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ABSTRACT

The design and effects of a data-based approach to training school staff in the implementation of innovative programs are discussed. The rationale and design of the Data-Based Staff Development Program, which has been developed to train school staff to implement the programmatic and personnel changes required to effectively establish and maintain an innovative program, the Adaptive Learning Environments Model (ALEM), in classroom settings, are outlined. This program is designed specifically to help school personnel improve their knowledge and skills in providing learning experiences that are adaptive to student differences, particularly in the context of the effective mainstreaming of exceptional students in regular classrooms. Findings from a study investigating the effectiveness of using the data-based approach to staff development in improving classroom implementation of the ALEM are discussed. Data from the study are reported as preliminary evidence of the effectiveness of the data-based approach to staff development, and future lines of work in this area are suggested. (Author/CJB)

LEARNING RESEARCH AND DEVELOPMENT CENTER

ANALYSIS OF THE DESIGN, IMPLEMENTATION, AND EFFECTS OF A DATA-BASED STAFF DEVELOPMENT PROGRAM

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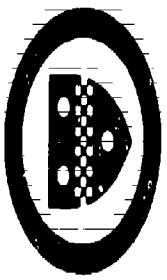
MARGARET C. WANG AND PATRICIA GENNARI



University of Pittsburgh

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ABSTRACT

This article describes the design and effects of a data-based approach to training school staff in the implementation of innovative programs. In addition to illustrating the use of this particular approach, the article summarizes the findings from a study of the efficacy of the Data-Based Staff Development Program. This program is designed specifically to help school personnel improve their knowledge and skills in providing learning experiences that are adaptive to student differences, particularly in the context of the effective mainstreaming of exceptional students in regular classrooms. Data from the study are reported as preliminary evidence of the effectiveness of the data-based approach to staff development, and future lines of work in this area are suggested.

ANALYSIS OF THE DESIGN, IMPLEMENTATION, AND EFFECTS OF A DATA-BASED STAFF DEVELOPMENT PROGRAM

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During the past two decades, great strides have been made in research on effective schooling and in the development of innovative programs aimed at improving schools' capabilities to provide effective educational services. Nevertheless, there have been very few examples of successful adoption and implementation of those educational innovations found to be demonstrably effective (Wang & Ellett, 1982). A major problem is the lack of adequate training supports for those school personnel who are responsible for implementing innovative programs (see, for example, Reynolds, 1982). Although the critical need to include systematic staff development as an integral component of school improvement efforts in general and the implementation of innovative programs in particular has been widely recognized, progress in this area has been spotty, at best. It is in this context that the work on the development and field testing of a data-based approach to staff development described here was initiated.

This article has two purposes. The first is to describe the rationale and design of the Data-Based Staff Development Program, which has been developed to train school staff to implement the programmatic and personnel changes required to effectively establish and maintain an innovative educational program, the Adaptive Learning Environments Model (ALEM), in classroom settings. It will also present and discuss the implications of findings from a study investigating the effectiveness of using this data-based approach to staff development in

improving classroom implementation of the ALEM.

OVERVIEW OF THE PROGRAM

A basic premise underlying the design of the Data-Based Staff Development Program is that establishing and maintaining innovative school programs require not only detailed specification of the programs' designs and operating features, but also staff development activities that promote understanding of the programs and support their day-to-day implementation (Wang, 1981). Toward this end, staff development programs must have certain characteristics. For example, they must be adaptive. Teachers (and other professional and paraprofessional staff) learn in different ways. More importantly, they come to the classroom at different stages of learning. Thus, staff development programs must be tailored to the identified strengths and weaknesses of individuals, not of the group at large. In addition to being adaptive, staff development programs must focus on the day-to-day implementation problems that teachers face and must be continuous, assisting teachers every step of the way. Inservice programs that occur every 6 months, or even every 2 or 3 months, are inadequate. Teachers need frequent contact and continuous support in their efforts to solve both short- and long-range problems (Cruickshank, Lorish, & Thompson, 1979; Griffin, 1979; McLaughlin & Marsh, 1979; McNergney, 1980; Miller & Wolf, 1979; Perry, 1980; Zigarmi, Amory, & Zigarmy, 1979).

The Data-Based Staff Development Program was designed to meet these support needs. Specifically, it aims to help school personnel responsible for program implementation systematically analyze relevant data on program implementation and student outcomes in assessing their staff development needs. The goal is to serve as a self-monitoring tool that increases the proficiency of school personnel in establishing and maintaining program implementation. While designed to accommodate the staff development needs of a specific educational program, the Adaptive Learning Environments Model, findings related to the efficacy of this program are expected to contribute to assessment of the merit of data-based approaches to staff development in general.

The Adaptive Learning Environments Model (ALEM)

The overall goal of the ALEM is to create school learning environments in which each student, exceptional and nonexceptional alike, can acquire basic academic skills and, simultaneously, become increasingly more confident in his or her ability to learn and to cope with the social and physical surroundings of the classroom (Wang, 1980). This goal is accomplished by combining the advantages of a highly structured programming component (which includes a built-in, diagnostic-prescriptive procedure for the development of skills in basic academic subject areas) with a more open-ended, exploratory learning component (which includes a variety of problem-solving and student-initiated activities for social and personal development). Among the major expected outcomes of the ALEM for students are effective use of school time, motivation to spend the time required to master basic academic skills, and development of increased competence in independently managing learning and the classroom environment. Teachers are expected to be able to spend increased amounts of time providing instruction rather than managing students.

