half-hour duration. The test questions or responses (100) were related to science concepts presented in the audio-tutorial programed lessons. (Lessons 1 through 13). A correct response represents knowledge of the particular concept tested in the question.

A Verbal True-False test on science concepts (J-S) Science Test) was also given to the special education students. The J-S test was developed at the Wabash Valley Education Center as a means of testing the responses of students to statements dealing with the concepts taught in the Audio-Tutorial Science Program. The child hears a science statement from taped instructions and then responds true or false to the statement by circling a smiling (true) or frowning (false) face. Knowledge of the science concepts contained within the statement should allow the students to correctly answer the question. The J-S test was administered after the post testing of the Science Picture Test in a separate setting. Test directions and instructions were presented by tape to insure standard presentation.

Because of their limited capacity for test taking, ten of the forty special education students were not given tests. Students moving away or absent from school on testing days further reduced the pre-post students to a total of twenty-three. The twenty-three students represented two instructional groups. Ten were from East Tipp Junior High and had 13 lessons and an immediate post test. Thirteen students were from Oxford Elementary School and they had four lessons, followed by a post test ten weeks later. The East Tipp students ranged from 13 to 17 years of age and all were classified as successfully using the audio-tutorial lessons. The Oxford students ranged from 9 to 15 years of age and were classified as eight successful and five operational in using the Audio-Tutorial lessons. The Oxford group was younger, had less performance ability, had only four programs, and were post tested for retension ten weeks after the last program.

The results of the pre-post test students for East Tipp can be found in Table II.

TABLE II - Description of Pre-Post Test Scores on East Tipp Students

Student	Pre-test Score	Post-test Score	Gain	Operation Performance
1	82	80	-2	S (successful)
2	77	75	-2	S
3	70	73	+3	S
4	68	70	+2	S
5	60	59	-1	S
6	60	72	+12*	S
7	60	78	+18*	S
8	52	50	-2	S
9	48	63	+15*	S
10	47	64	+17*	S
	$\bar{X}$ = 62.4	$\bar{X}$ = 68.4	$\bar{X}$ = +6	

An average of 6 test score points increase was recorded for the students after having received thirteen lessons over an eighteen week period. However, the average increase is misleading because only four students showed substantial increases in scores on the test. These four students, however, represent the bottom half of the students as reflected by their pre-test scores. The other six students remained constant in their scoring. The top students may reflect a ceiling on the test and therefore could not show a gain in score.

The results of the pre-post test students for Oxford can be found in Table III.

TABLE III - Description of Pre-Post Test Scores by Oxford Students

Student	Pre-Test Score	Post-Test Score	Gain	Operational Performance
1	72	73	+1	S (successful)
2	71	70	-1	S
3	67	59	-8	S
4	63	45	-18*	S
5	61	43	-18*	S
6	60	65	+5	S
7	49	51	+2	S
8	49	45	-4	S
9	44	43	-1	O (operational)
10	44	33	-11*	O
11	44	44	0	O
12	44	31	-13*	O
13	42	55	+13*	O
	$\bar{X} = 54.6$	$\bar{X} = 50.6$	$\bar{X} = -4$	

An average of 4 test score points decrease was recorded for the students after having received only 4 lessons and a ten week post retension test. Several problems must be considered when discussing the Oxford data. One, the test contained questions for programs 1 through 13 and the students had only the first four programs. Two, a ten week period elapsed before the post test was given. This amounts to a ten week post retension test, using a test designed for 13 programs on only the first 4 programs. A large gain or loss would not be expected by the students because of the above problems. However, as can be seen from the data in Table III, four students demonstrated rather a large losses, and one student, the very lowest student on the pre-test, demonstrated a large increase.

The instruction and retension period cause four students to show large reductions in scores, while one student demonstrated a large gain in score. These scores are unexpected and it is not clear what precipitated their occurence. The gain could have come from the first four programs and the losses from confusion caused by the first four programs. Both hypothesis, however, need more qualitative and quantitive evidence. One way of looking into this is to analyize the items where changes between pre and post testing took place. A summary of the items and their related concepts is shown in Table IV.

TABLE IV -- Item Analysis of Oxford Students

Subject Matter Area	No. of Questions Changing	No. of Questions Changing as Expected
Forms of Energy*	8	7
Energy & Living Things	9	6
Living and Non-living Things	8	7
Classification of Animals & Plants by Energy	3	1
Total	28	21

* Area taught to Oxford students, other areas not taught.

From the results of Table IV we can see that 21 of the 28 questions changed in an expected way. That is, questions in the area taught were correctly answered by more of the students, while questions in the three areas not taught were incorrectly answered by more of the students. This would support the hypothesis that what was taught was learned, and what was not taught, was confused by what was taught. In this case the reduction in pre-post test scores resulted from confusion on questions not covering material taught from the material taught in the first four programs. The first four programs deal mainly in physical forms of energy and not with living, non-living or animal-plant classifications based on energy uses, etc.

Item analysis of the pre-post tests for the East Tipp students was rewarding in discovering the areas where increased learning occurred. All items showing marked changes in percentage of students answering correctly were removed from the test and grouped by subject areas. There were twenty-eight such questions. Seventeen of the twenty-eight were questions involving energy relationships. The area of "energy for movement" or "moving energy" (kinetic energy) was the one most powerfully increased. Light energy, as it relates to other forms of energy and to plants and animals, was also increased. Nine of the twenty-eight questions dealt with the area of distinguishing living from non-living objects. These three areas stood out as being the areas where more learning took place as measured by the science picture test.

However, it should be pointed out that significant knowledge of science concepts was held before the instruction began. An item analysis of the combined pre-tests of both Oxford and East Tipp students demonstrated high knowledge in several areas. Thirty-three of the one hundred questions were answered correctly by 75% or more of the forty students tested. Sixteen questions were answered by 90% or more of the forty students. Easy, or mastery level, questions found the concepts of electric energy, living animals, non-living objects, more energy and energy forms (heat, light, electric) were highly developed in this age of special education students. The skill of classification was also developed and used by the students.

The J-S Science Test administered along with the post-test found much the same thing as the Science Picture Test. The East Tipp means were 23.00 out of thirty questions while the Oxford means was 19.00 only four above chance level. The concepts of electric energy, and what plants and animals need to stay alive are found to be well developed in the special education students under study.

LEARNING CONCLUSION

Evidence of learning from the audio-tutorial science programs was found with four of the ten East Tipp students. The concept areas of energy movement, light energy and living, non-living classification were found to have significantly increased during instruction. The lower scoring students on the pre-test were the students found to have learned.

Since only four weeks of the thirteen week instruction was given and a ten week period elaped between instruction and testing of the students, there was not sufficient evidence to discover learning in the Oxford students. Analysis of test items found evidence of confusion among the Oxford students in answering the questions not covered by the instruction. Combined pre-test analysis revealed significant knowledge by the special education students in the areas of electric energy, living animals, non-living objects, more energy, and energy forms. The skill of classification was also highly developed in the students tested. The J-S science test supported the findings of areas of science knowledge in the students tested.

In general the learning studies lack strength in numbers tested, but do show evidence of learning and of attainments of important relevant science concepts.

SUMMARY

Roughly 50% of the students now listed as being in "special education" can successfully handle the standard first grade audio-tutorial science lessons. Another 25 to 30% of the special education students can benefit from having the present science programs modified for their particular abilities. The last 20% of the special education students will require new programs if they are to function with the audio-tutorial science instruction.

Evidence of learning was found for students completing the first thirteen lessons. Increased in learning took place in the conceptual areas of "moving energy", of light energy and of living and non-living objects. Significant levels of science conceptual growth was found in special education students for electric energy, living animals, non-living objects, more energy, and energy forms, (heat, light, electric.) Skill in the process of classification was also found.

It would seem from this observational study that audio-tutorial science can be a relevant form of instruction for special education students. It would also seem that a special effort must be made to adapt the audio-tutorial instruction more closely to the learning characteristics of the slow learning and mentally handicapped. Evidence that special education students have and can learn important relevant science concepts was also found. It would seem that science can be a relevant and important part of special education.

Report III

Listed below is a summary of the meetings and conferences that were attended by Elementary Science Project Staff to promote elementary science and audio-tutorial forms of instruction.

1. West Lafayette Community School Corporation Teacher Workshop - April 1960, West Lafayette, Indiana.

2. Tippecanoe School Corporation Inservice Audio-Visual Workshop - October 1968 - Lafayette, Indiana

3. Indiana Office of State Public Instruction, Creative Science Workshop - February 14, 15, 1969, Indianapolis, Indiana.

4. U. S. Office of Education, Audio-Tutorial Science Demonstration, March 1969, H. E. & W. Office, Washington D. C.

5. National Meeting of National Science Teachers Association, March 1969, Dallas, Texas.

6. Ohio Silver Anniversary National Science Teachers Associations, April, 1969, Dayton, Ohio.

7. National Audio-Tutorial Conference, October, 1969, Purdue University, Lafayette, Indiana.

8. Indiana State Science Supervisors Meeting, November, 1969, West Lafayette High School, West Lafayette, Indiana.

9. Indiana State Office of Public Instruction, Regional Workshop on Elementary Science, January 16, 1970, New Albany, Indaina.

10. Indiana State Office of Public Instruction, Regional Workshop on Elementary Science, January 30, 1970, Vincennes, Indiana.

11. Indiana State Office of Public Instruction, Regional Workshop in Elementary Science, February 13, 1970, Peny East Junior High, Indianapolis, Indiana.

12. State Meeting for Council for Exceptional Children, February 13, 14, 1970, Indianapolis, Indiana.

13. Indiana State Office of Public Instruction, Regional Workshop in Elementary Science, February 20, 1970, Muncie, Indaina.

14. Indiana State Office of Public Instruction, Regional Workshop in Elementary Science, March 6, 1970, Highland, Indiana.

