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ABSTRACT

A multi-aged primary classroom environment was observed to determine (1) the degree to which teacher behaviors specified by developers of an adaptive learning environment (ALE) are actually exhibited by the teachers, (2) the nature of classroom processes and interactions between teachers and students in an ALE, and (3) the extent to which contextual variables alter teacher behavior. Forty-six five to eight year old students in an instructional program of prescriptive and exploratory components were observed, along with their two head teachers and one instructional aide. Two preplanned observation schedules were used to record frequencies of observed student and teacher behaviors in the ALE over a six-week period. Observational data provided explicit information about the nature and patterns of teacher functions in the ALE, functions that may be divided into consultative and management facets. Analyses of teacher behavior patterns, instructional climate based on these behaviors, student behavior patterns and their relationship to classroom processes, and patterns of teacher interaction with students of different characteristics were undertaken. The analyses indicated that teachers do direct the ALE to help students become self-directed and self-evaluating. The data also suggested that contextual variables, such as size of instructional group and subject matter, do affect the teaching patterns and teacher pupil interaction. (MJB)

THE STUDY OF TEACHER BEHAVIORS IN AN ADAPTIVE LEARNING ENVIRONMENT

by

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In spite of the fact that a considerable amount of work has been devoted to the design and implementation of school learning environments that are adaptive to individual differences during the past decade, very few systematic documentations of the classroom processes and student learning outcomes under such learning environments are available. The objective of the study described in this paper is to characterize behaviors of teachers and students functioning in a learning environment designed to adapt to the learning needs of the individual students. Specifically we were interested in studying the characteristic behavior of teachers and students functioning under an adaptive learning environment (ALE) to determine (a) the extent to which salient teacher behaviors specified by the developers of the ALE are exhibited by teachers in implementing the ALE, (b) the characteristic nature of the classroom processes and interactions between teachers and students under the ALE, and (c) the extent to which contextual variables such as subject matter, time, size of the instructional group, and certain student characteristics altered teacher behaviors.

The Design

Setting

The study was carried out in a multi-aged primary classroom with 46, five to eight year olds, two head teachers and one instructional aide. The instructional program implemented in this particular primary classroom consisted of a prescriptive component, which includes a series of highly structured curricula designed for teaching basic skills, and a relatively open-ended exploratory learning component aimed at fostering a wide range of social skills and general cognitive growth in students. The exploratory component includes such activities as sociodramatic play, block construction, game playing on computers, reading, creative writing, listening to stories or

music, creative arts, and exploration projects in science, math and social studies. These activities are generally self-selected by students. The program is implemented under an instructional-learning management system, the Self-Schedule System (Wang, 1974). Under this learning management system, students are encouraged to take the responsibility for planning when to do the teacher prescribed activities and what specific exploratory learning activities they want to do. Students are responsible for completing all the teacher-prescribed activities and at least two exploratory or prescriptive activities of his-her own choice each day. The primary goal of the program is to develop in students increasing competence in taking responsibility for planning and carrying out school learning while, at the same time, insuring mastery of basic skills.

Method

Systematic observation of teacher and student classroom behaviors was the technique used for data collection for this study. Two pre-planned observation schedules, the Salient Teacher Behavior Observation Schedule (STBOS) and Student Behavior Observation Schedule (SBOS) were used to record frequencies of observed teacher and student behaviors under the ALE.

The STBOS was designed by Colbert (1976) to examine the presence or absence of teacher characteristics and competencies related to major functions necessary for effective implementation of ALE's. The STBOS was developed on the basis of the specification of the roles of the teacher in an adaptive learning environment, by the program developers and through assembling reports of critical incidents (Ryans, 1960) observed in the classroom performance of teachers. For the present study, the STBOS was used to describe teacher behaviors relating to two major behavioral categories, the consultant instructional functions and the management functions. The consultant function section of the STBOS consists of 10 items designed to identify the frequency with which the teacher performs behaviors which encourage, support and reinforce learners to be self-directed and self-evaluative. The management function section of the STBOS records the frequency with which teachers perform behaviors which establish and maintain a classroom climate that provides an opportunity for positive interaction among participants within space, time

and materials constraints. This subsection consists of 13 items. Space is also provided on the STBOS form to record behavior occurrences in accordance to subject areas (math, reading, and exploratory) as well as the size of the instructional group (i.e., independent, small or whole group). A sample of the STBOS form is included in Appendix A.

