

FINAL REPORT

AN EVALUATION OF THE SPECTRUM OF TEACHING STYLES

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Description of the Project

Hypotheses

Based on an analysis of the philosophy, teachings and methods of the Spectrum of Teaching Styles it was reasonable to make the following hypotheses:

1. Spectrum teachers will give significantly more individual attention to students during class time than Control teachers (both in terms of frequency of individual contacts and in percentage of class time used for giving individualized attention).
2. Spectrum teachers will spend significantly less time than Control teachers dominating classroom academic discussions.
3. More efficient use of class time will be made in Spectrum classes than non-Spectrum classes. Specifically, Spectrum students will pay closer attention in class, the class pace will be faster, less time will be wasted getting started, students will spend more time on school work, students will give their teachers fewer discipline problems, and students will waste less time than non-Spectrum students.
4. Spectrum students will show more favorable attitudes toward their education than non-Spectrum students.

Rationale

Anderson and Faust (1973) have argued "Not all students will have the same difficulties with a lesson. This means that the teacher must make individual diagnoses for individual students and groups of students" (p. 176). In order to provide private, immediate feedback it is imperative that teachers take time to observe individuals as they are working in class and

be available for individual consultations with students. One of the goals of the Spectrum is to train teachers to interact privately with individuals in order to give them immediate feedback and appropriate new assignments. This study attempted to discover whether differences in the number of contacts with individuals and/or time spent with individuals existed between Spectrum and non-Spectrum classrooms.

Flanders (1970), after reviewing a large number of studies of teacher effectiveness, concluded that students tend to achieve best in classes in which teachers make use of ideas and attitudes expressed by students, were not critical, and did not dominate discussion. In spite of the fact that these findings are relatively well known no consistent and integrated effort has been made to help in-service teachers implement these ideas. It is a goal of the Spectrum is to decrease the amount of time teachers dominate academic discussion. This is done by training teachers to implement procedures which make students active learners rather than passive listeners. This study attempted to determine whether differences in the amount of academic time dominated by teachers existed between Spectrum and non-Spectrum teachers.

Rosenshine (1976) has reviewed a large body of literature which indicates that students' academic growth is positively correlated (1) with amount of time structured by the teacher; (2) with time spent on subject matter (whether in textbooks or in teacher-student verbal interactions); and (3) with time spent in seatwork with academic workbooks which students proceeded through at their own pace. Wiley and Harnischfeger (1974) found that the average number of hours of schooling provided in a particular school was positively related to academic achievement. Very clearly, then, the more time students are able to spend in subject matter related activities, the greater the

likelihood that they will achieve at high levels. Gump (1974), however, has reported that it is not unusual to find that up to 40% of a student's time on any given day is spent in "non-core, nonsubstance phases" consisting of moving about, waiting, and "getting organized." The average nonsubstance time he reports is approximately 25%. This does not even include time which students waste while fooling around during academically-oriented episodes. This was found in both "open" and "traditional" classrooms. Costin, Greenough and Menges (1971) did an extensive review of empirical studies which indicated that students' ratings can provide reliable and valid information on the quality of courses and instruction. Therefore meaningful information related to the efficient use of classroom time, such as class pace, amount of attention paid, time spent on schoolwork, discipline problems and wasted time, can be obtained from student ratings. Despite the need for more efficient use of classroom time few school districts are providing an in-service teacher training program which emphasizes this need. A third goal of the Spectrum is to increase the efficiency in use of class time. From the above review it is clear that:

- 1) there is probably a great deal of room for improvement in the amount of time spent on-task in most classrooms; 2) with larger amounts of time spent on-task students are more likely to attain higher levels of achievement; and
- 3) student ratings of classroom instruction are reliable and valid, therefore useful for finding out how class time is used in terms of class pace, student attention, time spent working, discipline problems, time wasted getting started and overall wasted time. This study attempted to show whether differences in efficient use of class time existed between Spectrum and non-Spectrum classrooms.

A fourth goal of the Spectrum is to promote positive student affect with regard to their education. Certainly teachers hope that students will have a positive attitude toward their education, but few programs currently available systematically attempt to implement those procedures inherent in the Spectrum which should tend to result in more favorable attitudes (i.e., increased socialization, more teacher-student interaction, precisely defined expectations, etc.). This study attempted to show whether differences in attitudes toward their education existed between Spectrum and non-Spectrum students.