15. National Meeting of National Science Teachers Association, March 1970, Cincinnati, Ohio.

SUMMARY

The staff of the Wabash Valley Education Center as well as the members of its goverance have made every effort to fulfill the most important objectives of PACE. It was apparent to these groups that the most important objectives were to:

invent creative soltuions to problems;
demonstrate exemplary programs;
adapt exemplary programs to local requirements; and,
supplement existing materials.

What follows is a summary of what has been done by the WVEC in its attempt to achieve the objectives.

The WVEC was instrumental in developing an imaginative new course of study for the primary grades utilizing auditory, visual and manipulative technology called audio-tutorial elementary science. The course of study includes weekly lessons based on scientific concepts and phenomina shown to be highly motivating to children. The teachers who have used the audio-tutorial science materials have been elated with the materials and with its effects on the children in their classes.

In another subject matter area, the social studies, center staff have stimulated the development of materials and have led programs that hopefully helped teachers to:

understand and use the inquiry approach to teaching;
implement creative teaching methods; and,
be familiar with new and innovative social studies curricula.

These things were done through conferences and workshops over the three years which covered the following broad areas:

I. Inquiry

inductive procedure
pupil involvement
problem solving

II. Content

course
subject matter
examination of materials

III. Micro-laboratory

micro-teaching

IV. Stimulation games

rationale
demonstration
practice

V. Multi-media

selection
use
development

VI. Individualizing instruction

independent study

VII. Goal setting

specific goals

VIII. Content

selection
development

IX. Designing a curriculum

course content
philosophy
sequence

X. Evaluation

by self
by others

The Center also worked in the area of the language arts. The rationale and the programatical approach to the language arts was very similar to that used by the social studies and as described above. The activities of the language arts project over the three years are summarized under the following broad areas:

I. Needs assessment

force field analysis
other techniques
systems analysis

II. Curriculum design

philosophy
course content
sequence

III. Content

selection
development

IV. Individualizing

instruction
independent study
content
equipment

V. Interaction analysis and evaluation

by self
by others

VI. Goal setting

behavioral
practice

VII. Micro-teaching

learn
practice

VIII. Inquiry

skills
practice
use

IX. Multi-media

selection
use
development

X. Content

sequence
try out

The supplementary phase of the WVEC in terms of materials has been provided through an instructional materials center composed of 2,500 16 mm films, 6,000 filmstrips, several hundred instructional items such as teaching kits, overlay masters, three dimentional objects, flat pictures, 2 x 2 slide sets and thousands of professional books and periodicals. These materials have been loaned at a rate of about 6,000 items per month. The appreciation of the value and availability of materials from the IMC by teachers had grown continually during the three year grant period. The WVEC provided materials and services that no one of the participating schools could affort to provide for themselves independently.

Other areas of effort by the WVEC to achieve PACE objectives have been to: develop a cooperative purchasing plan that has potential for large savings to each participant; provide professional consultants for all of the schools that they likely would not have been able to provide for themselves; operationalize a delivery system that provided each school all requested materials (This delivery communication system is made possible through the operation of three vans that go out from the Center each day); and provide seminars, conferences, workshops, research and development leadership on a variety of topics at the Center, and at the schools and other appropriate facilities.

The WVEC and other organizations like it make the improvement of education within the reach of every school. The key to success in a cooperative effort like the WVEC is the willingness of a number of school corporations to cooperate so that sufficient funds are made available to operate the cooperative. Experts generally agree that an area serving approximately 100,000 children is an ideal size for a cooperative. An area of this size can provide for cooperating schools facilities for research, development and instructional materials that can keep them abreast of the best in current educational practices.

The geographical area served by the WVEC meets the criteria just described. In addition, the schools in the area have agreed to cooperate and provide funds for the maintenance of a cooperative. During the past two years, schools cooperating in the programs and services of the WVEC have contributed $87,202 toward its support. For the fiscal year 1971 these same schools have agreed to support the WVEC in order to maintain some of the services that were avaliable to them when the WVEC was funded primarily by the federal government. During the coming fiscal year cooperating school corporations will provide approximately $153,000 to fund selected aspects of the WVEC.

At the time of this writing it appears that the cooperating school corporations want their funds to maintain the Instructional Materials Center of the WVEC.

Continued efforts will be made by the WVEC staff to obtain funds for the support of past programs such as curriculum consultant services, research and development and other activities that contribute to the continual educational enrichment of the geographical area served by the Center.

APPENDIX A

Responses on the "Writing Instructional Objectives" Workshop
held for the Western Boone School Corporation,
October 23, 1969.

The respondents were asked to write on the following questions:

1. What did you think about today's workshop?

2. What suggestions can you make that would have made the workshop better for you?

The following are responses to the above questions by participants in the workshop.

- - - - - - - - - - - -

The session was meaningful to me as a first year teacher.
(1) Must have a properly defined and attainable goal.
(2) Concerned about the attitudes and values and skills--that is, I have learned that, as a teacher, I must get beyond the knowledge level.
Thank you very much.

- - - - - - - - - - - -

I feel that the instruction received was very meaningful, in a field that needs more development at the teacher level.

Any suggestion of improvement would be: Pre-assigned material to be gone over before such a meeting so that a higher level of understanding could be reached in the formal meeting.

- - - - - - - - - - - -

I thought the sessions were very helpful to me as a first year teacher. I recently had most of this material in methods courses but this has been a help in working with my actual situation.

Drop outs in the afternoon are not your fault. Since everyone that was supposed to come didn't, I think the two girls that left felt they shouldn't have to stay.

- - - - - - - - - - - -

I had had much material on objectives in my methods class, so I knew most of the material.

I feel that this session would have had more value had I not had previous experience. However, if I had not had previous exposure to this material, I probably would have been little phased by this because application of this wasn't re-emphasized over and over--it takes this to convince people to write out objectives is worthwhile.

It did make me aware of how I <u>should</u> be writing objectives and am too lazy to! Therefore, I feel it was worthwhile for me if only for inspiration and a kick into action.

- - - - - - - - - - - -

(COPY)

CLINTON PRAIRIE SCHOOL CORPORATION
R. R. 6, Box 349
FRANKFORT, INDIANA 46041

November 3, 1969

William Floyd, Director
Wabash Valley Education Center
500 By Pass 52 West - University Square
West Lafayette, Indiana 47906

Dear Mr. Floyd:

This is written to thank personnel of Wabash Valley Education Center for participating in the planning and implementation of the in-service training program, Oct. 28, 1969, for our teachers and school board. Many of our personnel have stated the program was successful.

Special thanks should go to you, Harry Leader, and Bill Wright for assisting in making this experimental program a success. Please relay my personal thanks to Harry and Bill.

Yours sincerely,

/s/ E. H. Alexander

E. H. Alexander
Superintendent

(SAMPLE)

POST MEETING RESPONSE SHEET

1. In general, how do you evaluate today's workshop with respect to program, presentation and arrangements?

   ______ Excellent ______ Poor

   ______ Good ______ Very poor

   ______ Average

2. What aspect(s) of the workshop was of most interest to you? (If more than one, list in order of priority.)

3. What aspect(s) of the workshop do you feel will help you to be a better educator?

4. What changes would you suggest be made in order that future workshops be more beneficial to you personally?

5. If you have any comments, questions or criticisms, please list them here. (Use reverse side if more space is needed.)

SUMMARY

POST MEETING RESPONSE SHEET
ACE Workshop, Logansport, Indiana
February 11, 1970

1.	Excellent	1
	Good	16
	Average	18
	Poor	13
	Very poor	9
		57*

2.	Preview of textbooks and materials	14
	A-V material	8
	Readability of Math Eng	15
		37
	no responses from	20

3.	A-V material	5
	None	3
	Review of textbooks and materials	8
	All	1
	Readability	4
	Cookies and coffee	(1)
	Textbook selections	3
		24
	no responses from	33

4.	Included information about Sp. Ed. and Excep. Child	3
	Individual participation--i.e., actually preparing A-V materials	3
	More personal interaction	4
	Make presentation of material along practiced lines	3
	More about textbook evaluation	1
	Use more A-V materials other than overhead projector	1
	More topics and activities to choose from	4
	Better lighting in the gym	1
	More involvement by teachers in program and in planning program	2
	Have speakers that know something and how to make interesting presentations	2
	More speakers	1
	Have speakers at different grade levels	1
	Have shorter sessions	1
		27

* This figure represents a sample of those attending the workshop.

5.	Same as last year, except Mathematics	1
	Nothing new - why talk down to us?	1
	Staff very helpful--interested in us	1
	Have an afternoon where teachers interact (special room where special subjects are discussed) with no leader, small group discussions	1
	Wonderful work by planning & hospitality committee	1
	Too short periods between presentations	1
	Program timely and good; arrangements satisfactory; but presentation left something to be desired. Speaker unsure of what group he was addressing	1
	Speaker had nothing to say	4
	More A-V help	1
	Time better spent in classroom	3
	Be more specific	1
		16

Summary of Post Meeting Responses
South Newton School Corporation
February 20, 1970

1. In general, how do you evaluate today's workshop with respect to program, presentation and arrangements?

	Number of Responses	Percent of Responses
Excellent	4	6.3
Good	32	50.79
Average	23	36.50
Poor	2	3.17
Very poor	0	-
No response	2	3.17

2. What aspect(s) of the workshop was of most interest to you? (If more than one, list in order of priority.)

Section	Priority First	Second	Third
Instructional Objectives	17	1	3
Social Studies	14	7	1
Language Development	11	3	0
Media for Instruction	9	7	1
Individualized Instruction	6	5	0
Precision Teaching	0	0	1

3. What aspect(s) of the workshop do you feel will help you to be a better educator?

	Number of Responses	Percent of Responses
Instructional Objectives	24	45.28
Media for Instruction	11	20.75
Micro-lab	6	11.32
Language Development	4	7.54
Individualized Instruction	4	7.54
Social Studies Resources	3	5.66
Precision Teaching	1	1.88

Summary of Post Meeting Response Sheets
Stokes Elementary Schools, Lebanon
March 17, 1970

"Writing Instructional Objectives"

1. In general, how do you evaluate today's workshop with respect to program, presentation and arrangements?

Excellent	5
Good	8
Average	1

2. What aspect(s) of the workshop was of most interest to you?

Specifics of writing objectives	4
Filmstrip	4
Broad concept of goals to achieve	1
Teacher-made objectives	1
Literature	1
Talks	1
All	1
Understand meaning of behavior, minimum and conditions	1
Explanation of book "Instructional Objectives"	1
Got some enthusiasm previously did not have	1
Learning difference between objectives and long-range goals	1

3. What aspect(s) of the workshop do you feel will help you to be a better educator?

Learning that writing out objectives will help me to state my goals more clearly and evaluate them more correctly	9
Contents of film	1
Study of the materials	1
Some new ideas	1
All of it	2
More objective self appraisal	1
Ability to have more directed guidelines	1
Emphasis on positive objectives	1

APPENDIX B

"PROGRESS REPORT" FEEDBACK
(from June 21, 1968)

Forty-one out of the total forty-three participants completed and returned this self-evaluation form.