The SBOS was used to investigate pupil behavior or reciprocal behavior in response to teacher behavior in the ALE (Wang, 1972). The SBOS was designed to obtain information on (a) the frequency of student-teacher interactions and their purposes (whether it is for instructional or management purposes), (b) the frequency and purposes of interactions among students (whether it is for constructive ideas sharing or disruptive purposes), and (c) the percentage of time students spent working in group interactive, group parallel, or individual modes, and (d) the extent to which children exhibit on task or distracted behaviors. The SBOS has been used in several previous classroom process studies, and its validity and reliability have been reported elsewhere (Wang, 1976).

Procedures

Using the STBOS, teachers were observed in 10-minute intervals for a total of 180 minutes over a six-week period. A systematic observation schedule was preplanned to insure adequate coverage of small groups of students, as well as with individuals, and teachers teaching in a variety of subjects (e.g., reading, math and exploratory). Students were observed using the SBOS. Eight separate observations of five one-minute intervals were made on all students included in the class. A total of 40 minutes of observation were made on each student. To control for time variations, a specified schedule for an observation was set up to insure that an observation record was made for each child during each different time segment of the school day. No child was observed twice on the same day.

Results

Teacher Behavior Patterns

To determine the extent to which the two teachers exhibited the salient teacher behaviors when implementing the ALE in classroom settings, we examined the observed frequencies of the overall behaviors exhibited by the teachers

under each of the two behavioral categories. Table I summarizes the frequency of teacher behaviors by function, size of instructional group and subject matter. The percentage reported in Table I was calculated by dividing the number of observed behaviors per a given category by the total number of observed behaviors. As reported in Table I, 52.3% of all teacher behaviors were consultant functions and 47.7% were management functions. Table I also summarizes teacher behaviors data according to size of instructional group and subject matter. For example, 52.9% of all teacher behaviors in independent, math instruction were consultant functions while 47.1% were management functions.

Insert Table I about here

To further differentiate teacher behaviors by subject matter/size of instructional group, we divided the number of observed behaviors in a given subject area and its instructional group size by the total number of observed behaviors. As reported in Table 2, 49.7% of all teacher behaviors observed occurred during the teaching of reading, 32.2% during math and 18.1% during exploratory. Additionally, Table 2 indicates that 81.3% of all behaviors were observed during independent (one-one) teacher-pupil interactions and 18.7% during small group. No whole group interactions were observed. These particular results indicate that two contextual variables, subject matter and size of instructional group, affect teacher behavior patterns and therefore, classroom processes.

Insert Table 2 about here

To further describe teacher behavior patterns, the data were analyzed by item to identify the specific behaviors which teachers demonstrated. This data is summarized in Tables 3 and 4. Table 3 reports percentage of consultant functions per item. For example, 48% of consultant behaviors were item number one, "discussed...what/how to do learning task(s)." Furthermore, Table 3 reports the percentage of all behaviors, per item, by size of instructional group and subject matter. That is, math, independent interactions accounted for 16.1% of all behaviors observed.

Insert Table 3 about here

Table 4 reports the percentage of management functions per item. For example, Table 4 shows that 32.5% of all management behaviors were item number one, "Solicited assistance of learners."

Insert Table 4 about here

Data in Tables 3 and 4 suggest that teachers interact with learners in a consulting role to discuss how to do a prescriptive task, and then teachers manage the classroom by individually interacting with learners to assist them in completing the prescribed tasks. The individual assistance is both teacher and pupil initiated.

Description of Instructional Climate Based on Observed Teacher Behaviors

The observational data provided us explicit information about the nature and patterns of teachers functions in the ALE. Based on the frequency data, we conclude that teachers perform their consultant role by structuring the learning environment such that they instruct individual learners how to do tasks and, whether student or teacher initiated, they provide assistance to students in completing their prescribed tasks. When students complete their work, teachers correct and discuss progress with them.

The data further suggest that management functions concerned more than discipline, in that teachers continuously structure instruction and student behavior by praising/reinforcing students and explaining program usage and classroom rules. These behaviors seem to have the characteristics of the "smoothness of transition" quality as defined by Kounin (1970). Management behaviors are utilized to structure academic experiences to encourage learners to become self-directed (consultant role) as well as to direct behavior in order that the smoother social interactions and transitions can occur. To further describe the classroom processes, we also observed student behaviors under the ALE. The following discusses the student behavior data.