Brief Program Description

The Spectrum of Teaching Styles is a program of training teachers to utilize in their classrooms a range of instructional formats prescribed, detailed, and disseminated by the Center on Teaching. Seven distinct teaching styles which focus on the academic and behavioral roles of students and teachers have been identified. Teachers are trained to implement each teaching style and are taught the relative cognitive, emotional and/or physical benefits of each style. Each teacher chooses the teaching style(s) commensurate with his/her goals for any particular class period. Once the program is implemented a teacher can completely communicate his/her cognitive and behavioral expectations for that class period merely by naming the style to be used, thus, it is claimed, increasing efficient use of time.

The teacher training program lasts three weeks: one week for an overview of the Spectrum and an introduction to Spectrum theory; one week for practicing the styles in videotaped micro-teaching sessions; and the last week for preparation of actual classroom materials. The design of the

workshop is flexible enough to spend more time in one area when needed and less in another. Teachers must demonstrate competency in implementing the styles in the workshop sessions and must agree to a one-year follow-up program during which project staff constructively criticize implementation procedures and aid in solving problems which crop up during the regular classroom routine.

Once trained, teachers acquaint their students with the various teaching styles over a period of time which is regulated by the teacher. When the teacher feels that the roles of both teacher and student are both understood and competently carried out the teacher can then introduce a new teaching style.

During the follow-up program implementers are frequently visited by project staff not only for constructive criticism and problem solving, but for help in materials construction, analysis of preparation strategies, and general encouragement. Several teachers have, as a result of this, developed full year's elementary curriculum materials in several subjects specifically for use in Spectrum teaching.

There are no essential physical features of the program other than the regular setting in which teachers and pupils meet. Project staff use video-tape recorders and cameras and detailed analysis sheets both during workshop and actual classroom sessions.

The cost of the program is basically that of staff training, follow-up supervision, and evaluation. A three week pre-service workshop is necessary for the teachers and administrators of adopting districts. Costs are based on local salary schedules and availability of release time for participating teachers.

Evaluation Strategy

The evaluation technique used to measure the variables mentioned above utilized student and teacher questionnaires and a systematic analysis of videotapes of actual classroom sessions. The design of the study was Quasi-experimental (Campbell & Stanley, 1966) since it was impossible to randomly assign teachers to conditions and students to teachers. Because not all variables can be controlled in a quasi-experiment great pains were taken to get control teachers and students comparable to the trainees. The evaluation study relied on replication and the principle of converging evidence from various sources to determine where differences existed between Spectrum and non-Spectrum classrooms.

Direct achievement data on students was, of course, impossible to obtain due to the large range of ages and subject matters taught in Spectrum classrooms. The strategy was to measure those traits of teachers and students which have strong relationships with student achievement. Among these are time spent on task (Rosenshine, 1976), teacher time spend with individuals (Anderson & Faust, 1973), less teacher domination of academic discussion (Flanders, 1970), attention (Lahaderne, 1968) and class pace (Rosenshine, 1970). Three sources of data were used in this study: student and teacher questionnaires, both of which were administered both years of the evaluation study, and videotaped episodes of actual classroom instruction done by Spectrum and Control teachers. Each of these studies will be reviewed below.

Context

The program serves teachers who volunteer for the program in virtually every socio-economic condition, grade level, and subject matter area. The

primary demonstration site for the project is the Crossroads Middle School in South Brunswick, New Jersey, a growing middle class suburban community. The project, however, addresses a statewide need as well as local and involves several school districts, with over 1,000 pupils currently participating in some aspect via teachers trained under the project. Three schools, involving 56 teachers and approximately 3,000 students (over two years), were selected for full involvement in the evaluation studies.

- . Crossroads Middle School: contained Spectrum personnel.
- . Wall Intermediate School: contained Control personnel.
- . Carl Sandburg Intermediate School: contained Control personnel.