The following notations are used in reporting the results of the evaluation:

n = number of participants answering the item
X = mean or arithmetical average
s = standard deviation

1. How do you feel about the project work that you have been engaged in?

1 = terribly disappointed   7 = extremely satisfied

n = 40
X = 5.5500
s = 1.1169

2. To what advantage have you: a) used your time as efficiently as possible?

1 = worked very inefficiently   7 = to the fullest advantage

n = 41
X = 6.2195

2, b) To what advantage have you used the materials available here?

1 = have not used any   7 = to the fullest advantage

n = 40
X = 5.75
s = 0.7984

2, c) To what advantage have you used resource people (consultants and other participants)?

1 = not at all   7 = to the fullest advantage

n = 41
X = 4.8292
s = 1.1876

2. d) To what advantage have you used techniques from T-groups or from other consultants?

1 = not at all   7 = to the fullest advantage

n = 38
X = 4.8421
s = 1.8712

feedback (2)

3. Resources which you have investigated so far: (the firgures indicate the number of participants checking that item.)

    curriculum materials = 39
    professional periodicals = 23
    professional reference books = 28
    offprints of articles = 18
    bibliographies = 18
    reproduction facilities = 15
    film strips = 14
    films = 30
    records = 5
    permanent professional staff = 20
    other participants = 29
    resources suggested by other participants = 27
    visiting consultants = 28
    instructional material from commercial sources = 20
    subject matter textbooks = 17

4. What activity have you become most involved in? (Here, some marked more than one response; thus, n ≠ 41)

    sensitivity training = 20

    lunch = 2

    team or individual projects = 34

    afternoon consultants' presentations = 13

5. Rank order from 1 through 7 the activities or resources you consider most valuable to your workshop experience thus far. There was misunderstanding here as to the pole representing the most and/or least valuable activity, thus, the data was tossed out.

RESULTS

1968-1969 LANGUAGE ARTS SEMINAR

Evaluation in Retrospect

September 14, 1968 - Delphi, Indiana

1. During the Seminar I feel that I learned

1 (0)	2 (1)	3 (5)	4(11)	5(2)
Nothing				a great deal

2. How helpful has this workshop been in developing skills you can actually use in your own work?

1 (0)	2 (1)	3 (7)	4(10)	5(1)
Not at all helpful				very helpful

3. Rank order the activities in order of their helpfulness to you. (1 = most helpful; 5 = least helpful)

	1st or 2nd	3rd	4th or 5th
Inquiry	7	6	9
Goal Setting	11	4	3
Micro-Teaching	6	4	7
Audio-Visual Techniques	8	2	7
Audio-Visual Materials	12	0	6

4. What are the chances of your using some of the ideas presented?

(16) Very likely
(3) Somewhat likely
(0) Unlikely
(0) Very unlikely

5. Which of the ideas listed in item #3 do you think you will use?

(8) Inquiry
(5) Goal Setting
(3) Micro-Teaching
(3) Audio-Visual Techniques
(7) Audio-Visual Materials
(8) ALL

6. What kinds of changes are you most interested in making in your own classroom situation?

(4) More classroom participation
(4) More pupils doing the talking
(3) A greater number of activities to use to enhance learning
(1) Shift to inquiry
(1) Coordination of text material and extras using visual aids
(1) New methods, innovations, techniques

(1) Effective way of presenting literature and grammar to students
(1) Better understanding
(1) Develop students confidence to participate
(1) Student oriented changes
(1) Different groups doing different things
(1) Better use of audio-visual material

7. What kinds of changes are you most interested in making in your own teaching behavior?

(2) More of an observation type teacher, freeing me to make more individual evaluation of my class
(2) More interesting methods of teaching skills that will be helpful to students always.
(2) More specific in goal-setting
(2) Make students more active
(2) Use more audio-visual materials
(1) Shutting up
(1) Learn how to coordinate and plan for an overall picture so as to make use of supplementary material
(1) Inquiry and Goals
(1) Flexibility
(1) Try to be more sympathetic with children with problems
(1) To have a freer atmosphere
(1) Adopting new teaching techniques
(1) Make learning easier for slow learners
(1) More individualized instructions
(1) Better use of student initiative and curiosity

8. What suggestions would you make for changing this workshop?

Make the luncheon an integral part
More notification time
Making elementary workshop
More specific in using V.T.R.
Compiling lists of ideas that are practical and workable in the classroom from each teacher in a specific skill
It's fine
Brief outline of major ideas
To see teachers attending given more of a chance to react to some of the ideas
More than one meeting
Special interest meeting at WVEC or a local school
A follow-up - maybe have someone visit a classroom situation and offer suggestion
Teachers need to take part in more in-service training
Well planned and executed
A list of purchasable materials for elementary level
Make a break down in elementary and secondary level
More specific - less general
More examples of how to use materials

APPENDIX C

A PRELIMINARY EVALUATION OF THE WABASH VALLEY EDUCATION CENTER AUDIO-TUTORIAL SECONDARY PHYSICS PROJECT AT JEFFERSON HIGH SCHOOL, LAFAYETTE, INDIANA, LOWELL KNOOP, DIRECTOR

BY

MICHAEL SZABO

AND

WILLIAM ASHER

Education Researchers

Wabash Valley Education Center

West Lafayette, Indiana

I. SUMMARY

II. BODY

III. SUGGESTIONS FOR A FURTHER EXPERIMENTATION

IV. APPENDICES

The major part of the evaluation consisted of a quasi-experimental comparison of the audio-tutorial (A-T) classes with the previous year's physics classes on cognitive factors and achievement in physics. The comparison is a beginning evaluation; a first estimation of the effect of the A-T method on physics achievement. The method of using the class from the previous year as a quasi-control group is feasible because the tests given to both groups were similar. The conclusions drawn from this comparison will yield valuable information which will aid in the further directing and shaping of the program.

The first comparison was seven scores used to determine if the control group differed from the experimental group before they took physics. The control group was not significantly different. (See appendix for tests of significance.) Thus one can assume equality between the groups on these variables available prior to the treatment.

Nine criteria scores were used to assess the effects of the A-T instruction. (The set of 16 variables comparison and criteria are listed in the appendix.)

No significant differences were found between the two groups after one year of high school physics on eight of the nine criteria scores. The control group scored significantly higher on the ninth criterion, the first six weeks grade index.

The conclusion from these data and statistical tests is that the A-T physics program did not cause a significant change in increase or decrease of student performance in physics. However, the results must still be somewhat tentative for two reasons: (1) the quasi-experimental nature of the field study; and (2) the limitations imposed by the necessity of using only those variables which were available.

In general the students enrolled in the A-T classes enjoyed physics, exhibited enthusiasm for the course, and seemed to be highly involved in the subject matter. There was no common agreement concerning what the students disliked most about the course. This suggests that there is no major discontent with the method.

There were 40 respondents to this survey. Of these, almost 75 percent reported they liked physics, and more than half felt they had a better "deal" than those students in on-going regular physics classes. Thirty-four of the 40 responded that they liked the A-T physics program. Two factors were repeated frequently as being outstanding features of the method: (1) the opportunity to repeat or go over material that was not originally clear; and (2) the ability to proceed at the student's own rate.

Twenty different responses were recorded to the question, "What do you like least (about this method)?", indicating the absence of any prominent disadvantages in the A-T method. The most common response to this question (6 of 40) indicated that it was "too time consuming." Thirty-two of the 40 indicated their feelings about the method had changed since the first two weeks of the course and gave a variety of reasons for this change. (These reasons are included in the appendix.) They have been analyzed by a psychological assessment method, Content Analysis.

The majority of students indicated it was their own idea to take physics. The most common reason given was its utility for college preparation.

It probably would be more accurate to say that the A-T groups perform as well as the regular physics classes from the previous year. Thus, there certainly is no academic disadvantage to the students in the A-T groups. However, there is a big gain in the student's affective response to the A-T instructional method.

INSTRUCTIONAL METHOD

The audio-tutorial instructional method (A-T) as adopted to high school physics and used in this study has been described by Knoop (1968, p. 68).

> In this mode (A-T) the primary contact with the student is via audio tapes on inexpensive tape recorders. Each audio lesson has accompanying visual material in the form of duplicated notes, 35 mm slides, 8 mm single-concept magazines, or some combination of these. Homework assignments accompany each lesson as in the usual course. The audio portion uses the format of an instructor talking to a student on a one-to-one basis, hence the term <u>audio-tutorial</u>. Each student has for his use a tape recorder and a slide viewer. There are five magazine-type 8 mm projectors for the class. The student may use the equipment during his regular hour, during his study hall, or after school and occasionally at night.
>
> A typical unit of work will be from ten to fifteen days in length and will include: one or two lectures, two or three lab experiments, one PSSC film, five to eight lessons, one review session, and one unit test.

A field study research method using intact groups was necessary. Kerlinger defines field studies as " ...scientific inquiries aimed at discovering the relations and interactions among sociological, psychological, and educational varibles in real social structures."

A control group was desirable and obtainable since Knoop kept systematic evaluation records of past physics classes. Thus a quasi-control group was available in the previous year's population of physics students.