Student Behaviors Patterns

To describe the characteristic natures of the student learning processes and interactions between students and teachers under the ALE the SBOS data was analyzed and results are summarized in Table 5. As reported in Table 5, 63% of observed interactions between students and teachers were initiated by students and 18% were initiated by the teacher. Fifty-eight percent of the interactions between the teachers and students were for instructional purposes and 25% were for management purposes. This particular result seems, on the surface, to differ from the teacher behavior data from the STBOS. The management function from the STBOS data were considerably higher (47.7%). This difference may be explained by the fact that the management functions performed by teachers as measured by STBOS also include management behaviors occurring in situations other than management interactions between teachers and students (e.g., categories 10, 11, 12 on the STBOS form).

Insert Table 5 about here

The data in Table 5 further suggest that under the ALE, when students interacted with other students in the classroom, 96% of the time was for idea sharing and other constructive purposes and about 4% were classified as disruptive interactions. Students were observed to have spent about 74% of their time on completing teacher assigned prescriptive learning activities, and 15% of their time on completing the exploratory learning tasks of their own choices. Students were also observed to have spent 77% of their time working on individual tasks and 19% of their observed time was spent in group interactive situations. Furthermore, 70% of observed behaviors were classified as on task and 24% were distracted. These particular results of on task behavior of students are much higher than those reports in other studies (e.g., Berliner, et. al. 1976).

Relationship between Classroom Processes and Student Behaviors

To examine the relationship between certain classroom processes and student behaviors, intercorrelations among a selected number of categories of observed classroom processes and student behaviors from the SBOS data

were calculated. The results are reported in Table 6. The statistically significant correlation coefficients between pairs of variables shown in Table 6 suggest some very interesting patterns. The data shows, for example, that: (a) when a student initiated interaction with a teacher, it tended to be for instructional purposes ($r = 90$, $P < .01$), and these instructional interactions tend to occur when the students are working on individual tasks ($r = 90$, $P < .01$), (b) teacher initiated interactions with students, whether for instructional or management purposes, do not seem to relate significantly to any of the student behaviors or classroom processes, (c) when students interact with their peers they tend to occur in both group interactive settings ($p < .05$) and when students work on individual tasks, ($p < .05$), and (d) distraction tends to occur when the students work on individual tasks ($p < .05$), and distracted behaviors were found to be negatively related to student work in group interactive settings ($p < .05$).

Insert Table 6 about here

Patterns of Teacher Interaction with Students of Different Characteristics

No noticeable difference in the classroom behaviors were found when comparing the SBOS data on students of different age, achievement levels or sex, except in one case, the frequencies and nature of interactions, between teachers and high and underachieving children. As shown in Table 7, 66% of the teacher initiated interactions with high achievers were for instructional reasons, while only 34.7% of the teacher initiated contacts with underachieving children were for this purpose. In addition, over 65.2% of the time teachers attempted to initiate contact with underachievers they had management purposes in mind, while only 24% of teacher initiated contacts with high achieving students was for this reason. Teachers spent more time contacting high achieving students for instructional purposes, the underachieving children seemed to seek more instructional information from teachers than high achievers. Of the total number of student initiated interactions with teachers, 84.6% of the contacts initiated by underachieving students were for instructional purposes, while 75% of the teacher contacts sought by high achieving were for instructional purposes.

Insert Table 7 about here

These differences found in the teacher-student interactions between the two groups do not seem to be attributed by student behavior differences. No major differences in student classroom behaviors were observed between these two groups of students. On task behaviors for example, were 76% for the underachieving group and 72% for the high achieving group; 12% of the observed behaviors of the underachieving group was classified as distracted and 17% was observed for the high achieving group. Both groups were observed to have spent similar amounts of time working on prescriptive learning tasks assigned by teachers (67% and 61%) and their task completion rates were quite comparable, both groups completed more tasks than their teachers had assigned, 122% in reading, 126% in math for the high achievers and 115% in reading and 118% in math for the underachievers. Therefore, it is our hypothesis that the difference may be attributed to the difference in the expectations the teachers may have of students of different achievement levels. These expectations differences may be unconscious.