Wall and Carl Sandburg were carefully chosen as Control schools in order to insure that as many background variables as possible were similar. All three schools serve the same kind of socio-economic community, suburban-rural; are approximately the same size; contain seventh and eighth grade pupils; have approximately equal per-pupil expenditures; parental income is the same (Crossroads = \$10,657, Carl Sandburg = \$10,065, Wall = \$9,813); level of occupation is the same (Crossroads = 6.81, Carl Sandburg = 6.82, Wall = 6.77 on a scale from 1 = lowest to 11 = highest); and Educational Assessment Program (EAP) data from 1975 indicates equivalent math and reading achievement in the seventh grade. The teachers in these schools were all paid volunteers who agreed to essentially the same evaluation strategy demands.

Student Questionnaire

It is inappropriate, of course, to do item by item significance tests on differences between Spectrum and Control responses to items on the Student Questionnaire. The statistical test used was a discriminant analysis

(Tatsuoka, 1971), which provides an overall test of the significance of the difference between Spectrum and Control classes and indicates the configuration of variables which most contribute to differences.

Appendix A shows the percentage of students repoding to each alternative of each question on the 1975 Student questionnaire. Appendix B shows the discriminant weights and significance statistics resulting from the analysis of the 1975 questionnaire. Appendices C and D show the item analysis and the results of the discriminant analysis for the 1976 questionnaire.

There were 380 Spectrum students and 300 Control students responding in 1975. The two group (Spectrum vs. non-Spectrum) analysis yielded one significant ($p < .001$) discriminant function, Bartlett's V statistic, which is a χ^2 function, with 13 degrees of freedom = 80.59. Alternate significance tests appear in Appendix B. Those items which contributed most to the differences between Spectrum and non-Spectrum students revealed that:

1. Spectrum students find it easier to pay attention in class.
2. Spectrum students say there are fewer discipline problems in their classrooms.
3. Spectrum students get more individualized attention from their teachers.
4. The pace in Spectrum classrooms is perceived as being somewhat faster.
5. Spectrum teachers are trusted less.
6. Spectrum students don't like class as much as Control students do.
7. Spectrum students don't like to have the teacher work individually with them.

In order to ascertain the consistency of the differences between Spectrum and non-Spectrum classrooms, the questionnaire study was replicated and

extended in 1976. Each teacher had every one of his/her students fill out the questionnaire. Since some students had several of the teachers in this study some students filled out the questionnaire on two or more occasions. No student responded to the questionnaire more than once for any particular teacher, however. The total number of questionnaires returned was 2,356, approximately a third of which were from Spectrum students. Spectrum and non-Spectrum students responded to 19 identical questions on the questionnaires. It was those 19 questions which served as the variables in the discriminant analysis. The results of this analysis yielded one significant ($p < .001$) discriminant function, Bartlett's V statistic, which is a χ^2 function, with 19 degrees of freedom = 661.6. Alternative significance tests appear in Appendix D. Those items which contributed most to the differences between Spectrum and non-Spectrum students revealed that:

1. Spectrum students are instructed to work with other students much more often.
2. Spectrum students feel that they work at a faster pace than do Controls.
3. Spectrum students don't like how their class is run.
4. Spectrum students get more individualized attention from their teachers.
5. Spectrum students feel as if it takes them longer to get started to work in class.
6. Spectrum students report being hard at work more of the time than do Controls.
7. Spectrum students consider their teachers to be more friendly than do Controls.

8. Spectrum students report paying close attention in class more of the time.
9. Spectrum students feel as if they waste somewhat less class time.

The results of these analyses show that over a two year period, with different teachers and different pupils, there are several consistent differences in the classroom perceptions of Spectrum students and their non-Spectrum counterparts. On the positive side students with Spectrum teachers feel they get more individual attention, feel they move at a faster pace, work with other students more often and find it easier to pay attention. Other positive findings appearing in one of the analyses and receiving some support from the other include fewer discipline problems, more time spent hard at work, friendlier teachers and less overall wasted time in Spectrum classes. On the negative side students with Spectrum teachers don't like their classes as much and feel as if they waste more time getting started. While students trusted Spectrum teachers less in the first analysis there were no differences between Spectrum and non-Spectrum teachers in reported trust on the second analysis. There was also a tendency for Spectrum students in the second study to agree that they liked individual attention from their teachers, a sharp contrast from the first.