Of a total sample of 98 students, general. school background data on 17 students was incomplete. There students were omitted from the study after they were compared on the background varible scores and found to be roughly equal to the students with complete background data. This left a control sample of 41 students and an experimental group sample of 40.

Both control and experimental groups were required to exhibit similar behavioral objectives to indicate their mastery of physics. The unit tests in physics for both the experimental (A-T) and control groups were nearly identical for both groups, thus allowing meaningful comparisons on these criteria. It was decided to limit the evaluation to non-obtrusive effects if possible. Thus the data consisted of seven prior collected, group comparison varibles.

All the criterion scores were achievement measures. They are: five unit tests, three six weeks grades, and the first semester grade.

The seven comparison varibles were a geometry grade, fourth semester grade index, and the total score on the Primary Mental Abilities (PMA) test and the verbal, numerical, reasoning, and spatial subscores. This test is administered routinely by the high school guidance personnel.

RESULTS

The results of the analysis indicate equality between the groups prior to formal exposure to physics. None of the tests showed significant differences between the groups. However, the control group sample had a slight edge in mental ability over the experimental group. If this were true, it would mean that the equality on criterion achievement scores between the groups would indicate that the A-T method is superior to the typical course instruction.

The PMA numerical varible is of some additional interest. Its variance (spread of the scores) of the control group's score is almost one-quarter that of the experimental group. The control is a more homogeneous group on numerical abilities as measured by this test. This means that on a test with items above average in numerical difficulty, one might expect the experimental group to score lower than the control group on criterion scores.

The control group means were not significantly different on any of the criteria varibles except for the first six weeks grade. A possible explanation for this fact may be that the adjustment period is a new experience for the students. This conjecture seems to be supported by the results of the second six weeks marking period. The experimental group sample mean is numerically slightly higher than the control. An overall interpretation could be that the A-T physics program compares favorably to a regular physics classroom on achievement measures. But, there is abundant evidence that the students greatly favor the A-T instruction method. Thus it would seem that the A-T method should be the recommended method of instruction until further evidence is presented.

A student opinion questionaire constructed and administered by Knoop posed some basic questions concerning student opinion about the A-T method.

Over 57 percent of the A-T students felt their friends in standard physics classes did not have as good a "deal" as they did. Many students in standard physics have friends in A-T physics, so there is some chance for exchange of opinion. It is felt, however, that the response to this question reflects reasonably well the students' personal feelings about the A-T method. Only 40 percent felt they understood physics better than their friends in standard physics. This result indicates a bit of uncertainty on the part of the other 60 percent about the learning effectiveness of this technique. Without qualifications, however, 85 percent of the students indicated they liked the A-T method.

The following set of responses gave some indications of what it was the students liked about the method. Over 37 percent indicated they liked the course because it allowed them to progress at their own rate of speed. Another 37 percent appreciated the opportunity to go over the material which was not clear or had been forgotten by the student. These two factors are important aspects of the A-T method. One should note here that this A-T system allows the students to take home tape recorders and recorded lectures to study privately. Ten percent indicated the course was "not boring", while another ten percent lauded the selective study aspects; that is, they could concentrate on the most unfamiliar material rather than keep up with the class as it progressed through the material. All of these comments reflect a favorable attitude of the students toward the A-T method.

There were 20 scattered responses to the question, "What do you like least (about this method)?". This seems to indicate no major sources of discontent. Fifteen percent objected that the course consumed too much time. However, this response could refer either to the time necessary for A-T method or to a physics course generally. Ten percent felt that it was easy to waste time, while another ten perncet felt that they, instead of their teacher, should be responsible for discipline. Ninety percent of the 40 students said it was their own idea to take physics. This response might explain the high positive feelings for the A-T method.

Eighty-five percent were in favor of using the A-T method again for the second semester while only 2.5 percent were undecided.

The motivation and self-discipline factor appears in response to the question, "How have your feelings about this method changed since the first two weeks of school?" Fifteen percent responded that they felt the need to do more than "just get by." Once again, it is difficult to separate method and course in the interpretation of this response. There were in all 13 different responses to this question.

The last question on the survey was a general free-response question about the course. Two students made comments about the instructor, four about themselves, and two about physics in general. 22 percent did not respond, while 22 percent responded favorably and 5 percent responded with a negative response. Fifteen percent indicated that time was a significant factor, possibly to the point of affecting performance in the course.

DISCUSSION

It is the feeling of many educational researchers that a formal evaluation should not be imposed upon a new and still developing educational innovation. The major reason for this feeling is to aviod fixing the development at a premature stage. Further, the assessment procedure must not alter the quantity being measured. A highly formal system for evaluation could very well have a stifling restrictive effect on a program that should be steeped in development and creativity. Formal, systematic evaluation should be undertaken after the innovation program has been developed and taken on a more definitive form.

SUGGESTIONS FOR FURTHER RESEARCH

Limitations: The major weakness of this evaluation is two-fold. First, the research design was a field study. It is difficult to draw explicit cause and effect relationships from such a quasi-research design.

Second, the criterion scores used were primarily physics achievement oriented, and the group-equating varibles were primarily general achievement oriented. While subject matter achievement evaluation is an important factor to students, parents, teachers, and administrators, one would be remiss to ignore other noncognitive aspects of the A-T program of instruction.

For instance, this approach to teaching physics generally places much of the responsibility of learning on the student. A determination of the effect of this emphasis on student responsibility for learning should be made. How does the A-T method affect attitude and motivation of a student? Does he continue to "...learn mainly to aviod the consequences of not learning for his own personal experience?"

An additional important question might be asked. Does the additional free time available to the instructor for individual teacher-student interaction make important differences? These and other questions will be useful in generating answers which will be of interest to educators and researchers alike. A well-designed, truly experimental research setting would be helpful in evaluating the answers to these questions.

FURTHER RESEARCH

The conclusions drawn from a true experiment are in general more valid than conclusions drawn from a field study. The true experiment is a research setting in which the treatment variable is manipulated by the experimenter; e.g., given or withheld to randomize subjects. The major characteristics of a true experiment are discussed below. (For more detailed information, one might consult Kerlinger (1965).) The principle of randomization is crucial to an experiment. With randomization, it can be assumed that there is equality of groups.

A second principle is to bring variables under control. One must provide a control group; e.g., a group not unequal in all characteristics to the experimental group, that receives some other treatment. Combining these two principles after having defined the population, one would randomly assign individuals to two equal groups, and then randomly assign these groups to experimental or control treatment. In this study, the population would be all students enrolling in physics, and assignment would be accomplished by using a table of random numbers. Ideally, neither the students in the control nor those in the experimental groups would know they are taking part in an experiment.

The treatment the experimental group receives should be developed from the objectives or hypotheses developed from a thorough appraisal of the objectives of the study.

The data collected should be derived from among the criteria of greatest interest in the educational situation.

Analysis of the data should be consonant with the original design, and should use those statistics which are appropriate for the levels of measurement used in the data collection.

After the analysis, the conclusions should be made accessible to those who are interested. Dissemination should be a well-planned process, designed for maximum information transfer.

A. DESCRIPTION OF STATISTICAL METHOD USED

To assess the impact of a given program or treatment, one compares the treatment group with a control on some varible, in this case a numerical score. The F-ratio, or F-test, is a statistical method of determining if the difference between the two group means is significantly different. That is, it determines the probability of obtaining a difference between the means by chance alone. A level of significance of .01 implies that one would expect the obtained scores to occur, by chance only, once in 100 times.

In the analysis of variance (Anova), or F-test scheme used in this study, testing was done at the .01 level of confidence (Buros, 1959).

Only one significant difference was observed. The control group scored significantly higher on the first six weeks grade index at the .01 level.

B. Comparison and Criteria Variables, Analysis of Results.

Variable	Group	Mean	Std. Dev.	F-Ratio	Significance
Comparator 1-Second Semester Geometry Grade	C A-T	2.927 2.825	1.253 0.984	0.1649	NS
Comparator 2-Fourth Semester Index	C A-T	2.894 2.749	0.688 0.651	0.9480	NS
Comparator 3-PMA Verbal Subscore	C A-T	114.56 109.30	16.471 19.601	1.714	NS
Comparator 4-PMA Number Subscore	C A-T	119.27 118.13	11.722 20.343	0.0966	NS
Comparator 5-PMA Reasoning Subscore	C A-T	120.46 116.30	14.457 16.578	1.4532	NS
Comparator 6-PMA	C A-T	115.78 112.45	13.613 16.129	1.0104	NS
Comparator 7-PMA Total	C A-T	120.78 120.35	11.663 9.598	0.0328	NS
Criterion 1-Unit Test #1	C A-T	1.6634 1.2550	1.1122 0.8436	3.4545	NS
Criterion 2-Unit Test #2	C A-T	1.8110 1.7107	1.1030 0.7328	0.2306	NS
Criterion 3-Unit Test #3	C A-T	1.3354 1.8400	0.9974 0.8304	6.1080	NS
Criterion 4-Unit Test #4	C A-T	1.0341 1.1650	0.8472 0.6669	0.5947	NS
Criterion 5-Unit Test #5	C A-T	1.0683 0.7560	1.0701 0.7353	2.3320	NS
Criterion 6-First 6 Weeks Grade	C A-T	2.0124 1.4677	0.9202 0.6810	*9.1334	Significant (p=.01)
Criterion 7-Second 6 Weeks Grade	C A-T	1.4966 1.7072	0.9706 0.7015	1.2482	NS
Criterion 8-Third 6 Weeks Grade	C A-T	1.6788 1.2917	0.9092 0.7035	4.5749	NS
Criterion 9-First Semester Grade	C A-T	1.6810 1.4862	0.9095 0.5537	1.3466	NS

*F(.99) (1.79)=7.01

Criterion grades based on grade index-A=3.0,B=2.0, etc.

