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ABSTRACT

This study concerned whether a model designed to enchance educational accountability developed by university science educators could be used to enhance science educational accountability in a public middle school. Participants in the study were 39 teachers who attended a combined summer/inservice institute in the summer of 1973 at Ball State University. The inservice followup project involved 14 participants who lived within a 75 mile radius of the university and concerned applying the knowledge, skills, and model gained during the summer institute and then reporting the results. Participants developed instructional units consisting of specific performance objectives, pre- posttests, and teaching strategies appropriate for meeting the needs of the students in their local school systems. Statistical analysis of the pre- posttests provided evidence concerning the amount of learning that had taken place. Additional data were obtained by applying a t-test to individual paired pre- posttest scores. Results indicated that statistically significant learning by students had taken place using the model and that this model could be applied where educational accountability is important. (Author/BR)

APPLICATION OF A COOPERATIVE UNIVERSITY/MIDDLE SCHOOL MODEL TO ENHANCE SCIENCE EDUCATION ACCOUNTABILITY

by

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> What is accountability? Conceptually defined and in its simplest form,accountability is a delineation of the goals and function of education. Each goal and function is qualitatively described in measurable objectives which are either directly or indirectly related to student performance. Operationally defined, accountability is the reporting of achievement against promised accomplishment.[1]

Increasingly, the general public is demanding a full justification of educational policy decisions and program operations. The often disagreeable but legitimate demands of the various publics served by the profession require educators to address themselves to the problem of accountability for their decisions. Confusion about the goals and objectives of contemporary education and dissillusionment with the quality of the preparation of students are illustrated by the number of school bond issues and levies that have failed in recent years, the rising discontent of teachers, the dejected attitude of many students, and the inflationary cost of education relative to static or even declining revenue sources. These events demonstrate a need for educational institutions to be accountable as are other social institutions.[2]

The purposes of accountability are numerous, and encompass the

[1]Robert Roush, Dale L. Bratten, Caroline Gellin, "Accountability in Education: A Priority for the 70's," Education, 92:113-117 September, 1971.

[2]Ibid.

entire educational establishment. Schools must try to meet the goals that they have established. Teachers must attempt to demonstrate measurable evidence of student learning; by doing so the teachers will be accountable to students, parents, and to school authorities. Furthermore, educational accountability allows for the establishment of valid cost-benefit standards in the allocation of funds.[3]

Historical Background

The earliest movements toward a program for educational accountability were made by the federal government when considering funding and granting of program monies. The Elementary and Secondary Education Act of 1965 established guidelines for evaluation of programs in order to monitor the use of approximately five billion dollars a year provided by the Act. In 1967 the U.S. Office of Education began requiring cost-effectiveness program audits for bilingual and dropout prevention programs.[4] As a result, a framework for educational accountability emerged, and currently pressure from the various publics is demanding incorporation of educational accountability into classroom activities. Models of educational accountability include the establishment of goals, measurable objectives, and evaluation devices.

The National Science Teachers Association, requires the school and the community to offer tangible evidence that specific educational goals were established, and that appropriate procedures were designed to meet and implement the goals, as well as to evaluate the procedures.[5]

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[3] Allan C. Ornstein, Accountability for Teachers and School Administrators, p. 79.

[4] Richard Novellis and Arthur Lewis, "Schools Become Accountable-A Pact Approach," Association for Supervision and Curriculum Development. p.1, 1974.

[5] "Accountability and Women in Science Education: New NSTA Position Statement," The Science Teacher, Vol. 41, Number 7, October 1974.

The educational accountability movement continues to involve all of these prior phases, but even more specifically, the National Science Foundation encourages accountability when it provides funds for its science education projects. The NSF, along with others seeking accountability, desires quantitative evidence of project effectiveness since such evidence may be subjected to statistical analysis.

One program producing such evidence was developed by the Department of Biology at Ball State University. This program enabled fourteen institute participants to apply a model designed to enhance educational accountability with the students in their own classrooms during academic year 1973-74. The implementation of the model posed an important question: "Could a model designed to enhance educational accountability developed by university science educators, be used to enhance science educational accountability in a public middle school?" The answer could only be found by attempting to use and assess such a model.