Teacher Questionnaire

The analyses of the 1975 and 1976 teacher questionnaire data presented here are descriptive. Obviously, tests of significance on individual items are inappropriate considering the small sample sizes. Anyone wishing to do such tests, however, may consult the summary information in Appendices E and F. Summaries of the responses to items within each category are presented below for each year the questionnaire was given. It should be noted that the

questions changed slightly from the first year to the second. This was done in order to attempt replication of findings which indicated differences the first year and to test whether or not differences existed on issues which arose during the course of the first analysis.

1975. Two questionnaires were constructed. The first (the Spectrum Teacher Questionnaire, STQ) was administered only to teachers who had had Spectrum training and who were implementing Spectrum styles in their classrooms. The second questionnaire (The Teacher Questionnaire, TQ) was also administered to Spectrum teachers and to a control group of teachers who knew nothing of Spectrum.

The questionnaires were constructed with the following variables, which Spectrum training was hypothesized to effect, in mind: preparation, efficiency in use of classroom time, clarity of roles and role expectations, perceived student attitude, confidence in learning progress, time spent with individuals in class, and discipline problems. Another category, personal characteristics, was also included. Spectrum teacher comments obtained from an open-ended question concerning the strengths and weaknesses of Spectrum will be included in Appendix F. There were 19 Spectrum teachers and 21 Controls. Identification of questions corresponds with the labeling given in Appendix E.

Preparation (Questions TQ3, STQ4). Spectrum teachers report spending more time than other teachers preparing for their classes. Spectrum teachers (90%) disagree that preparation for using the Spectrum takes more time than it is worth.

Efficiency in time use (Questions STQ20, TQ10, STQ14). Spectrum teachers report spending somewhat less time giving directions to students than do Control teachers. Nearly half of the Spectrum teachers say they cover more

material since implementing the Spectrum. However, 30% of the Spectrum teachers reported spending more time giving directions when they use Spectrum teaching.

Discipline.(Questions TQ15, STQ16). Spectrum teachers reported having fewer discipline problems than other teachers. About half of the Spectrum teachers said they had fewer discipline problems since implementing the Spectrum.

Clarity of roles and subject matter presentations (Question TQ17, TQ8, STQ18). Virtually all teachers agreed that their students could easily follow prescribed roles and follow teacher's directions. Spectrum teachers were more willing to say that their subject matter presentations were clear.

Confidence in Learning progress (Questions STQ12, TQ11, TQ20, TQ13, STQ21). Spectrum teachers were somewhat more willing than Controls to say that their students were learning more this year than had they been in last year's class. Overall, Spectrum teachers felt their classes worked harder than did Control teachers. Over 60% of the Spectrum teachers felt that students work more diligently when in a Spectrum style than when not.

Time spent with individuals in class (Questions TQ18, STQ19). About 60% of the Spectrum teachers reported spending more time with individuals in class since implementing the Spectrum. Overall, about half of the teachers in both groups felt they spent more time than other teachers working privately with individuals.

Perceived student attitude (Questions STQ13, TQ12, STQ17). Nearly all of the teachers felt their students were as happy or more happy than they had been the year before. Ninety percent of the Spectrum teachers agreed that their students liked learning by different styles.

Personal characteristics (Questions STQ10, TQ9, STQ23, STQ5, STQ6, STQ24).

One of the most surprising results of this analysis was the fact that over 60% of the Spectrum teachers disagreed that their experience as a teacher before Spectrum training was more useful than the Spectrum training program attesting to the regard with which the Spectrum is held by implementers. 90% of the Control teachers agreed that their experience would be more useful than any training program. 95% of the Spectrum teachers agreed that all teachers could benefit from the Spectrum. Spectrum teachers disagreed that the program took away their individuality, generally disagreed that they had been using Spectrum techniques before training, and disagreed that the Spectrum was just new labels on old ideas.

A summary of responses to each question on the 1975 questionnaires can be found in appendix E.

1976. Questions on the Teacher Questionnaire were assigned to one of the following categories: preparation, efficiency in time use, discipline, attention, amount of learning, trust, interest, impression of student attitude, individualized attention, variation in activities, and personal background. There were 10 Spectrum and 20 non-Spectrum teachers. Summaries of responses to each question are shown in Appendix G.

Preparation (Questions 1, 2, 17). While Spectrum and Control teachers have the same number of distinct preparations to make for each day's teaching, Spectrum teachers report spending longer total preparation time for the average day's teaching. Spectrum teachers (80%) disagree that preparation for using the Spectrum takes more time than it is worth.