The underlying assumption of the ALEM's design is that the implementation of innovative educational programs requires fundamental changes in the nature and structure of curricular materials, instructional procedures, organizational and staff support systems, teaching and learning processes, and the roles of teachers and students. Because of the ALEM's unique program design and the changes in teacher and student roles required to effectively establish and maintain program implementation, the development of a staff development program that provides school personnel with appropriate technical assistance has been a major research effort in the design and field testing of the ALEM (Wang, 1983).

Design of the Data-Based Staff Development Program

The Data-Based Staff Development Program comprises a training sequence, a set of measures for assessing the degree of program implementation, and a method for using a number of data sources to design staff development plans that meet the needs of individual teachers.

Training Sequence The Data-Based Staff Development Program incorporates three levels of training, ranging from initial awareness training to ongoing inservice training. Figure 1 shows the training levels and sequential steps. Level I provides basic working knowledge of the curricular content and procedures incorporated in the ALEM. In Level II, more intensive training is provided in specific staff functions. Level III provides clinical training tailored to the needs of individual staff members. Training at Level III is ongoing inservice training designed to help school staff members continually improve and upgrade their classoom implementation. It is primarily at the third level that the iterative process of assessment, feedback, planning, and training occurs (Wang, 1981).

1. *Level I: Basic Training.* Training at Level I provides an overview of the ALEM and working knowledge about the implementation requirements of the various program components. The three major topic areas are (*a*) the rationale and design of the ALEM and program evaluation results; (*b*) an overview of the program's components; and (*c*) the knowledge and skills required for program implementation (e.g., information on the content of the basic skills and exploratory learning areas; procedures for diagnostic testing, prescription writing, and record keeping; design of the classroom environment; management and display of learning materials; and procedures for self-scheduling). Level I staff development activities generally are scheduled as preimplementation sessions. They are designed for all relevant administrative personnel (from central administrative staff to those at the building level), as well as for instructional and other support personnel whose duties affect the implementation of the ALEM. The basic training level generally requires 2 or 3 days.

2. *Level II: Individualized Training.* Level II staff development activities provide in-depth training that is specific to each staff member's functions. Based on analyses of school-specific needs, a detailed plan for each school's program implementation is developed. Differentiated staff training activities are designed according to an analysis of the functions to be carried out in the implementation of the ALEM and assignment of those functions to personnel.

As indicated in Figure 1, individualized training is provided to classroom teachers, teacher aides, instructional leaders, family specialists, building administrators, and central office administrators. The time required for Level II training varies by school and instructional leader, depending on each school's unique constraints and the staff's understanding of their roles and functions. Individualized training sessions, which last 2 or 3 days, generally are scheduled immediately after Level I basic training sessions. Levels I and II can be completed in one week-long workshop prior to the opening of school.

3. *Level III: Inservice Training.* Level III is the culmination of an interactive process of program assessment, feedback, planning, and ongoing staff development work. It provides the technical support required to establish and maintain program implementation at school sites. Because inservice training is designed to be adaptive to the needs and expertise of individual staffs, the type and frequency of the sessions vary. They range from short meetings (during teacher preparation times) to half-day workshops.

As shown in Figure 1, the two types of Level III training sessions are staff planning sessions and sessions for feedback and training. Staff planning sessions are designed to develop plans for accomplishing selected instructional-learning objectives and to determine topics for staff feedback and training. Staff planning is based on information from classroom observations, data on students' learning progress, and feedback from family members. Sessions for staff feedback and training are scheduled regularly throughout the school year, according to staff members' needs and interests. They provide opportunities to discuss critical issues related to program implementation, particularly in terms of program refinement and improvement in the degree of program implementation. Feedback and training sessions usually take place during regular staff planning times or during schools' scheduled team meetings and inservice training times.

Degree of Program Implementation Measures A prerequisite for implementing an innovative educational program is the availability of information on the extent to which the program's design is actually implemented. The development of degree of implementation measures to assess the presence and absence of the ALEM's