Implementing Instructional Improvements

A combined summer/in-service institute was conducted in the summer of 1973 and throughout academic year, 1973-74 by Ball State University. Thirty-nine teachers participated in the eight-week summer phase of the project. The summer program was designed to update the participants with respect to recent advances in biology and in the philosophic bases for contemporary science instruction. The long range goal of this project was to assist the participants in implementing modern science educational materials, philosophy and instructional strategies in their own classrooms.

Prior to the start of the project, participants were asked to complete an assessment of institute topics as related to their perceived instructional needs. These assessments were used to aid the staff in adapting the institute program to participant needs and to assist the participants in assessing their respective instructional programs.

During the summer phase of the project each participant enrolled in an eight quarter hour course which emphasized recent developments in biology and modern laboratory investigations. An additional four quarter hour course was designed to assist the participants in using modern educational theory, teaching strategies, and instructional methodology in preparing to teach contemporary biology principles to public school students. Emphasis was placed on BSCS curricular materials, philosophy and methodology. Teaching strategies useful in teaching BSCS curricular materials were stressed with all participants, regardless of grade level taught or curriculum currently used.

The in-service follow-up project involved fourteen participants who lived within a 75 mile radius of Ball State University. The in-service project was designed to assist the participating teachers in applying in their own classrooms the knowledge and skills gained during the summer of 1973. Participants developed instructional units consisting of specific performance objectives, pre/post tests, and teaching strategies appropriate for meeting the needs of the students in their local school systems.

A faculty member from Ball State University was designated as the Coordinator of the School Science Visitation Program. The duties of the Coordinator were to work directly with the teachers and their local school administrators. Each participant was visited twice per quarter by the Coordinator. During these visits the Coordinator attended the participants' classes and consulted with local school administrators. The purpose of the visits were to facilitate the implementation of each participant's instructional objectives. In addition, once each quarter all participants met on the university campus with the entire project staff and shared instructional materials that each participant had created, used, and evaluated.

Application of the Model to Enhance Educational Accountability

Table I summarizes the entire model as it was applied in the in-service program.[6] The model was used by each participant and in each school system involved.

The teacher, working with the school principal and the Coordinator of the School Visitation Program, assessed the needs of the students based upon the goals of the school's science program. The goals included those mandated by state requirements, those developed by the local community, and those dictated by the personal needs of the students. From this assessment, a plan for developing the curriculum was prepared by the teacher, principal, and Coordinator of the School Science Visitation Program. The teacher proceeded to outline and develop each instructional unit to be presented, using the curricular plan as a guide. In the course of developing a unit, the teacher constructed behavioral or performance objectives and developed pre/post-test items designed to measure each objective. The Coordinator of the School Science Visitation Program reviewed the objectives and test questions, and established content validity for each question. If the Coordinator concluded that some questions did not measure the performance objective for which they were designed, suggestions were made for improvement.[7]

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[6] Jerry J. Nisbet, Thomas R. Mertens, and Jon R. Hendrix, "Enhancing Educational Accountability: A Model for University/Secondary School Cooperation," Science Education, (In Press, 1975).

[7] Ibid.

The pretest was administered before a unit of instruction started. The pretest was designed to determine student entry behavior with respect to the specific objectives. Data from the pretest enabled the teacher to decide which objectives needed to be stressed in order to meet student needs. Modification of specific instructional strategies as was indicated by the pretest results followed and emphasis was placed on the objectives needing the most attention. Students were given a copy of the unit objectives and the results of their pretest. A post-test was administered following the instruction. A statistical analysis of the pre/post-tests provided evidence concerning the amount of learning that had taken place.

Data

Computer printouts of the analysis of test data for each section included: individual student's scores, frequency of each score, cumulative frequency, percentile rank, mean, standard deviation, individual normalized test scores and an answer distribution tally. A total test population computer analysis included: item difficulty, item discrimination, reliability estimate, and standard error estimate for each test.[8]

Additional data were obtained by applying a _t_ test to the individual paired pre/post-test scores. Individual pre/post-test scores for each section were analyzed using a two-tailed _t_ test designed to test the null hypothesis that the difference between the means of the pair-wise measures is equal to zero. The teacher used this information to evaluate the student's progress and the effectiveness of his own

[8] Ibid.

instructional strategy.[9]

Interpretation of Data

If statistically significant increases in scores were revealed, the instruction used for that unit was considered to be effective. The probability that the differences between the pretest and post-test means were due to chance alone is less th .001 for most of the units (Table II). Thus, we concluded, for those units, that statistically significant learning had taken place.