Efficiency in time use (Questions 13, 19, 21). Spectrum teachers report spending 1/2 to 2/3 as much time giving directions to students as do Control teachers. Spectrum teachers report getting more subject matter taught and spending less time on directions since they began using the Spectrum.

Discipline (Questions 4, 11, 15, 24). Spectrum and Control teachers both report having very few discipline problems every class period. Control teachers, however, find the problems which do occur more distracting and disruptive of the learning environment than do Spectrum teachers. Spectrum teachers report spending less time dealing with discipline problems than do controls. While none reported more problems, 30% of the Spectrum teachers said they had fewer discipline problems since implementing the Spectrum.

Attention (Questions 16, 25). There were no differences between Spectrum and Control teachers' perceptions of how easy/difficult it was for their students to pay attention in class. Half of the Spectrum teachers, however, reported that their students seem to pay more attention since the Spectrum was implemented (the other half reported the same amount of attention being paid since implementation).

Amount of learning (Questions 7, 14, 20, 22). Virtually all teachers were willing to say that their students had learned more than the students would have if they had been in the teacher's class the year before. Spectrum teachers were slightly more willing than Controls to agree that their classes work very hard. Spectrum teachers felt that their students were learning more and working more diligently since they had implemented the Spectrum.

Trust (Question 8). While all teachers agreed that their students trusted them, Spectrum teachers were somewhat more likely than Controls to "strongly agree" that students trusted them not to make students appear foolish in front of their friends.

Interest of instruction (Question 9). No differences were found between Spectrum and Control teachers.

Impression of student attitude (Question 10). While all teachers agreed that more of their students probably liked their class than didn't, Control teachers were somewhat more likely to "strongly agree."

Individualized attention (Question 12). Spectrum teachers report taking time to get around to work with individuals much more often than do Control teachers.

Variation in activities (Question 3). Spectrum teachers report more variation in classroom activities and lessons than do Control teachers.

Personal background (Questions 5, 6, 18, 23). Most teachers agreed that their experience has been and will be more useful than any teacher training program. Virtually all teachers agreed that they enjoyed being a teacher this year. Ninety percent of the Spectrum teachers agreed that all teachers could benefit from the Spectrum, and all who responded said they had adopted many, most, or all of the ideas learned during Spectrum training.

Summary. Spectrum implementers report taking more time to prepare, spending less time giving directions in class, taking less time for discipline problems, getting more subject matter taught, and giving individualized instruction more often. Implementers have a large personal investment in the Spectrum and appear as satisfied, if not more so, of their teaching performance as their non-Spectrum counterparts. Nearly all implementers felt that all teachers could benefit from Spectrum training.

Videotape Chronometric Analyses

The purpose of the videotape chronometric analyses was to determine whether there were differences between Spectrum and non-Spectrum classes on

(1) teacher time spent working with individuals; (1) teacher time spent dominating subject matter discussion; and (3) student time spent on subject matter, on procedures, and time wasted.

Method

Subjects. The subjects were 19 Spectrum teachers and 20 Control teachers for the Teacher analyses. 76 randomly selected Spectrum students and 80 randomly selected Control students were subjects in the Student analyses.

Equipment. Data on use of classroom time was obtained by recording entire class periods of both Spectrum and control classes on Sony V-32 1/2 inch video tape. Tapes were viewed on Sony CVM-950 Monitors driven by Sony AV-3600 Videocorder decks. Time intervals were recorded on two pairs of Marietta 14-15D, .01 sec cumulative interval timers switched by two pairs of DPDT-center off switching devices operated by the principle tape viewer.

Using this equipment two trained tape viewers were able to continuously monitor teacher and student behaviors for entire class periods. The switching devices on the timers enabled the viewer to instantaneously clock changes in classroom activity, such as a change from student role behavior to student on-task (academic) behavior, with a potential accuracy of one one-hundredths of a second. In this manner every second of classroom time for both teachers and students was accounted for. Reliability among the two principal tape viewers was $r = .92$.

Design and procedure. The dependent variables of interest in the chronometric analyses were teacher time spent dominating academic discussions, and academic behaviors, procedural behaviors, and waste-time behaviors by students. An additional variable, time spent interacting with individuals, was included

in the Teacher analyses. Teacher training (Spectrum vs. non-Spectrum) was the between-subjects factor.