Easy to get behind from spending too much time on one topic 1	Reading Text 1	Lab Reports 1
Too much work 1	Not enough illustration on lab work 1	Too much time between tests 1
Lack of clarity 1	Pressure near test time 1	Tapes do not allow for concentration 1

Don't enjoy being a guinea pig 1	Boring 1	Harder to ask questions 1	Guidelines not precise 1

(7) Question: WAS IT YOUR IDEA TO TAKE

a. If no, whose was it?
b. If yes, why did you want to?

Yes	No	
36	3	Parent's choice

Reasons

Better future preparation	Required for college	Interesting	Challenging
12	10	9	4

Counsellor's advice	Like science	Recommendation of friend or parent
2	1	1

Science major requirement	Better electronics understanding
1	1

(8) Question: WHAT PERCENT OF THE PROBLEMS ON THE AVERAGE, DO YOU ATTEMPT TO WORK BEFORE EACH AUDIO LESSON?

0-25%	26%-50%	51%-75%	76%-100%
5	8	12	13

Can't say	No response
1	1

(9) Question: DO YOU WANT TO USE THIS METHOD NEXT SEMESTER?

Yes	No	Undecided
34	5	1

(10) Question: DO YOU FEEL DIFFERENTLY ABOUT THIS METHOD NOW THAN YOU DID DURING THE FIRST TWO WEEKS OF SCHOOL? IF YES, IN WHAT WAY?

Yes	No	No Response	Undecided
32	5	2	1

Need to do more than "just get by"	More understanding	Lessons come much harder
6	5	4

Course "got worse"	More enjoyment	Know better how to use it
3	3	3

Adjustment time a factor	Easier now	Course is more than just tapes
2	2	2

Helps my "organization"	Less fun	More confident
2	-	1

Course "got good"
1

(11) Question: WHAT DO YOU WANT TO TELL ME ABOUT THE COURSE THAT I DIDN'T ASK? Although the students were to comment about the course, 2 commented about the teacher, 4 about themselves, and 2 about physics in general.

Nothing -	General positive response	General negative response
9	5	2

Time element a big factor

Negative	Positive	Better explanation desired	Instructor should answer questions without making student feel ignorant
5	1	3	1

Neighbors are distractors	Likes no lecture idea
1	1

Desires external discipline	Need more lectures
1	2

D. RECOMMENDATIONS TO LOWELL KNOOP ON CLASS QUESTIONAIRE

The opinion survey conducted by Knoop in the audio-tutorial physics class at Jefferson High School seems to have done a good job in surveying student opinion. Student's reactions to the course as recorded were very favorable and comments indicated particular aspects of the course which they especially liked. Some suggestions for another survey similar to the first one have been made by Professor Asher and Michael Szabo. The rest of this memo will concern itself with these recommendations.

The questions on the first survey were very good for surveying student opinion. Question #2 was especially good. Perhaps many of these questions could be included on the next survey to further assess student reaction.

Each item used should be checked to see if it meets the desired objective namely that of surveying student opinion.

Try to get 100 percent response from all the students on all of the items. The lack of a full response reduced selection factors.

Of interest might be the assessment of the following items:

(a) How do students feel about distracting influences which are encountered due to the lack of individual private study areas?

(b) Do the students perceive any difference between this class and their regular classes concerning attitude which permeates the class structure?

E. References

1. Knoop, Lowell, "High School Physics by Audio-Tutorial Mode," The Physics Teacher, 6 (2), February 1968.

2. Kerlinger, Fred N., Foundations of Behavioral Research, New York: Holt, Rinehart and Winston, 1965.

3. Skinner, B.F., "Teaching Science in High School-What is Wrong?" a paper presented at the December 1967 meeting of the American Association for the Advancement of Science, New York.

4. Buros, O., ed., The Sixth Mental Measurements Yearbook, Highland Park, New Jersey: Gryphon Press, 1959.

Preliminary Evaluation (#2)

1968-1969

Preliminary Evaluations of Two Courses Taught by Audio-Tutorial Systems: Secondary Physics and Undergraduate Botany.*

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Purdue University

Attempts to objectively evaluate curriculum innovations have often been criticized for lack of thoroughness and inappropriateness of evaluative objectives. Evaluation of the effectiveness of the audio-tutorial (A-T) instructional approach to science teaching at the secondary and undergraduate level is the topic of this paper.

Guidelines and a theoretical framework for this evaluation were consistent with the curriculum evaluation model suggested by Scriven (1967). More descriptive information on the instructional aspects of audio-tutorial systems are being presented in this symposium and may also be found in Knoop (1968) and Postlethwait (1964).

The outline of this presentation naturally divides itself into 2 parts. The first centers around the investigation of the instructional effectiveness of a secondary physics course. The second part is a report of similar activities, presently in the data-gathering stages, in an undergraduate level botany course.

AUDIO-TUTORIAL PHYSICS

During the 1967-1968 school year, Knoop (1968) developed and implemented a course in secondary physics for juniors and seniors at a large midwestern high school. The course was based upon the audio-tutorial system of instruction. To investigate the effectiveness of the course, assess feelings and attitudes of the students, and

*A paper presented at the annual convention of the National Society for Programmed Instruction, Washington, D. C., April, 1969.

attitudes of the students, and provide feedback on both week and strong features of the program, an evaluation study was conducted. During the current 1968-1969 school year, the somewhat revised course is in use with 60 students.

The results of the evaluation will be presented in chronological order with the findings from the 1967-1968 school year data presented first. Analysis of the 1968-1969 data is incomplete at this writing. The data included are pretest scores, posttest (achievement) scores, grades, results of student attitude questionaires, and a multiple regression analysis.

<u>1967-1968 School Year</u>

1. <u>Cognitive Data</u>

To asses the effectiveness of A-T in the 1967-1968 school year, a field study research method using intact groups was necessary. Kerlinger defines field studies as "...scientific inquires aimed at discovering the relations and interactions among sociological, psychological, and educational varibles in real social structures." (Kerlinger, 1964, p. 387).

A control group was desirable and obtainable since the instructor kept systematic evaluation records of past physics classes. Thus a quasi-control group was available in the previous year's population of physics students.

Of a total sample of 98 students, general school background data on 17 students was incomplete. These students were omitted from the study after they were compared on the background variables and found to be equivalent to the students with complete background data. This left a control sample of 41 students and an experimental group of 40.

Both control and A-T groups were required to exhibit similar behavioral objectives to indicate their mastery of physics. The unit tests in physics for both groups were nearly identical, thus allowing meaningful comparisons on these criteria. It was decided to limit the initial evaluation to nonobtrusive effects if possible. The antecedent variables consist of scores on seven variables obtained from school files. They are: geometry grade, fourth semester grade index, and the total and four subscores (verbal, numerical, reascning, and spatial) from the Primary Mental Abilities Test. All criterion scores were achievement measures. They are: five unit tests, three six weeks grades, and first semester grade.

2. <u>Attitude Questionaires</u>

Two attitude questionaires, developed by Knoop (1968), were administered to the A-T students. The first was given approximately two months after the beginning of the school year; the second near the end of the full school year. A comparison group of students, consisting of those taking conventional physics also took the second questionaire. The responses of this latter group made possible a meaningful comparison of attitudes of A-T students with attitudes enrolled in conventional physics.

3. <u>Regression Analysis</u>

A step wise multiple regression analysis was run on a CDC 6500 computer at Purdue University. The predictor variables were 4th semester grade index, geometry grade, and the verbal, numerical, reasoning and spatial subscores of the PMA. The criterion was first semester physics grade. Separate analyses were performed on the control and audio-tutorial groups to enable the researchers to determine which individual learner characteristics from the above predictors are important to success in A-T and conventional physics. Build-up multivariate regression analysis was employed.

4. <u>Pretest Results</u>

The first comparison was seven scores used to determine if the control group differed significantly from the experimental group before they took physics. The control group was not significantly different. Thus one can assume equality between the groups on these variables available prior to the treatment.

See <u>Table 1</u> on the following page.

5. <u>Posttest Results</u>

Nine criteria scores were used to assess the effects of the A-T instruction. Although no significant differences were found between the two groups on eight of the nine criterion scores, the A-T group achieved higher means in four of the nine scores. The control group scored significantly higher on the first six weeks grade. (p. .01)

A possible explanation for this may be that the adjustment period to A-T is a new experience for the students. This conjecture seems to be supported by the results of the second six weeks marking period. The A-T group mean is numerically higher than the control's. An overall interpretation could be that the A-T physics program compares favorable with a regular physics class on achievement measures. Thus it would seem that the A-T method should be recommended as a method of instruction until further evidence is presented.

Table 1

Analysis of Prestes and Posttest Data, 1967-1968

Variable	Group	Mean	Std. Dev.	F-Ratio	Significance
Comparator 1-Second Semester Geometry Grade	C A-T	2.92 2.82	1.25 0.98	0.16	NS
Comparator 2-Fourth Semester Index	C A-T	2.89 2.74	0.68 0.65	0.95	NS
Comparator 3-PMA Verbal Subscore	C A-T	114.56 109.30	16.47 19.60	1.71	NS
Comparator 4-PMA Number Subscore	C A-T	119.27 118.13	11.72 20.34	0.10	NS
Comparator 5-PMA Reasoning Subscore	C A-T	120.46 116.30	14.45 16.57	1.45	NS
Comparator 6-PMA Spatial Subscore	C A-T	115.78 112.45	13.61 16.12	1.01	NS
Comparator 7-PMA Total	C A-T	120.78 120.35	11.66 9.59	0.03	NS
Criterion 1-Unit Test #1	C A-T	1.66 1.25	1.11 0.84	3.45	NS
Criterion 2-Unit Test #2	C A-T	1.81 1.71	1.10 0.73	0.23	NS
Criterion 3-Unit Test#3	C A-T	1.33 1.84	0.99 0.83	6.11	NS
Criterion 4-Unit Test #4	C A-T	1.03 1.16	0.84 0.66	0.59	NS
Criterion 5-Unit Test #5	C A-T	1.06 0.75	1.07 0.73	2.33	NS
Criterion 6-First 6 Weeks Grade	C A-T	2.01 1.46	0.92 0.68	*9.13	Significant (p .01)
Criterion 7-Second 6 Weeks Grade	C A-T	1.49 1.70	0.97 0.70	1.25	
Criterion 8-Third 6 Weeks Grade	C A-T	1.67 1.29	0.90 0.70	4.57	NS
Criterion 9-First Semester Grade	C A-T	1.68 1.48	0.90 0.55	1.35	NS

*F(.99) (1, 79) = 7.01

Criterion grades based on grade index - A = 3.0, B = 2.0, etc.