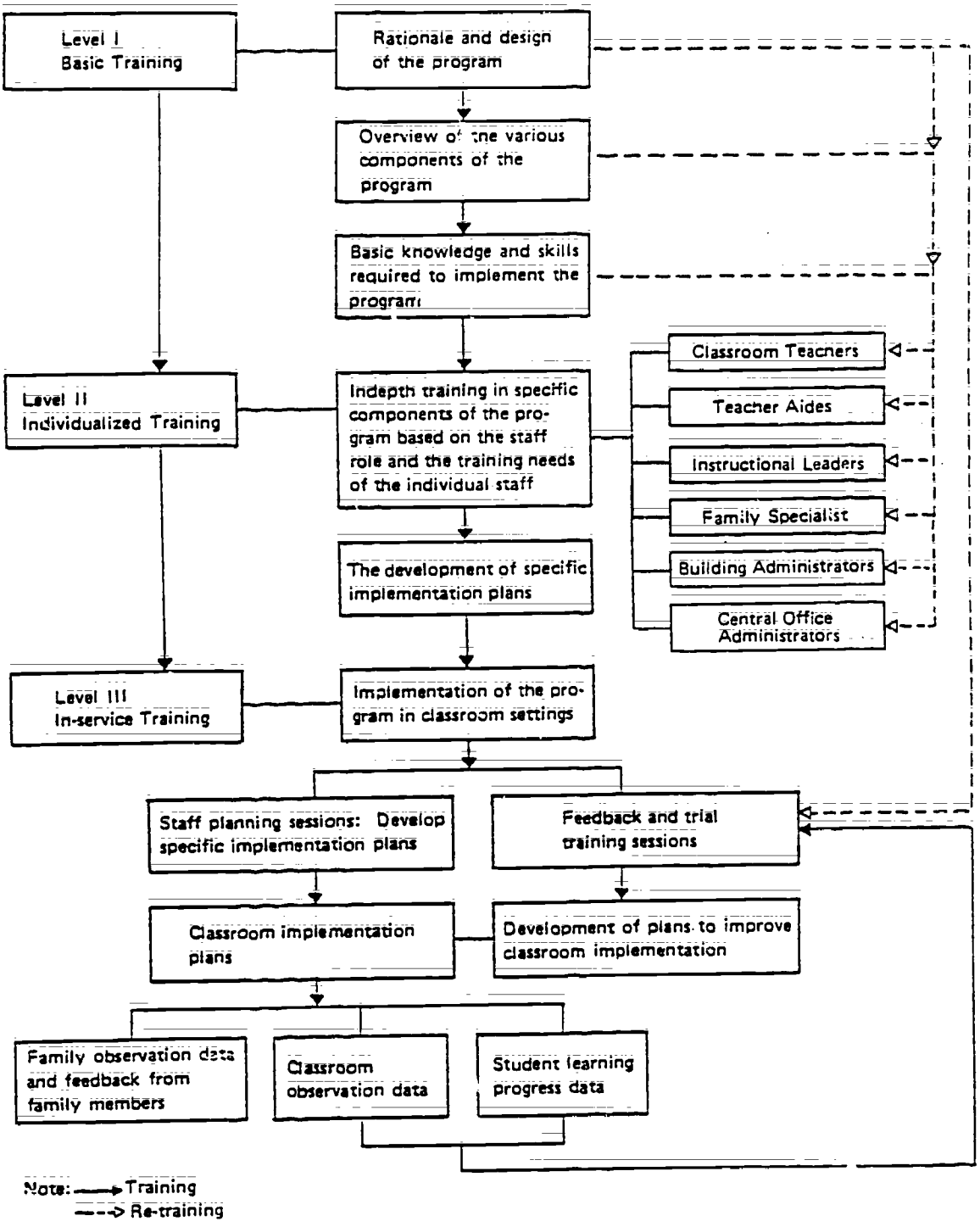

FIGURE 1
The Data-Based Staff Development Program

essential design features began with the identification of 12 critical dimensions. These dimensions were identified by analyzing the program's structural and action domains. The structural domain refers to those aspects of the program's design that are required to establish the conditions under which program activities can be implemented effectively. The action domain consists of those roles and behaviors of instructional staff and students necessary for effective functioning under the ALEM. After the critical dimensions were identified, performance indicators were derived for each dimension. Ninety-six performance indicators for assessing the implementation of the 12 critical dimensions were identified and grouped into a battery of six data collection forms known as the *Implementation Assessment Battery for Adaptive Instruction* (Wang, Catalano, & Butcher, 1983).

Two of the forms in the battery record dynamic aspects of program implementation—the Teacher Instructional Roles and Interactions Observation Form and the Student Learning Process and Behaviors Observation Form—and are administered during class time, while students and teachers engage in the instructional-learning process. Two forms focus on nondynamic observables—the Observation Checklist for Physical Design of the Classroom and the Observation Checklist for Classroom Records—and are administered before or after class time. The final two forms are interview questionnaires designed to elicit comments from students and teachers on various aspects of program implementation—the Student Interview Schedule and the Teacher Interview Schedule. The Teacher Interview Schedule is administered before or after class time, and the Student Interview Schedule is administered during class time.

The battery is regularly used by school personnel (e.g., teachers, principals, team leaders, education specialists) to collect implementation information for the inservice training component of the Data-Based Staff Development Program. School personnel are encouraged to use the data collection forms, as needed, to monitor the program implementation in their classrooms. Data also are collected at least three times during the school year (usually in October, February, and April) for program evaluation purposes. It generally takes about 2 hours per classroom to administer the entire *Implementation Assessment Battery for Adaptive Instruction*. An empirical validation study of the battery suggests its validity and reliability. The interobserver reliability coefficients for the 12 dimensions varied from .48 to .91, with a median of .74 (Strom & Wang, 1982).