Discussion

The teacher and student data indicates that teachers do direct this learning environment such that students become self-directed and self-evaluating as specified by the goals of the program. Furthermore, the data suggests contextual variables, such as size of instructional group and subject matter, do affect the teaching patterns and teacher-pupil interaction. Similar findings were also reported by Brophy and Evertson (1976), McDonald and Elias (1976) and Tikunoff and Ward (1977). Additionally the results from this study suggest that student achievement level characteristics also affect teacher-pupil interactions. One of the unique findings from this study was that consultant and management functions are not mutually exclusive. Each compliments the other to insure mastery of basic skills as well as realizing the goal of more independent learners.

In spite of the preliminary nature of this study, the results seem to suggest some methodological implications for teacher effectiveness research.

The importance of simultaneously observing teacher and pupil behavior in natural settings holds importance for teacher education. Doyle (1977) suggests that naturalistic, environmental investigations can yield descriptions of teaching patterns which result in desirable pupil behavior. These explicit descriptions can then be utilized to design pre- and in-service teacher training programs that are likely to be adaptive to local school settings and program implementation demands.

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TABLE 1
Per Centage of Observed Teacher Behaviors by Function, Size of Instructional Group and Subject Matter

Teacher Functions	Independent			Small Group			% of all behaviors
	Math	Reading	Exploratory	ch	Reading	Exploratory	
Consultant Functions	52.9	54.2	33.9	16.7	71.2	50.0	52.3
Management Functions	47.1	45.8	66.1	83.3	28.8	50.0	47.7

TABLE 2
Per Centage of Observed Teacher Behaviors by Subject Matter and Size of Instructional Group

	Independent	Small Group	% of all behaviors
Math	30.4	1.8	32.2
Reading	34.5	15.2	49.7
Exploratory	16.4	1.8	18.1
% of all behaviors	81.3	18.7	

Table 3

Percentage of Consultant Function Observed Teacher Behaviors Per Item

The Teacher	Independent			Small Group (2-10)			% of Consultant Behavior
	Math	Reading	Exploratory	Math	Reading	Exploratory	
1. Discussed with learner(s) what/how to do learning task(s).	14.5	13 97	3 9	–	14 5	1 1	48 0
2. Requested of learner(s) in instructional plan.	0 6	2 2	1.1	–	2 8	–	6.7
3. Discussed progress with learner(s).	4.5	5 0	3 4	0 6	1 1	–	14.6
4. Requested progress information from learner(s).	3 9	5 6	1.1	–	1 7	0 6	12.8
5. Corrected completed work of learner(s).	7.3	8 9	1 1	–	0 6	–	17.9
% of all behaviors	16.1	18.7	5 5	29	10 8	87	

Table 4

Percentage of Management Function Observed Teacher Behaviors Per Item

The Teacher	Independent			Small Groups (2-10)			% of Management Behaviors
	Math	Reading	Exploratory	Math	Reading	Exploratory	
1. Solicited assistance of learner(s).	13 5	14 1	4 3	0 61	–	–	32 5
2. Unsolicited assistance of learner(s).	11 7	7 98	10 4	0 61	–	0 61	31 3
3. Praise/reinforcement to learner(s) for independence.	3 1	9 2	1 8	–	1 2	–	15 3
5. Encouragement for learner to provide assistance to peer.	–	–	0 61	0 61	–	–	1 2
6. Explanation of "Program" rules to learner(s).			0 61	–	7 97	0 61	9 2
7. Explanation of classroom rules to learner(s).	1 8	1 8	3 7	–	–	–	7 4
8. Solicitation of "Program" rules from learner(s).	–	–	0 61	–	–	–	0 61
10. Display/referred to posted "Program" or classroom rules.	–	–	0 61	–	–	–	0 61
**11. Arrangement of material for easy access by learner(s).				0 61			0 61
12. Labels on materials for easy identification by learner(s).				0 61	–	0 61	1 2
% of all behaviors	14 3	15 8	10 8	1 5	4 4	0 87	