6. <u>Results of Questionaires</u>

The results of the questionaires were not surprising to those who had observed the students and listened to their comments during informal conversations. It was found that, in general, the A-T students enjoyed physics, exhibited much enthusiasm for the course, and were highly involved in the subject matter. In view of the declining physics enrollment (Phi Delta Kappan, 1968) these results show promise for reversing this trend.

A sample of student responses is presented in Table 2. Forty percent of the students felt they understood physics better than their friends in conventional physics. This result indicates a bit of uncertainty on the part of the other 60 percent with respect to the instructional power of this technique. Without qualification, however, 85 percent of the students indicated they liked the A-T method.

Two factors were repeated frequently as being outstanding features of the A-T method: (1) the opportunity to repeat or go over material the student felt was not originally clear, and (2) the ability to proceed at one's own rate of progress.

There were 20 scattered responses to the question "What do you like least?" (about this method). This seems to indicate no major source of discontent with A-T. Eighty-five percent were in favor of using the A-T method for the second semester while only 2.5 percent were undecided.

From the results of the student responses on the second questionaire, a comparison of student attitudes in A-T and regular physics is possible. Each group indicated they felt the same about "physics in general." Most A-T students (90% vs. 51%) felt there was more than the average amount of class time available to talk with the instructor. Fifty-nine percent of the A-T group said they would highly recommend the A-T approach to next year's students, while only 36 percent of the regular group made the same statement about regular physics. The A-T group indicated stronger feelings of liking independent study than their control counterparts.

In terms of student attitudes toward the course, the A-T method is a success. This is an encouraging sign for those who feel that success and positive attitudes toward physics and physics courses is an important course objective.

See Table 2 on the following page.

Table 2

Content Analysis of Selected Items from the First Questionaire

(2) Question: DO YOUR FRIENDS IN STANDARD PHYSICS HAVE A BETTER DEAL THAN YOU DO?

Yes	No	No Response	Undecided
10	23	1	6

(4) Question: DO YOU LIKE THIS AUDIO-TUTORING METHOD?

Yes	No	Undecided
34	4	2

(5) Question: WHAT DO YOU LIKE BEST ABOUT THIS METHOD?

Progress at own rate of speed	Go over the material that is not clear or has been forgotten	Not Boring
15	14	4

Element of selection concentrate on a most unfamiliar material	Freedom	Take lectures home
3	14	4

Little or no pressure	Nothing	No lectures
1	1	1

Laboratory movies	Allows for sufficient time	Easy for teacher
1	1	1

Easier to waste time	Better understanding
1	1

(6) Question: WHAT DO YOU LIKE LEAST?

Too time consuming	Easy to waste time	Must discipline self
6	4	4

Labs	Not enough explanation	Can't get all the work done	Not enough lecture
2	2	2	2

Easy to get behind from spedding too much time on one topic	Reading text	Lab reports
1	1	1

Too much work	Not enough illustration on lab work	Too much time between tests
1	1	1

Lack of clarity	Pressure near test time	Tapes do not allow for concentration
1	1	1

Don't enjoy being a guinea pig	Boring	Harder to ask questions	Guidelines not precise
1	1	1	1

7. Results of the Multiple Regression Analysis

The results of the stepwise regression analysis revealed that the multiple R^2, corrected for bias (Guilford, 1965) was .78 for the control group and .22 for the A-T group. These figures indicate that the variables which successfully predicted success for the control group failed to predict success for the A-T group. The overall multiple R for the control group was significant, but not significant for the A-T group. In addition, the difference between the multiple R's was significant(p .01).

A feasible explanation for these results is that the A-T method reduces the variance, or range of student performance on the criterion. Hence the multiple R is low due to restriction of range. An F test for equality of the variances of the two groups revealed that the two variances of the six predictors showed the variances to be equal. Thus the restriction of the range appeared to be related to the instructional setting associated with A-T.

It was also observed that the predictors in the final regression equation were different for the control and A-T groups. All 6 predictors went into the final equation for the control group, and 5 predictors comprised the A-T group final regression equation.

When the individual predictors were tested for significance (Guilford, p. 403), the fourth semester grade index and the reasoning subscore of the PMA were significant (p .01) for the control. For the A-T group, only the geometry grade was significant (p .01).

In view of these results, it can be stated that the 4th semester grade index and the PMA's reasoning subscore are more than adequate to explain the criterion variance for the control group. One should be cautioned that these results have not yet been subject to cross-validation.

1968-1969 School Year

A more formal comparison, designed in an experimental fashion, is presently under investigation. Ss are randomly assigned to A-T or conventional physics classes. Ten percent of the students had their physics assignments changed due to acheduling conflicts.

As in the previous year's study, the control group (n=35) was compared to the A-T group (n=60) on algebra grade, geometry grade, 4th semester grade index, and the 5 PMA scores. Using unequal cell analysis of variance, it was discovered that the A-T group had significantly higher algebra grade means and fourth semester index (p .01). Evidently the schedule changes necessary after randomization introduced a systematic bias into the comparison. Analysis of covariance with 4th semester grade index as covariate on the criteria of first semester test and first semester grade was used.

No significant differences were found between treatments on the two criteria. The control group achieved a slightly higher mean on both measures.

Discussion

The fact that group means were not different for course performance may indicate the success of the A-T approach. Students in a new approach to teaching physics as well as students enrolled in a course taught in a well-established, well-tested manner. In addition, the A-T method resulted in a high level of enthusiasm and interest in the course. It should be noted that the curriculum developer designed and implemented the course with an emphasis on the role of the student in assuming the responsibility for learning. While some educators, such as Lindvall and Bolvin (1967), urge the adoption of independent study for the complete school experience, it must be recognized that the A-T students are: (a) spending only a small fraction of their time in some organized form of independent study (i.e., one period per day, once in four years of high school) and, (b) coming into direct contact with independent study for the first time in their scholastic careers. How well do the students assume this responsibility as the course progresses? If they fail to do so, what can be done in the course to more adequately develop this motivation? Perhaps more saturation in independent study is the answer (Lindvall and Bolvin, 1967). It is also highly possible that an important function of a course of this nature is to identify students with high potential for independent study (Chickering, 1964). As our knowledge of individual learner characteristics and instructional media becomes more thorough than it is today, the answers to these and other questions should unfold.

Table 3

Multiple Regression Analysis Results, 1967-1968

Variable	Control Group	A-T Group
Multiple R^2 (corrected for bias)	.781*	.222
Significance of Individual predictors.		
4th semester index	*	not significant
geometry grade	not significant	*
verbal, PMA	" "	not significant
numerical, PMA	" "	" "
reasoning, PMA	*	" "
spatial, PMA	not significant	not significant

*(p .01)

APPENDIX D

RESULTS

SOCIAL STUDIES SUMMER WORKSHOP 1969

ELEMENTARY

JUNE 9-27, 1969

1. In your opinion, how helpful has this workshop been?

1	2	3	4	5
Not at all				Very Helpful

14 -- 5

8 -- 4

2. What aspect of the workshop experience interested you most?

12 Materials and facilities available for use.

7 Assistance in operating machines and the use of media and visual aids.

3 Examining new materials.

2 Working on own units.

3. Do you feel that the Center staff offered enough assistance and guidance during the workshop period?

10 Yes

3 Very helpful

2 Yes, very helpful

2 Did all they could

1 Adequate

1 Staff was excellent

1 Uncertainty at beginning, but progressed very well

1 Good assistance and guidance

1 No

If not, what do you feel was needed?

1 Desired results were left rather vague.

4. Were resources plentiful enough for you to work toward fulfilling your objectives -- the development of supplemental resource units?

18 Yes

1 Excellent

1 Most of the time

1 Never been where it was as plentiful

1 No (fairly limited)

5. On a personal experience level, how would you evaluate the value of this workshop?

___6___ Excellent

___3___ Very helpful

___2___ Very good

___2___ Great

___1___ Helpful

___1___ Good

___1___ Most valuable

___1___ Very rewarding

___1___ Very beneficial

___1___ No Answer

___1___ Very informative

___1___ Best to prepare good class work

___1___ Effective

6. Do you feel that units developed will be helpful to classroom teachers in the coming year?

___15___ Yes

___2___ Definitely, yes

___1___ Some

___1___ Very much so

___1___ Hope so

___1___ Could be informative

___1___ It will be for those who prepared them

7. Will you be using some to these units to enrich your social studies program?

___16___ Yes

___2___ Definitely, yes

___2___ Definitely

___1___ All of them

___1___ All units on my level

8. Has the workshop changed your concept of the Center?

___19___ Yes

___3___ No

If so, how?

12 Now aware of materials and services available

3 Now understand how it works and its functions

2 Better acquainted with materials

1 Helped in preparing classes

9. What suggestions can you offer for the improvement of Center services to the Center area schools and teachers?

4 Services have been satisfactory

4 No comments

3 Workshops -- spread word

2 Continue operation

2 Explanations of what is available

2 Tours of WVEC

2 More resource materials

1 Released time to become better informed

1 Open longer in the evenings

1 Meetings for teachers

1 More time for use of materials

10. How far did you commute daily to attend the workshop sessions?

6 76-100 miles

4 51-75 miles

4 26-50 miles

3 16-25 miles

3 1-15 miles

2 less than 1 mile

11. a. If you had it to do over, would you volunteer to participate?

22 Yes

b. Based on your experience here, would you encourage colleagues to become involved in Center activities?

22 Yes

12. During the 1969-1970 school year, what do you think the social studies program of the Center can do to best help you and your colleagues in your own school corporation?