A computer program was developed to analyze and report degree of implementation data in a form that can be used by site personnel to design and monitor site-specific staff development plans (Schmidhammer, 1982). Figure 2 is a sample computer printout of an analysis of the degree of implementation data.

As shown in the figure, the data are analyzed at four levels: site (school district), school, grade level, and class (teacher). The mean scores for the critical dimensions of the ALEM are reported in 12 separate columns. The names and acronyms for the dimensions are listed at the top of the printout. The number in parentheses under each acronym indicates the total number of performance indicators included in the battery that assess the degree of implementation of that dimension. The printout includes information on each teacher's degree of implementation of the 12 critical dimensions, as well as mean percentages of the degree of implementation for each grade within a school, for a given school, for grade levels across a school district, and for the entire district.

The criterion for a high degree of implementation of a critical dimension has been set at 85%. That is, when 85% or more of the performance indicators in a given dimension are present, the degree of implementation of that program dimension is considered "high." When 50% to 84% of the items are present, implementation of that program dimension is considered "average," and the presence of less than 50% of the performance indicators suggests "low" implementation. Using these criteria, Figure 2 shows, for example, that all of the classes in School A except Grade 2 achieved a high degree of implementation of the Instructing (INST) dimension. Grade 2 had an average degree of implementation score (79% of the performance indicators present).

The overall degree of implementation across a variety of schools for an extended period of time can provide evidence of the "implementability" of the ALEM. In addition, the degree of implementation of particular dimensions can be analyzed for individual teachers, grades, schools, and districts to assess training needs and develop specific staff development plans. Analyses of the changes in degree of implemen-

CRITICAL PROGRAM DIMENSION CODES

ASSF	ARRANGING SPACE & FACILITIES	M&D	MONITORING & DIAGNOSING
CMRM	CREATING & MAINTAINING INSTRUCTIONAL MATERIALS	PRES	PRESCRIBING
ECRP	ESTABLISHING & COMMUNICATING RULES & PROCEDURES	TRAV	TRAVELING
MA	MANAGING AIDES	INST	INSTRUCTING
TEST	TESTING	MOTI	MOTIVATING
RCRD	RECORD KEEPING	SP	STUDENT PLANNING

NUMBERS IN PARENTHESES INDICATE NUMBERS OF ITEMS (PERFORMANCE INDICATORS) INCLUDED IN THE DEGREE OF IMPLEMENTATION ASSESSMENT INSTRUMENTS

DISTRICT X
APRIL, 1981

		ASSF (11)	CMRM (11)	ECRP (27)	MA (3)	TEST (4)	RCRD (3)	M&D (8)	PRES (5)	TRAV (2)	INST (14)	MOTI (5)	SP (3)
School A													
Grade 1	Teacher A	100	82	93	100	75	100	100	100	100	100	100	100
Grade 2	Teacher B	100	91	93	100	100	100	88	100	100	79	100	100
Grade 3	Teacher C	100	46	85	100	50	100	100	80	100	86	60	100
Kindergarten	Teacher D	100	73	93	100	100	100	100	100	100	93	100	67
Average for School		100	73	91	100	81	100	97	95	100	89	90	92
School B													
Grade 1	Teacher E	91	73	100	100	75	100	100	100	100	100	100	100
	Teacher F	91	73	82	100	100	100	100	100	100	100	80	100
	Average	91	73	91	100	88	100	100	100	100	100	90	100
Grade 2	Teacher G	100	73	96	100	100	100	100	100	100	100	100	100
	Teacher H	91	73	96	100	100	100	100	100	100	100	100	100
	Average	96	73	96	100	100	100	100	100	100	100	100	100
Grade 3	Teacher I	91	73	78	100	100	100	100	100	100	79	80	67
	Teacher J	100	73	96	100	75	100	100	100	100	100	100	100
	Average	96	73	87	100	88	100	100	100	100	89	90	83
Kindergarten	Teacher K	100	73	100	100	75	100	100	100	100	100	100	100
	Teacher L	82	73	70	100	75	100	63	100	50	57	80	67
	Average	91	73	85	100	75	100	81	100	75	79	90	83
Average for School		93	73	90	100	88	100	95	100	94	92	93	92
School C													
Grade 1	Teacher M	100	73	85	100	100	100	100	100	100	100	100	67
Grade 2	Teacher N	91	73	93	100	100	100	100	100	100	100	100	100
Grade 3	Teacher O	100	73	96	100	100	100	100	100	100	100	100	100
Kindergarten	Teacher P	91	73	82	100	50	100	75	100	50	93	80	67
	Teacher Q	91	100	96	100	100	100	88	100	100	100	100	67
	Average	91	86	89	100	75	100	81	100	75	96	90	67
Average for School		96	78	90	100	90	100	93	100	90	99	96	80
Average for Site													
Grade Averages													
Grade 1		95	75	90	100	86	100	100	100	100	100	95	92
Grade 2		96	77	94	100	100	100	97	100	100	95	100	100
Grade 3		98	66	89	100	81	100	100	95	100	91	86	92
Kindergarten		93	78	88	100	80	100	85	100	80	89	92	73
Overall Average		95	74	90	100	87	100	95	99	94	93	93	88

FIGURE 2
Sample computer printout of a summary of degree of implementation data

tation from one assessment period to the next can provide information to teachers about their individual implementation progress, as well as the data base for evaluating the effectiveness of staff development efforts.