At least two videotaped episodes of each teacher teaching in his/her actual classroom for one class period was made. In the case of Control teachers, who had not been videotaped before, three tapes were made and the first discarded to minimize reactive effects of taping.

Two videotape recorders and cameras were present in each room during the taping of each episode. One camera focused on the teacher and the other focused on four randomly selected students in each class. The teacher wore a wireless microphone and several microphones were placed about the room. Of these latter microphones only the one placed amidst the four randomly selected students was actually "live." The dummy microphones elsewhere in the classroom were included to minimize the chance that the four target students would realize that they were the subjects of interest.

The four students from each classroom were randomly chosen by matching the first four numbers obtained from a random number generator to the number next to each student's name in the teacher's class roster. Of these four students, two were randomly selected for chronometric analysis. A different set of randomly generated numbers was used for each classroom.

Scoring

Individual interactions. A count of the number of times and the duration of time a teacher interacted with any individual in the class was kept. In order to be counted as an individual interaction the following had to occur: the teachers had to be in physical proximity with the student and had to obviously be directing his/her attention to the student or the student's work.

The teacher had to be looking at the student or the student's work, or conversing with the student in such a manner that the conversation was primarily meant to be heard only by that student.

Dominating academic discussion: Teacher. Teacher domination of academic discussion included those activities directly dealing with subject matter. These behaviors fell into one of four categories: 1) Disseminating information (i.e., lecturing, reading aloud, demonstrating); 2) Observing an individual student's work while the student was working on it; 3) Providing feedback (contingent upon the evaluation of a student's work); 4) Aiding students with problems (i.e., asking and answering questions, giving clues, rephrasing questions).

Non-academic behavior: Teacher. All behavior not classified as academic was considered non-academic behavior. These behaviors included passing out papers, explaining procedures (when they were not subject matter related; i.e., how to get the graph paper), walking around the room without stopping to observe students' work.

Academic behavior: Student. This includes any on-task, subject matter related activity on the part of the learner. This included attending to a teacher's lecture, asking a subject matter related question, listening to and working with other students on that day's lesson, obtaining feedback on the lesson, engaging in a remedial session with the teacher on work incorrectly completed.

Role behavior: Student. These are behaviors in which the student does what he/she is told to do, but which are not directly subject matter related. Included in this category are such activities as collecting materials to be used during the lesson, listening to the teacher explain how to proceed through

a sequence of activities, waiting for help at the teacher's desk while the teacher finishes with other students.

Waste-time behavior: Student. All behavior not classified as academic or role behavior falls in this category. These behaviors included wandering aimlessly around the room, hitting other students, not working on the prescribed task, talking with other students about things irrelevant to the subject matter, gazing out the window.

Results

Individual interactions. Spectrum teachers made significantly more individual interactions with students per 40 minute period and spent a significantly greater percentage of each class period directly with individuals (cf. Table 1).

Table 1
Results of Videotape Chronometric Analysis of
Teacher - Student Individual Interactions

| Group | N | Mean Number ^a Interactions | S.D. | df | t |
|----------|----|--|------|----|-------|
| Spectrum | 19 | 49.5 | 29.0 | 37 | 4.11* |
| Control | 20 | 22.9 | 27.9 | | |
| Group | N | % Class Time for Individual Interactions | S.D. | df | t |
| Spectrum | 19 | 34.03 | 24.8 | 37 | 2.98* |
| Control | 20 | 16.48 | 27.0 | | |

^aStandardized to 40 minute periods

* p < .005

These data confirm Hypothesis 1. Spectrum teachers spent more time each class period working with individuals and participating in individual interactions per 40 minute period.

Teacher domination of academic discussion. Spectrum teachers spent less than half as much time dominating classroom academic discussion as did Control teachers. The results of this analysis are shown in Table 2.

Table 2

Results of Videotape Chronometric Analysis of
Percentage of Class Time Teachers Dominated Academic Discussion

| Group | N | % Academic Time Dominated by Teacher | S.D. | df | t |
|----------|----|--|------|----|--------|
| Spectrum | 19 | 30.2 | 21.7 | 37 | 7.85** |
| Control | 20 | 67.6 | 20.4 | | |

**
p < .001

These data indicate that the Spectrum Group achieved Hypothesis 2 by spending less time each class period dominating the academic discussion than Control teachers.