3 Send out information and explanations on all new acquisitions

3 More materials

3 Be sure teachers know what materials are available

2 Continue services previously offered

2 Keep materials readily accessible

2 More information to school boards about free material

1 Be open in the evenings

1 Suggestions on obtaining materials

1 Advice and help

1 Consultant

1 Tours

1 Go out to schools

1 Keep teachers up-to-date on new social studies programs

1 Have map overlays made up for each person who might ask for them

1 Speakers in specified fields

1 Have a pre-set date (Saturday) to use the materials and machines for up-dating our needs about once every two months.

1 More media boxes

CREATIVE TEACHING DAY - Purdue Memorial Center - April 25

Schedule of sessions of most interest to Secondary Teachers

9:00-10:00	EXCHANGE FORUM 9th Grade Social Studies Electives Panel of administrators and teachers now involved in such courses Room 313	TEAM TEACHING ~~WITH~~ MULTI-MEDIA UNITS Room 310	TEACHER-STUDENT DEVELOPED GAMES "The Legislative Game" Room 311	REGISTRATION BEGINS AT 8:30 Second Floor - PMC --------------- Coffee - cokes - snacks available second floor lounge. Lunch available in Union. --------------- Time will be set aside in every sessions for questions, discussion, exchange of ideas. Interaction emphasized! --------------- Don't miss a session just because it is not in your special area - IDEAS are the thing! Come and see what you can adapt to your classroom situation.
10:00-11:00			THE CULTURAL AREAS APPROACH IN WORLD HISTORY 10:00 - 11:30 Room 311	
11:00-12:00	TAPE SLIDE PROJECT Motivation Unit Intro to Non-West Room 310	ECONOMICS - COMPARATIVE SYSTEMS Room 313		
12:00-1:00	12:30 -1:45 MULTIPLE RESOURCES IN THE JUNIOR HIGH Room 313		12:30 - 1:30 THE WEST - AMERICAN INDIANS. Tape-slide ideas with music, art and photographs. Room 310	
1:00-2:00		STUDENT DEVELOPED AUDIO-TUTORIAL UNITS Civil Liberties Immigration Minorities Room 311		
2:00-3:00	PROBLEM SOLVING WITH MULTI-MEDIA Room 313			

CREATIVE TEACHING DAY - Purdue Memorial Center - April 25

Schedule of sessions of most interest to elementary teachers

9:00 - 10:00	CREATIVITY WITH I.T.A. Room 209	TEACHING ABOUT INDIANA Room 213		TEAM TEACHING WITH MULTI-MEDIA UNITS (American History) Room 310	REGISTRATION BEGINS AT 8:30 a.m. Second Floor - PMC ----------- Coffee - cokes - snacks available in second floor lounge. Lunch available in Union -----------
10:00 - 11:00	NEIGHBORS - Second grade Room 209	THE U.S.A. -Using Regional studies and group work Room 213			
11:00 - 12:00	PRIMARY READING "Open Court" with A.V. aids Room 209	INDIANA - MAP SKILLS Room 213	TAPE-SLIDE PROJECT MOTIVATION INTRO TO NON-WEST Room 310		Don't miss a session just because it is focused on a different area than you are NOW teaching - or on a different grade level! -----------
12:00 - 1:00			12:30-1:30 Room 310 THE WEST - THE INDIANS		Time will be set aside in each session for questions, discussion and exchange of ideas.
1:00 - 2:00	IDEAS FOR SLOW LEARNERS (Primary Oriented) Room 209	POLLUTION UNIT (Intermed) Room 213	Tapes & Slides Music, Art, Photographs	AUDIO-TUTORIAL Student developed units: Civil Liberties Minorities Immigration Room 311	----------- Although developed for high school, the Team Teaching & Audio-Tutorial sessions should be of interest to intermediate teachers.
2:00 - 3:00	NEW KINDERGARTEN AND PRIMARY LEARNING KITS Room 209	PROBLEM SOLVING WITH MULTI-MEDIA Room 313			

POST MEETING EVALUATION

CREATIVE TEACHING DAY

April 25, 1970

1. How helpful has this workshop been for you?

1	2	3(5)	4(18)	5(19)
Not at all				Very helpful

2. What aspect of the workshop helped or interested you most?

--IDEAS (listed in various ways)
--Ideas from other teachers
--Exchange of ideas
--Ideas to get children interested in learning
--Ideas for slow learners
--Ideas on things to make for the classroom
--Reading tips
--Practicality - seeing things that have worked
--Ways to individualize
--The practical aspect - things and ideas I can actually put to use in my classroom
--Indiana history resources, book lists
--ITA
--Session on slow learners
--Teacher aid ideas
--Open Court Reading
--ITA
--Kindergarten-primary learning kits
--Proven ideas, that had been successfully used by experienced teachers - materials and ideas were very ably presented
--Ideas that can make learning more interesting
--Ideas for using all media

3. What session or sessions did you most enjoy?

--Intermediate grade sessions
--Slow Learners and Learning kits
--Indiana History and Map Skills
--Slow Learners
--U.S.A. - Regional studies
--I.T.A. and Open Court Reading
--Junior High-Senior High project ideas
--Neighbors
--Everything I visited!
--Use of media and projects
--All on multi-media
--Ideas to use tapes, slides, other media besides films
--Team teaching and problem solving with multi-media

4. How likely is it that you will use some of the ideas and/or materials presented today?

--Likely
--Very likely, especially map skills
--Will try!
--I may even be teaching special ed. next year. This helped!
--Most likely will use some of these ideas presented today
--I plan to make some of the materials during the summer
--Very!
--Want to try, at least
--I wasn't aware of the Human Values Series and pictures. I plan to use those. The Peabody Language Kits also interested me.
--Several new ideas were mentioned by either consultants or other teachers which will be helpful
--Yes, very likely that I will use the materials presented today
--Several ideas useable
--I'm sure I will

5. Please feel free to add any additional comments below:

--Enjoyed it all
--We need curriculum services and days like this!
--I benefited very much from the discussion we had in U.S.A. Regional studies
--It is sad that no more teachers could be here for this exchange of ideas
--A worthwhile day!
--A good day!
--Workshop most worthwhile in my opinion. Workshops of this nature have many advantages over summer school. I hope necessary funds become available to WVEC
--Wish this had been at the beginning of the year
--Good day! Good job!
--We need more like this
--All sessions were very well conducted
--More ideas - teacher exchanges were disappointing in the kindergarten session
--A most valuable day for social studies teachers! Now if I can manage to adapt some of these ideas to English, I'd like a similar day for English teachers
--Slow learners session was really more geared for special ed. Really not much new information - I feel a need for help with normal IQ children with learning disabilities - in other words, ideas a little more advanced (I think the trend is so much toward the learning disability area now)
--The final (New Kits in Kindergarten-Primary) presentation was quite new and interesting
--I enjoyed listening and seeing practical ideas that can be made by me, and used as such or adapted to my situation
--The most valuable part has been the ideas I've picked up on things to make

--Interested in your multi-media units, but just now I've little opportunity for audio-visual

--I attended the primary sessions. All were interesting, well organized and helpful

--It's inspiring to observe that our own classroom teachers are so creative - it gives me incentive to try new things

--The multi-media approach opens new vistas for teaching and learning!

6. Please check your role (DO NOT SIGN YOUR NAME)

Elem 30 Junior High 5 Secondary 3
Student 3 Administrator 2 Teacher 40
(4 listed only teacher, no level)
NOTE: Secondary sessions were held on another floor - we missed getting forms back from many participants.

APPENDIX E

WABASH VALLEY EDUCATION CENTER
500 By Pass 52 West - University Square
West Lafayette, Indiana 47906

December 1, 1969

Dear Teacher:

Due to the expanding wealth of knowledge in the field of special education, I realize that it is just about impossible for a classroom teacher to keep up with the new techniques, methods, and materials currently in use today. I also am quite aware that it is sometimes impossible to grant teachers time off to look into the many new and innovative areas of development in special education.

As you well know from my introductory letter to you I am serving in the capacity of Special Education Curriculum Consultant for the Wabash Valley Education Center. One of my responsibilities as outlined to you in this letter is to work with the classroom teachers in improving classroom instruction. An effective means of transmitting some of the new developments in the area would be to give the teacher the opportunity to visit some other programs. Since there are a lot of materials at the Wabash Valley Education Center, I feel it is essential that the teacher get a look at them. Also, I feel they should have the opportunity to visit some other program, such as the Purdue Achievement Center or the Wabash Center for the Mentally Retarded or some other special education classroom.

I would like to be of assistance to you in an in-service training day that would enable you to grant some time off for the teacher without interferring with the student's schedule and also eliminate the need for a substitute.

I would like to come into the teacher's classroom in the morning, after I have made arrangements with her, and parallel teach with her. Then, after I have become acquainted with scheduling, programming, and the student's unique individual needs, I would substitute teach for the rest of the day, thus freeing the teacher for professional enrichment. This would also allow me to become aware of the classroom situation in your system leading to a much more comprehensive curriculum planning development.

I would like to begin this in the month of January. If this meets with your approval, please sign and return the enclosed form. Thank you for your cooperation.

Sincerely,

James R. Taylor
Special Education

WABASH VALLEY EDUCATION CENTER
500 By Pass 52 West - University Square
West Lafayette, Indiana 47906

January 22, 1970

Mr. Lon Woods, Supervisor
Program for the Mentally Retarded
Department of Special Education
Room 108, State Office Building
Indianapolis, Indiana 46204

Dear Lon,

I am writing to you in hopes that we might be of assistance to each other in the area of curriculum development. I am sure you are well aware of the fact that an adequate and comprehensive curriculum needs to be developed for our state. A new approach must be taken. Since I agree wholeheartedly with Dr. James Gallagher in his criticism that the practice of getting local groups of teachers together to write curriculum is "one of the weaknesses of our present system in special education," (1967 Exceptional Children)

An examination by Sinches and Bohn in 1963 of over 250 curriculum guides for the educable mentally retarded found that exsisting guides lacked sequence and comprehensive development.

They concluded that the special education curriculum is in reality "not distinctive, but a watered down version of the curriculum for normal children."