Adaptive Staff Development Plans. The Data-Based Staff Development Program is operationalized in school sites through site-specific staff development plans. A comprehensive staff development plan is developed for each site at the beginning of every school year. The plan is based on a variety of information, including degree of implementation and student learning progress data from the spring of the previous school year (for new teachers or new implementation sites, from the beginning of the school year), each site's identified staff development needs, and the major categories of activities proposed to meet those needs during the year. Staff development plans include (*a*) a description of specific training tasks/objectives for performance indicators in critical dimensions that consistently show scores below the 85% criterion level across a significant number of teachers (or for a particular teacher), (*b*) dates the training is to be completed, (*c*) person(s) responsible for training, (*d*) types of activity to be conducted, (*e*) expected outcomes, and (*f*) evidence of effective service as it relates to successful completion of the training. Figure 3 shows an excerpt from a sample staff development plan.

Staff development plans are reviewed periodically by site personnel to determine the appropriateness of planned training objectives and to monitor progress. Monthly training logs, kept by

Site: School District B

Task Training Objective	Date	Person(s) Responsible	Type of Activity	Expected Outcome(s)	Evidence Effective Service
1. Creating and Maintaining Instructional Materials					
1.1 Conduct in-service workshop on criteria for creating exploratory activities.	March 18	LRIC Project Staff Education Specialist Principal	Workshop	Increased awareness of criteria used in constructing exploratory activities.	Teachers use criteria in designing and evaluating exploratory activities.
1.2 Teachers evaluate materials according to criteria.	March 23-27	Classroom Teachers	Evaluation	Teachers examine exploratory materials.	Materials which meet criteria are used in exploratory activities.
1.3 Teachers categorize self-constructed materials according to curricular area.	March 23-27	Classroom Teachers		Materials are categorized and ready for classroom use.	Exploratory materials are labeled according to curricular area.
1.4 Teachers list useful materials (as per criteria).	Ongoing	Classroom Teachers	Consultation	Teachers list materials already constructed and add new materials as they are constructed.	Update of list.
2. Student Planning					
2.1 Review performance indicators included in the degree of implementation measures related to student planning in weekly staff meeting.	March 11	Education Specialist School Principal	Staff Meeting	Teachers understand the rationale and need for developing supports for student planning and for developing strategies to help students plan.	Teachers are able to help students gain increased responsibility for planning.
2.2 Classroom rules and procedures are re-established and written down.	March 16	Classroom Teachers Education Specialist	Discussion and development of list	Rules and procedures are listed.	Listing of classroom rules and procedures.
2.3 Teachers review planning procedures and rules with students.	March 18	Classroom Teachers	Discussion with students	Teachers and students establish rules.	Students are able to verbalize rules.
2.4 Students are observed and interviewed by teachers and education specialist during self-scheduling.	April 14	Classroom Teachers Education Specialist	Observation	Description of each student's functioning under the Self-Schedule System.	Students communicate rules and procedures to observers verbally and nonverbally.

education specialists or principals, are a major source of information for reviewing each site's progress and updating its staff development plans. The logs include descriptions of implementation-related behavior, specific strategies for improving the degree of implementation (e.g., classroom observations, conferences between teachers and education specialists, and inservice training workshops), expected outcomes, and follow-up activities. In addition to periodic reviews, when staff development plans for each site are updated and revised if needed, formal reviews are scheduled following each of the three periods for collecting degree of implementation data. Figure 4 shows a sample training log.

THE STUDY

During the 1980–81 school year, the effectiveness of the Data-Based Staff Development Program in improving classroom implementation of the ALEM was investigated. This descriptive study is part of an ongoing program of research designed to provide information for systematic improvement of the ALEM and its implementation in a variety of school settings, including classrooms where mildly handicapped and gifted students are mainstreamed with regular students on a full-time basis.

Setting

The setting for the study consisted of 10 school district sites, including 138 kindergarten through fourth grade classrooms. The school districts, located in areas with varying ethnocultural, socioeconomic, and geographic characteristics, include inner-city, suburban, rural, and Appalachian communities. Each of the sites participated in either the National Follow Through Program (a nationwide compensatory education program of the U.S. Department of Education) or a mainstreaming program for gifted and mildly handicapped students sponsored by the Special Education Program of the U.S. Department of Education.

Measures

Data for the study were obtained through three sets of measures: the *Implementation Assessment Battery for Adaptive Instruction*, the

LOG

School: J. J. District: A Grade: 2
Teacher: XX Date: November 6, 1981 Time: 9:50 - 10:30

Observed Behavior	Strategy Suggested	Expected Outcome
Math skills introduced without use of concrete aids.	Use concrete aids to introduce new skills.	Concepts are introduced with manipulatives. Less time is spent teaching a skill.
Students marked self-scheduling folder at their own.	Aide or teacher marks self-scheduling sheet.	Students ask teachers (aide) to check their self-scheduling sheet when work has been completed.
Paper/pencil tasks used in math exploratories.	Include math activities - math bingo.	More hands-on tasks are included.