Table 5

Summary of Frequencies of Observed Behaviors
Study II . 1976-77
N = 39

Categories of Variables			Mean Percent of Observed Frequencies
A.	Interactions with Teacher:		
	1.	Initiation	
		a. Student	.83
		b. Teacher	.18
		c. Unknown	.18
	2.	Purpose	
		a. Instructional	.58
		b. Management	.25
		c. Unknown	.08
B.	Interactions with other Children		
	1.	Share ideas, materials, activities, etc.	.96
	2.	Disrupt (tease, fight, argue, etc.)	.04
C.	Activity Types:		
	1.	Prescriptive	.74
	2.	Exploratory	.15
	3.	Other	.11
D.	Setting:		
	1.	Group: interactive	.19
	2.	Group: parallel	.03
	3.	Individual	.78
E.	Manner:		
	1.	On Task	.70
	2.	Waiting for Teacher's Help	.07
	3.	Distracted	.24

Table 8

Interactions Among a Selected Number of Classroom Process Variables
Study II 1976-77
N = 39

$^{*}p < .05$
$^{**}p < .01$

Variables	Student initiated interactions with teacher	Teacher initiated interactions with students	Interactions between teacher and student for instructional purposes	Interactions between teacher and student for management purposes	Student interactions with peers for task oriented purposes	Student interactions with peers for discriptive reasons	Student work in interactive settings	Student work in individual settings	Student observed to be on task	Student observed to be distracted
1. Student initiated interactions with teacher	1.00	− .03	.90**	− .13	.38*	− .08	− .21	.86**	.78**	.79**
2. Teacher initiated interactions with students		1.00	.22	− .03	− .01	− .12	− .17	− .04	− .23	.07
3. Interactions between teacher and students for instructional purposes			1.00	− .27	− .33*	− .07	− .26	.81**	.71**	.77**
4. Interactions between teacher and student for management purposes				1.00	.09	.19	.21	− .18	− .12	− .15
5. Student interactions with peers for task oriented purposes					1.00	.16	.40	.31	.43*	.51**
6. Student interactions with peers for discriptive reasons						1.00	.19	− .12	− .14	.07
7. Student work in interactive settings							1.00	.07	− .01	− .36
8. Student work in individual settings								1.00	.79**	.89**
9. Student observed to be on task									1.00	.61**
10. Student observed to be distracted										1.00

Table 7

Patterns of Interactions Between High and Under Achieving Students with Teachers

Interactions with Teachers	Mean Percent of Observed Frequencies	
	High Achievers	Under Achievers
Teacher-Initiated Interactions:		
Instructional purposes	66%	35%
Management purposes	24%	65%
Purposes unknown	10%	0%
Student Initiated Interactions:		
Instructional purposes	75%	85%
Management purposes	15%	15%
Purposes unknown	10%	0%

SALIENT TEACHER BEHAVIORS CLASSROOM OBSERVATION FORM

II. Instructional Functions—Consultant
Model Goal: Teacher encourages learner to be self-directed and to self-evaluate progress.

The teacher:	Independent			Small Group (2-10)			Whole Group (10+)			Sum
	Math	Rdg.	Explor.	Math	Rdg.	Explor.	Math	Rdg.	Explor.	
1. Discussed with learner(s) what/how to do learning task(s).										
2. Requested of learner(s) an instructional plan.										
3. Discussed progress with learner(s).										
4. Requested progress information from learner(s).										
5. Corrected completed work of learner(s).										
6. Provided learner(s) with "Key" for self-scoring of work.										
7. Provided "Key" upon learner request.										
8. Discussed with learner(s) their readiness for testing.*										
9. Responded to learner(s) expressed readiness for testing.*										
10. Other										

III. Management Functions
Model Goal: Teacher provides opportunity for frequent individual interaction between teacher-learner and learner-learner.

Teacher provided:										
1. Solicited assistance of learner(s).										
2. Unsolicited assistance of learner(s).										
3. Praise/reinforcement to learner(s) for independence.										
4. Encouragement for learner to seek peer assistance.										
5. Encouragement for learner to provide assistance to peer.										
6. Explanation of "Program" rules to learner(s).										
7. Explanation of classroom rules to learner(s).										
8. Solicitation of "Program" rules from learner(s).										
9. Solicitation of "classroom" rules from learner(s).										
10. Display/referred to posted "Program" or classroom rules.										
**11. Arrangement of materials for easy access by learner(s).										
12. Labels on materials for easy identification by learner(s).										
13. Encouragement for learner(s) to reorganize materials after use.										

*Testing: Pre- or Post-tests; CAT's; Unit Tests; or End-of-Book Tests.
**Draw a map of physical arrangement of room.