If we put our primary focus, as Dr. Gallagher (1969) suggests, on curriculum review, I would wager to say we would find some of the same basic problems apparent now as there were in 1963. He further suggests that another primary focus that should be pursued by special educators is curriculum reform.

This leads me to the next point which I would like to consider. I would like to suggest that we make a concentrated and coordinated effort together so we do not develop just "another curriculum". The point made by Gallagher that we give "consideration to the possibility of a massive curriculum project involving psychologists, sociologists, anthropologists and special educators," is an idea that I thought we might discuss in our preliminary plans for the development of a curriculum.

Dr. Robert Puchigame (October, 1969) states that the old curricula in special education are inappropriate or inadequate. He suggests that some of the forces or sources of major influence which indicate possible directions for curriculum development should include: regular education, compensatory education, prescriptive education, and special education.

I thought some of the preceeding comments and suggestions would be very appropriate in our discussion of curriculum design for the future. I am looking forward to hearing from you on this matter in the near future. I would appreciate hearing from you before the IFCEC in Indianapolis, so I can consider your comments. Then, if we could get together sometime during the convention we might be able to sit down and discuss some of the possible steps to take. I hope everything is well with you and will be looking forward to our working together on this matter.

Warm regards,

James R. Taylor
Special Education
Curriculum Consultant

JRT/zm

cc: Leslie Bringgar

"The one thing certain about a dynamic curriculum is change"

Bernice B. Baumgartner

(copy)

WEST LAFAYETTE COMMUNITY SCHOOL CORPORATION
141 ANDREW PLACE
WEST LAFAYETTE, INDIANA
47906

2 December 1969

Mr. James Taylor
Wabash Valley Education Center
500 By-Pass 52 West
University Square
West Lafayette, Indiana 47906

Dear Jim:

A note of appreciation for your contributions to our recent workshop.

It is always nice having dependable friends supporting us.

Cordially,

/s/ Carmon P. Fabian

Carmon P. Fabian
Assistant Superintendent

CPF:ms
CC: Mr. William Floyd
Director, Wabash Valley
Education Center

(COPY)

KOKOMO-CENTER TOWNSHIP
CONSOLIDATED SCHOOL CORPORATION
ADMINISTRATION BUILDING

April 7, 1970

Mrs. Mary Hildebrant, Coordinator
Cass County Joint Special Education
2829 George Street
Box 718
Logansport, Indiana 46947

Dear Mrs. Hildebrant:

I have set the following assignments for the in-service training day in Kokomo on Wednesday, April 15, 1970. The Kokomo teachers will expect your teachers at 9:00 a.m. at the respective schools:

School	Kokomo Teacher	Logansport Teacher
McKinley 1217 W. Carter (Mr. Link, Prin.)	Mrs. Wessendorf (P)	Baker Zerkel
	Mrs. Rush (I)	Nelson
Roosevelt 220 N. Washington (Mr. Brooke, Prin.)	Mrs. McCoy (P)	Lindsey Minks
	Mrs. Rayl (I)	Ritzenhaler
Meridian 700 Apperson Way S. (Mr. Lawson, Prin.)	Mrs. Hockman (P) Mrs. Dossey (I)	Whaley McNulty
Bon Air 2800 Apperson Way N. (Mr. Hawkins, Prin.)	Miss Cassidy (MS)	Smith Elson
Sycamore 1600 E. Sycamore (Mr. Russell, Prin.)	Mrs. Scott (MS)	Bannon Watts

Mr. Taylor had suggested that the visitation be from 9:00 a.m. to 11:30 a.m. Will your teachers please check in with the respective principals? I am sending some maps. I would hope you have a fine day.

If I have overlooked or there are questions, please call me at 453-5400 or the above address.

Sincerely,

Charles Nipple, Director
Special Services

Rationale for Special Education Workshop

May 9, 1970

In any teaching situation the teacher must do everything feasible to adapt to the differential needs, capacities, and interests of the individual pupils in the class. The special part of special education is that which is additional to the regular program in organization and some unusual teaching procedures rather than in the purposes and goals. The special aspects deal with methods and procedures adapted to specific learning disabilities of the child which do not necessarily exist in the normal child.

Due to this wide descrepancy in growth patterns of the mentally handicapped child it is of absolute necessity to individualize the program to a much more intense degree than that of the "normal" child. Even though many commercial kits are available, even if the teachers had all of them it would be ridiculous to say that they meet the needs of all of the mentally handicapped children. Thus the importance of individualized teacher-made materials is magnified.

The workshop being planned by the Special Education section of the W.V.E.C. will be an attempt to reinforce the importance of this often forgotten creative talent of the teadher due to all of the available commercial kits. The objectives that the workshop will attempt to accomplish will be as follows:

-To inform observing participants of materials, skills, and procedures and other elements involved in the production of teacher-made materials.

-To develop an understanding about the time and space relationships between the various materials being produced.

-To stimulate interest in the use of teacher-made materials being produced by teachers who have effectively produced and used them.

-To demonstrate how the use of teacher-made materials can closely complement instructiinal objectives and precision teaching techniques.

-To enable the participants in the workshop at the W.V.E.C. to obtain skill and understanding to demonstrate these skills to groups of teachers in their local corporation level.

The last objective, needless to say, has a number of important implications. Some of them are having a resource person in each of our 30 school corporation areas for the planning of the sequential development of programs when classes are formed, having a person that is skilled in the preparing of teacher-made materials to meet certain instructional objectives as outlined by Robert Mager in his book <u>Preparing Instructional Objectives</u>, and some other quite obvious reasons.

WABASH VALLEY EDUCATION CENTER
500 By Pass 52 West - University Square
West Lafayette, Indiana 47906

April, 1970

Dear Superintendent,

A workshop is being planned by the special education section of the Wabash Valley Education Center. This workshop will be different from past W.V.E.C. special education workshops in that we will be attempting to train a representative from each school corporation who will return to his respective corporation and train others in the skills that he has acquired. As a result of his training others in your school corporation these newly acquired skills, he will receive an honorarium of twenty dollars.

The workshop theme will be centered around the accomplishment of specific instructional objectives through the preparation and use of teacher-made materials. The use of teacher-made materials is highly relevant and important when attempting to meet the individual needs of the "special" student.

We would like each superintendent to appoint one of his special education teachers to attend the workshops scheduled at the Wabash Valley Education Center from 8:30 a.m. until 3:30 p.m. on May 9, 1970. If you do not have any special education teachers per se, a classroom teacher from the kindergarten or primary level or a teacher who has expressed an interest in special education will serve essentially the same purpose. Hopefully this person will be planning to stay in your school corporation the next couple of years so he can serve as a resource person.

It is anticipated that this person will serve as a group leader in the development of curriculum and the selection of materials for the comprehensive programs that are being planned in the immediate future for the handicapped children of your school corporation. We feel that a person like this would be invaluable for you to have in your school corporation and also for the W.V.E.C. to have as a contact person in the future.

We would like to be informed of your choice of the person to serve as a trainee in this in-service program no later than April 24, 1970. Since only an honorarium can be allocated from the Center for the service performed by the trainee of your corporation in training others, it is hoped that the individual school corporation could appropriate some allowance for travel.

We will be looking forward to hearing from you in the near future in regard to this matter. Enclosed you will find a form to complete along with an addressed stamped envelope to the Center for your convenience. Thank you for your cooperation.

Sincerely,

James R. Taylor
Special Education

WABASH VALLEY EDUCATION CENTER
500 By Pass 52 West - University Square
West Lafayette, Indiana 47906

April, 1970

Dear Special Educator,

Are special educators special? I think so. After working with special education teachers as a consultant in northeastern Indiana and presently in west-central Indiana, I find from my observation that special educators are indeed "special." You are probably wondering what the criteria are that determined this judgment. It is speculated that the affective characteristics of the special educator are different from those of the regular classroom teacher; that is, the difference lies in the personality and attitudes of the special educator.

As you are probably quite well aware, the last general assembly of the Indiana State Legislature mandated that "after July 1, 1973, all school corporations shall establish and maintain any and all such special education services and facilities needed to serve such handicapped children of and between the ages of six and eighteen which are categorized and defined in rule S-1 of the Rules and Regulations of the Commission and General Education." How are we going to provide enough teachers to fill the positions that will be made available as a result of this state legislation? Here is where the challenge lies.

An appeal to your personal sense of professional involvement in the teacher shortage problem in special education is being made here. By your participation in completing the following two instruments, the Minnesota Teacher Attitude Inventory and the Guilford Zimmerman Temperment Survey, hopefully we will be able to identify the affective factors that are relevant to professional commitment in special education as opposed to those expressed by regular classroom teachers. In addition to the information requested on these two instruments, the biographical information sheet is quite important.

The findings from this study could serve as a guide to identifying early in college life those students who express attitudes and personality characteristics similar to those held by you who are already successful in the field. Students so identified could then be encouraged to explore more carefully a career in special education. As a consequence of guiding and encouraging the students thus, identified the increasing problem of teacher shortage may tend to be reduced.

Two years ago, four major special education teacher training programs in Indiana awarded approximately 200 degrees in special education. If this continues, there will be an estimated shortage of 3,500 in special education classroom teachers for the mentally retarded alone. A challenge has been presented to us. Your help is vitally needed. Your cooperation can result in a major contribution for personnel recruitment in special education. Please take the time to aid your profession and help its future by filling out the enclosed forms. The instruments are self-administering and will require approximately one and one-half hours of your time.

Your results will be held in complete confidence and will be used only for the purpose of research. Only group findings will be interpreted; notinterpretation of individual results will be made. The prompt return of all completed materials will be greatly appreciated. Because not much time is required to complete the biographical information questionaire and the two instruments, please return these materials within 10 days.

Thank you for your cooperation in this effort. It is very important to the future of special education in Indiana.

Sincerely,

/s/ James R. Taylor

James R. Taylor
Special Education
Curriculum Consultant

/s/ Kathryn W. Linden

Kathryn W. Linden
Educational Psychology
Purdue University

JRT/zm
Enclosure