The instructional unit on the metric system produced some alarming results. No evidence of statistically significant student learning progress was obtained in any of the three class sections. An examination of individual student scores and the teacher's own subjective evaluation confirmed the statistical analysis. The teacher and the Coordinator of the School Visitation Program jointly determined the possible reasons for the apparent ineffectiveness of the metric system unit. Although certain strategies and methods appeared to be ineffective, an analysis of the performance objectives developed for the metric unit suggested that some of the objectives were beyond the intellectual capabilities of the students. Consequently, the objectives were modified and a different strategy for teaching the metric system was developed. To maintain the predetermined goals and objectives of the science program, the new objectives and test questions on the metric unit were incorporated into the remaining instructional units.

Personal Reactions of a Middle School Teacher

Personal reactions to the use of the model were obtained from both the teacher and the students involved. Students appreciated

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[9] Ibid.

knowing what objectives they were to achieve and experienced a feeling of confidence as a consequence. Individual test data also seemed to create student interest and encourage student achievement. The teacher found students to be more receptive to the material being presented when they knew exactly what was expected of them.

Quantitative data showing that a teaching strategy had been successful were quite rewarding for the teacher. More important was the assessment of pretest data which developed the awareness of the need to change some strategies in order to better meet the needs of the students. The use of the model aided in the preparation of each unit and enabled the teacher to collect concrete evidence of students' strengths and weaknesses with respect to the goals of the science program.

Encouragement for using the model by the school administrators was not as strong as the expectations held by both the participant and the Coordinator of School Visitations. The participant and Coordinator inferred that since the school system did not employ a program of educational accountability, the administrators would be interested in finding a suitable model and then, perhaps, extending its use to other teachers and disciplines. Instead, administrators demonstrated minimum interest in finding out how effective the model was or how much it facilitated learning, by both the teacher and the students. Our expectations may have been to gigh even though, to us, it would appear that use of such a model would benefit students, parents, teachers and school administrators. We believe that facing the publics expectations of educational accountability is an opportunity and a professional obligation.

Bibliography

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Table 1

MODEL DESIGNED TO ENHANCE EDUCATIONAL ACCOUNTABILITY

1. Assess students' needs relative to goals of local school's science program.
2. Develop curricular guideline based on needs assessment.
3. Develop teaching unit, performance objectives, pre/post-tests, and proposed instructional strategy.
4. Establish content validity for pre/post-tests.
5. Administer and score pretest.
6. Analyze pretests and modify unit content and instructional strategy based on data.
7. Implement instructional strategy initiated by providing students with performance objectives and pretest results.
8. Administer and score post-tests.
9. Compute t test based upon the mean of the pre/post-test paired measures.
10. Evaluate student progress and instructional strategy.
11. Repeat steps three through ten for subsequent units.

Table 11

t TEST DATA

Section #	Mean of Pretest	Mean of Post-test	Difference of Means	t Score	Degrees of Freedom	Probability P
			Communities and Insects			
1	22.20	37.27	15.07	13.9509	14	.001
2	17.17	30.00	12.83	8.5748	11	.001
3	25.56	37.15	11.59	13.4112	26	.001
			Foods			
1	15.18	22.72	7.54	8.9190	10	.001
2	13.20	17.60	4.40	3.0093	9	.01
3	15.22	23.66	8.44	12.0432	17	.001
			Senses			
1	6.93	12.22	5.29	6.6167	14	.001
2	4.25	9.08	4.83	5.0344	11	.001
3	7.08	12.72	5.64	13.4336	24	.001
			Metric			
1	12.13	13.82	1.69	1.7294	14	.10
2	9.43	11.43	2.00	2.0493	9	.10
3	13.15	14.27	1.12	1.5591	25	.20
			Eye			
1	10.80	20.66	9.86	14.1758	14	.001
2	7.00	16.91	9.91	7.6825	11	.001
3	10.75	19.87	9.12	11.3526	23	.001