Follow Up: An observation of XX's class has been scheduled for November 12.

FIGURE 4
Sample monthly training log

school districts' staff development plans, and the monthly training logs kept by the sites' education specialists.

Implementation Assessment Battery for Adaptive Instruction. The battery was administered during October, February, and April of the 1980–81 school year in each of the classrooms. The resulting data were analyzed and reported in the format illustrated in Figure 2. Of particular interest in this study were the changes in the degree of implementation between data collection periods.

Staff Development Plans. A staff development plan, as shown in Figure 3, was designed for each site at the beginning of the 1980–81 school year. The critical dimensions requiring improvement were identified through analysis of the sites' degree of implementation data for fall, 1980, and other related data, such as students' learning progress in the ALEM's curriculum and the results of standardized achievement tests. As mentioned previously, staff development plans are updated throughout the school year according to sites' changing training needs. Information on changes in staff development plans was analyzed in terms of specific critical dimensions requiring improved implementation and the nature of the prescribed training activities.

Monthly Training Logs. Data on the actual implementation of training activities prescribed in the sites' staff development plans were obtained from the monthly training logs prepared for each classroom by education specialists. As shown in Figure 4, information is categorized according to (*a*) classroom observations of student-teacher behaviors associated with the ALEM's critical dimensions, (*b*) strategies suggested by education specialists for improving the implementation of particular critical dimensions, (*c*) expected outcomes of the suggested training strategies, and (*d*) findings of follow-up observations.

Results

Information obtained from the three sources forms the basic data set for the study. The data were analyzed to investigate the relationship between staff development plans and program implementation needs as suggested in the degree of implementation scores for individual teachers. Specifically, the data served as the basis for answering three related questions: Did the staff development plan for each site reflect the individual staff's program implementation needs? Were the sites' training activities related to the staff development plans? Did degree of implementation scores improve as the result of specific training activities?

Consistency between Staff Development Plans and Identified Program Implementation Needs. To determine whether the sites' staff development plans were consistent with their identified training needs, the degree of implementation scores from fall, 1980, and the sites' overall 1980–81 staff development plans were analyzed. The training objectives listed in the staff development plans were analyzed. The training objectives listed in the staff development plan were compared to the critical dimensions in which degree of implementation scores fell below the 85% criterion level. The percentages of agreement between the two sets of data were calculated.

Results of the analysis are reported in Table 1. As shown in the table, the staff development plans excluded 98% of the dimensions with scores at or above the 85% criterion level (an indication that no special training was needed), while 86% of the dimensions with scores below the criterion level (an indication that training was needed) were included in the staff development plans. In other words, there was 86% agreement between the specific performance indicators for which the data suggested the need for training and the training activities/objectives included in the staff development plans. Similarly, 98% agreement was achieved between the data indicating no training was needed and the critical dimensions excluded from the staff development plans. The overall data suggest that the sites' staff development plans were highly consistent with the training needs identified in the data.

It is noteworthy that investigations of the exclusion from the staff development plans of 14% of the critical dimensions with scores below the criterion level revealed that these dimensions were included in the plans designed for individual teachers. Because only a few of the sites' teachers were involved, training in these dimensions was excluded from the sites' overall staff development plans.

Consistency between Identified Staff Development Needs and Training Activities. To investigate the extent to which the prescribed train-

Table 1
Percentage of Agreement Between the Sites' Degree of Implementation Data and Staff Development Plans
Fall, 1980

Degree of Program Implementation	Staff Development Plans	
	Percentage of Critical Dimensions Not Included in Staff Development Plans	Percentage of Critical Dimensions Included in Staff Development Plans
Percentage of Critical Dimensions At or Above the 85% Criterion Level	98	2
Percentage of Critical Dimensions Below the 85% Criterion Level	14	86

ing activities actually were conducted to accomplish the specific training objectives identified in the staff development plans, correlation analyses were carried out between the prescribed training activities and those recorded in the education specialists' monthly logs. Each entry in the log was classified as relating to one of the ALEM's 12 critical dimensions, based on the relationship of the nature of the training activity to one (or more) of the 96 performance indicators. The result was a list, for each of the 119 teachers on whom data were available, of the number of training-related contacts in each of the dimensions. The reliability of this process was calculated from the percentage of agreement scores for two raters. These scores were consistently above 98%.

Table 2 summarizes the correlations between the critical dimensions included in the staff development plans and the number of times training related to those dimensions was listed in the education specialists' monthly logs. The correlations were all positive in direction, ranging in magnitude from .05 (Traveling) to .59 (Arranging Space and Facilities). Significant correlations were found in 8 of the 12 dimensions, and an overall significant correlation was found ($r = .37$; $p < .01$).