Student behaviors: Academic time. There were no differences between Spectrum and Control students in on-task time measured by the videotape chronometric analysis. Table 3 depicts these results.

Student behaviors: Role-time. Since group variances could not be assumed equal, p was approximated by Welch's method. It would appear that Spectrum students spend a greater percentage of each class period in role-related behaviors than do Control students. Although unexpected, this result seemed inevitable due to the greater student independence in Spectrum classrooms (where students

collect and score their own and each others' papers, etc.). These results are shown in Table 3.

Student behaviors: Waste time. While Spectrum students spend more time in role behaviors in class they waste less time than do Control students. Table 3 shows these results.

Table 3
Results of Videotape Chronometric Analysis of
Percentage of Class Time Spent in Various Student Behaviors

| Group | N | % On-Task Time | S.D. | df | t |
|----------|----|----------------|------|-----|--------|
| Spectrum | 76 | 59.8 | 18.9 | 154 | .918 |
| Control | 80 | 62.8 | 20.7 | | |
| Group | N | % Role Time | S.D. | df | t |
| Spectrum | 76 | 22.0 | 18.6 | 154 | 2.91* |
| Control | 80 | 14.7 | 12.1 | | |
| Group | N | % Waste Time | S.D. | df | t |
| Spectrum | 76 | 18.1 | 14.9 | 154 | 1.76** |
| Control | 80 | 22.6 | 16.8 | | |

* p < .01

** p < .10

These results suggest that Spectrum students waste less time in class, thereby spending more time doing what they are supposed to do. The videotape data did not, however, confirm the part of hypothesis 3 which hypothesized that Spectrum students would spend more time in class on task. It should be noted, however, that both groups displayed high percentages of productive class time spent when compared to previous estimates (Gump, 1974).

Conclusions

Putting all of the evidence together, Hypothesis 1 is decisively confirmed. In two large studies Spectrum pupils described themselves as receiving more individual attention from teachers than did non-Spectrum pupils. In both years Spectrum teachers reported giving more individual attention than Control teachers. Finally, analysis of videotaped classroom episodes showed that Spectrum teachers spent over twice as much time ($p < .005$) as Control teachers in academically oriented interactions with individual students. Conclusion: Spectrum teachers appear to give more individual attention.

Hypothesis 2 was clearly supported. Results of the chronometric analysis of the classroom videotapes showed that Spectrum teachers spent less than half as much time as Control teachers in such activities as disseminating information, lecturing, and reading aloud ($p < .001$). Conclusion: Spectrum teachers appear to display less domination of academic discussions.

The results of the various phases of this evaluation are consistent with Hypothesis 3. In both 1975 and 1976 Spectrum students reported moving at a faster pace and paying closer attention than non-Spectrum students. Other trends in the student questionnaire data favoring the Spectrum and appearing in both years were fewer discipline problems, more time spent in hard work, and less wasted class time. All of these trends were also seen in both years in the comparisons of the reports of Spectrum and Control teachers. (There was one negative trend in the data. In one of the two years, Spectrum students said they spent more time getting started to work than non-Spectrum students.) The chronometric analysis of classroom videotapes indicated that slightly less time was wasted in Spectrum classes ($p < .10$). Conclusion: There appears to be more efficient use made of class time in Spectrum classes.

The data are inconclusive, tending negative, with respect to Hypothesis 4. In both 1975 and 1976 Spectrum pupils had less favorable attitudes toward how their classes were run than non-Spectrum students. In 1975 there were other trends on attitude questions unfavorable to the Spectrum as well. However, the tide turned the other way in 1976. Spectrum teachers were then regarded as more friendly and trustworthy than Control teachers. Conclusion: No consistent effect of the Spectrum on student attitude has been clearly demonstrated.

We are in no position to conclude that the Spectrum caused the benefits just enumerated; however, it is certainly associated with characteristics (with the possible exception of attitude) known to be desirable. We judge that the results over two years and three types of data are consistent enough and strong enough to warrant full dissemination of this program. The Spectrum appears to aid teachers in implementing procedures and strategies known to contribute to high student achievement.

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