Nature and Patterns of Changes Observed as the Result of Training. To examine the extent to which training based on staff development plans was effective in improving the degree of program implementation, changes in degree of implementation data between the fall, 1980, and spring, 1981, data collection periods were analyzed. Table 3 reports summaries of each site's fall and spring average percentage scores for each of the 12 critical program dimensions along with changes in the two scores. While the magnitude of changes in the 10 sites' degree of implementation scores varied, positive changes were observed in all sites in a majority of the critical dimensions. In fact, 88% of the total number of scores on all the critical dimensions across all 10 sites improved or remained stable. Analysis of the overall changes in the sites' degree of implementation scores was statistically significant at the .01 level.

An analysis also was done of the relationship between the critical dimensions shown in both the fall data and the educational specialists' monthly logs as not having met the criterion level and the critical dimensions shown in the spring data as not having met criterion. The results of this analysis across the sites showed that the mean number of critical dimensions not

Table 2
Summary of the Correlations Between Critical Dimensions Identified in Staff Development Plans and Training Activities Listed in Monthly Logs
1980 - 81
(N = 119 Teachers)

Critical Dimensions	r_{pb}	Significance
Arranging Space and Facilities	.59	<.05
Creating and Maintaining Instructional Materials	.48	<.05
Establishing and Communicating Rules and Procedures	.45	<.05
Managing Aides	.14	N.S.
Testing	.23	<.05
Record Keeping	.33	<.05
Monitoring and Diagnosing	.17	N.S.
Prescribing	.29	<.05
Traveling	.05	N.S.
Instructing	.13	N.S.
Motivating	.57	<.05
Student Planning	.36	<.05

meeting the 85% criterion level in fall, 1980, was four. By spring, 1981, the mean number of dimensions not meeting the criterion level was reduced to two. This reduction is statistically significant ($p < .01$).

To assess the extent to which changes in degree of implementation for specific critical dimensions were the result of planned staff development activities, comparisons were made of the changes in (*a*) the degree of implementation

Table 3

Summary of the Degree of Implementation Data

Average Percentage Scores

Fall, 1980 and Spring, 1981

N = 138

Sites	Critical Dimensions													
	Arranging Space and Facilities			Creating and Maintaining Instructional Materials			Establishing and Communicating Rules & Procedures			Managing Aides			Testing			Record Keeping		
	Fall	Spring	Change	Fall	Spring	Change	Fall	Spring	Change	Fall	Spring	Change	Fall	Spring	Change	Fall	Spring	Change
School District A	94	97	(+3)	72	85	(+13)	73	86	(+13)	98	98	(0)	100	100	(0)	94	100	(+6)
School District B	97	92	(-5)	70	89	(+19)	72	92	(+20)	97	98	(+1)	100	99	(-1)	100	100	(0)
School District C	92	95	(+3)	88	74	(-14)	89	90	(+1)	96	100	(+4)	91	87	(-4)	100	100	(0)
School District D	92	94	(+2)	71	80	(+9)	75	93	(+18)	70	100	(+30)	92	100	(+8)	100	95	(-5)
School District E	92	98	(+6)	45	97	(+52)	76	94	(+18)	100	100	(0)	100	100	(0)	100	100	(0)
School District F	92	92	(0)	74	87	(+13)	85	89	(+4)	99	99	(0)	98	100	(+2)	91	96	(+5)
School District G	62	100	(+38)	73	71	(-2)	69	97	(+28)	100	100	(0)	100	100	(0)	67	100	(+33)
School District H	80	97	(+17)	67	88	(+21)	82	89	(-7)	100	100	(0)	100	100	(0)	67	89	(+22)
School District I	73	91	(+18)	71	64	(-7)	70	91	(+21)	80	93	(+13)	100	100	(0)	67	100	(+33)
School District J	83	96	(+13)	73	76	(+3)	80	84	(+4)	97	100	(+3)	95	100	(+5)	90	100	(+10)
Cross-Site Average	86	95	(+9)	71	91	(+10)	77	91	(+14)	94	99	(+5)	98	99	(+1)	88	98	(+10)

Table 3 (continued)

Sites	Critical Dimensions													
	Monitoring and Diagnosing			Prescribing			Traveling			Instructing			Motivating			Student Planning			Overall Average		
	Fall	Spring	Change	Fall	Spring	Change	Fall	Spring	Change	Fall	Spring	Change	Fall	Spring	Change	Fall	Spring	Change	Fall	Spring	Change
School District A	85	93	(+8)	94	99	(+5)	81	75	(-6)	86	92	(+6)	73	90	(+17)	73	88	(+15)	85	92	(+7)
School District B	97	98	(+1)	99	97	(-2)	89	93	(+4)	87	91	(+4)	78	92	(+14)	76	82	(+6)	89	94	(+5)
School District C	84	95	(+11)	100	99	(-1)	94	94	(0)	97	93	(-4)	88	93	(+5)	80	88	(+8)	92	92	(0)
School District D	91	93	(+2)	98	92	(-6)	58	95	(+37)	88	97	(+9)	81	99	(+18)	81	84	(+3)	83	94	(+11)
School District E	97	93	(-4)	95	100	(+5)	100	100	(0)	90	92	(+2)	73	98	(+25)	67	85	(+18)	86	96	(+10)
School District F	86	91	(+5)	95	96	(+1)	87	88	(+1)	82	87	(+5)	76	88	(+12)	76	90	(+14)	87	92	(+5)
School District G	81	94	(+13)	80	100	(+20)	75	100	(+25)	75	82	(+7)	75	85	(+10)	42	58	(+16)	75	91	(+16)
School District H	83	100	(+17)	93	100	(+7)	67	100	(+33)	74	86	(+12)	87	87	(0)	67	100	(+33)	81	95	(+14)
School District I	63	88	(+25)	92	100	(+8)	40	80	(+40)	70	76	(+6)	64	80	(+16)	73	60	(-13)	72	85	(+13)
School District J	91	93	(+2)	98	100	(+2)	65	94	(+28)	69	76	(+7)	64	96	(+32)	60	96	(+36)	80	93	(+13)
Cross-Site Average	86	94	(+8)	94	98	(+4)	76	92	(+16)	82	87	(+5)	76	91	(+15)	70	83	(+13)	83	92	(+9)

of the critical dimensions identified in the staff development plans as areas in which training was needed and those dimensions identified in the monthly logs as areas in which training actually took place and (*b*) the critical dimensions that did not appear in the monthly logs. The results are reported in Table 4.

Table 4 shows that greater increases were found in the fall and spring degree of implementation scores for dimensions in which training took place than in the scores for dimensions not included in the training. Of the 1,108 critical dimensions in which training took place, 80% (886) showed improvement. On the other hand, only 40% (219) of the 548 critical dimensions for which no specific training was planned showed improvement. Differences were found between the percentage of critical dimensions included in training but not showing any change and the percentage of those excluded from training and showing no change (last column of Table 4). Scores for only 14% (155) of the critical dimensions in which training took place remained stable, while 52% (285) of the scores for critical dimensions not included in the staff development plans remained stable.

SUMMARY AND DISCUSSION

Data from this study provide preliminary evidence of the feasibility and effectiveness of using degree of implementation as a data base for designing staff development programs that meet the training needs of individual teachers. Three major findings from the study seem most relevant to increasing understanding of, and improving capabilities to provide, effective staff development systems. First, information derived from degree of implementation measures that are based on the use of specific performance indicators is useful in identifying staff development needs for improving program implementation. Second, staff development activities designed on the basis of identified needs can be effective in improving the degree of implementation of specific program dimensions. Finally, training does make a difference. Teachers tend to improve their program implementation in areas where specific staff development work is conducted.

The long-range implication of this work center on the development of much-needed technical support for schools in their efforts to provide relevant ongoing staff development programs that meet changing implementation needs. Although preliminary evidence seems to support the effectiveness of the Data-Based Staff Development Program, this study represents only a first step. At least two types of further research and development work are needed. One obvious line of future work includes replication of this

Table 4
Comparison of Patterns of Changes in Degree of Implementation Between Fall, 1980 and Spring, 1981 (N = 138 Teachers)

		Direction of Change in Degree of Implementation Score*		
	Critical Dimensions	Increase	Decrease	No Change
Number of Critical Dimensions Included in Training	1108**	886 (80%)	67 (6%)	155 (14%)
Number of Critical Dimensions Excluded from Training	548**	219 (40%)	44 (8%)	285 (52%)

Note. *$\chi^2 = 287.8$, $p > .01$

**Represents the sum of the critical dimensions across all 138 teachers

study and additional detailed descriptive studies of the implementation and outcomes of the Data-Based Staff Development Program. In such studies, other sources of efficacy information should be tapped (e.g., teachers', education specialists', and other professional staffs' assessments of the usefulness of the data-based approach). Moreover, emphasis should be placed on documenting the various alternative strategies employed by teachers and other school personnel in systematically using the Data-Based Staff Development Program. In addition, further refinement and development in widespread use of the data-based approach discussed here depends, to a great extent, on the availability of detailed information on how the program can be integrated to support ongoing staff development efforts. For example, information is needed on the types of training activities designed and used, the decision-making rules used to prioritize training needs, the time required for and spent on certain types of training activities, the extent of teachers' involvement in designing specific training activities, and the efficacy of various training strategies in meeting individual staffs' training needs.

The second line of research needed in this general topic area is investigation of the "generalizability" of the particular data-based approach described in this article. At least two types of studies are needed. The first would involve testing the validity and utility of using the Data-Based Staff Development Program to improve teachers' expertise in providing adaptive instruction in classrooms where educational programs other than the ALEM are implemented. The second type of study would focus on investigating the use of the basic strategies and concepts of the data-based approach to staff development in conjunction with the implementation of a variety of innovative programs in a wide range of educational settings. The objective of this line of research would be to document the alternative roles that can be played by such a staff development approach in helping schools implement different types of programs aimed at delivering improved educational services.

The basic question to be addressed in investigations of the generalizability of the Data-Based Staff Development Program would be: Is this particular training program, which incorporates the ALEM's degree of implementation measures, effective in providing training for the development of expertise required to successfully implement other adaptive education programs? Results from this line of research not only would provide external validation of the ALEM's design, but also could prove to be very fruitful in the development of a systematic methodology for improving the implementation of programs with goals similar to those of the ALEM.

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