An Elementary Student as a Behavioral Engineer

Surratt
AN ELEMENTARY STUDENT AS A
BEHAVIORAL ENGINEER

by

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INTRODUCTION

Numerous studies utilizing behavior modification techniques have been conducted in regular public school classrooms (Hall, Lund, and Jackson, 1968; Thomas, Becker, and Armstrong, 1968; Madsen, Becker, and Thomas, 1968). In each of these cases the teacher was utilized as a behavioral engineer, which necessitated that he or she selectively observe the behavior of each of the children in question. Within a normal classroom, there are times when such observations are not practical. For example, when a teacher is working intensively with a small reading group, it is not possible at the same time to attend closely to the behaviors of other class members located in another part of the room.

In a setting where the teacher is unable to work with the behaviors in question and where highly trained psychologists are not available, one must utilize the resources at hand. In the typical school setting, an abundant resource available for the modification of student behavior, is other students.

It has been shown that nurses and hospital attendants (Ayllon and Michael, 1959), parents (Zeilberger, Sampen, and Sloane, 1968; Hawkins, Peterson, Schweid, and Bijou, 1966), as well as many other diverse populations can be trained in a short period of time to effectively modify the behavior of others (Ulrich, Stachnik, and Mabry, 1966; Homme, 1966).

If time, personnel, and adequate funds were available, the optimal condition within a school would be for a trained behavioral
therapist to work with children who are exhibiting mild problems. Because of the prohibitive cost involved in hiring special personnel and the lack of individuals with sufficient training, many problems are allowed to exist and to develop until it is only after a severe behavioral problem is well established that any student is given professional attention.

The present study investigated the behaviors of four students in response to controls exerted by a fifth grader functioning as a student therapist.

METHOD

Subjects

The subjects were four students enrolled in the first grade of a public school serving a rural middle class population. These children had been identified by the teacher as students who did not complete work assignments during study times, but engaged in incompatible behaviors such as talking, walking around the room, and "day dreaming". All four of these children were experiencing some trouble with their classwork. Two of the four had repeated at least one grade and were being considered as candidates for a special remedial classroom. The student therapist was a fifth grader from the same school.

Apparatus

The experiment was conducted in the first-grade room of a
public school which measured 27' X 27'. It was equipped with the usual classroom facilities and accomodated twenty-nine students and a teacher.

The apparatus consisted of a console which was designed and constructed to both record the behaviors in question and to give feedback to the subjects as to whether they were meeting criterion for these behaviors. Power to the entire console was controlled by a Gra-Lab Session Timer, Model 176, which determined session length. Four silent single throw, mercury switches each controlled a Cramer Time Totalizer, Model 636 (push button resettable), as well as current to an outlet on the back of the console. When a subject engaged in the behavior being monitored, the console operator would place that student's switch in the "ON" position which would both activate the time totalizer and provide current to the outlet for that particular student. During Phases II through VI, electric lights were plugged into the outlets on the console which illuminated when the student's switch was in the "ON" position. During the session, then, there was a continuous rather than discrete measure of the behavior being monitored, with an option of giving continuous feedback to the subjects.

Throughout all phases of the study, the student therapist wore dark sunglasses with narrow eye openings to prevent direct eye to eye contact between the student therapist and subjects.

Procedure

Sessions were conducted each weekday morning between the hours
Fig. 1. A schematic and line drawing of console.
of 9:40 and 10:00. During this time the teacher conducted a small reading group in one corner of the room and the remaining students in the classroom were assigned arithmetic problems to be completed individually at their desks.

"Working" was the behavior recorded and was operationally defined as any of the following: (1) looking at the blackboard for the problems, (2) counting on fingers, pencils, crayons, etc. or (3) writing on paper. When the student was engaged in any of these behaviors, his or her timer was turned "ON", and that time was counted as "time working". When the student was engaged in any behavior other than "working", the switch was kept in the "OFF" position. These data were converted into "percent time working" by dividing total number of minutes spent working by the total session length in minutes, times 100.

For several days, prior to the first session, the student therapist operated the console within the classroom without lights in order to become proficient in its use and to further allow the students within the class to adapt to the observer's presence.

The study was conducted in seven phases which will be discussed in order. At the onset of the study, Phase I, the student therapist collected baseline data to determine the amount of time spent "working" during each session.

During Phase II, lights were placed on the desks of Ricky and Dennis which were illuminated when either of the students met criterion for "working". Tim and Lisa, without lights, continued in the baseline phase. This phase allowed an assessment of the effect of
response contingent lights (with Ricky and Dennis) and of the effect of seeing another student receive response contingent light (with Tim and Lisa).

During Phase III, Ricky and Dennis were told, "If you study a great deal during class today, you will get a little blue ticket. On that ticket you may write anything that you want to do tomorrow morning such as ________." In this blank the students could have written any activity in which they desired to engage, such as going to the gym, going to the playground, performing janitorial tasks around the school building, or any other activity that could be arranged by the experimenter. The duration of each of these reinforcing activities was fifteen minutes.

On the first day of Phase III, criterion for reinforcement for Dennis or Ricky was twelve minutes of work out of a total session length of twenty minutes. For the following three days, criterion was raised two minutes per day and on the fourth day was raised one minute; thus, the successive criteria were twelve, fourteen, sixteen, eighteen, and nineteen minutes. From that point on, throughout Phase III and IV for Ricky and Dennis, criterion remained at nineteen minutes. That is, the students had to emit working behaviors during 95% of the session in order to receive a blue ticket exchangeable for a chosen activity.

At the onset of Phase III, lights were placed on Tim and Lisa's desks but no reinforcement contingencies were stated, nor were the students reinforced for increased study time. This allowed for the assessment of the effects of response contingent lights where rein-
forcement was not available and where the two other subjects were being reinforced for increased study time.

At the onset of Phase IV, Tim and Lisa were told, "If you study a great deal during class today, you will get a little blue ticket. On that ticket you may write anything that you want to do tomorrow morning such as___________." The same sequence of reinforcement criteria, beginning with twelve minutes of working behavior, was utilized with Tim and Lisa as had been used with Ricky and Dennis.

At the beginning of Phase V, a differential reinforcement of other behavior contingency (Bijou and Baer, 1966) was put into effect for all four children. Under this contingency, all behaviors except "working" were reinforced.

At the beginning of Phase VI, the reinforcement contingencies that had been in effect during Phase IV were reinstated.

Upon completion of Phase VI, the students and the student therapist were told that the study was completed. They were thanked for their help and participation, and the experimenter, with his equipment, left the building. Between Phases VI and VII, a time lapse of thirty-seven days occurred. During this time period, the four children continued to have a period each morning when the teacher was working with a reading group and the remaining class members were expected to work individually on arithmetic problems.

Prior to Phase VII, the experimenter returned on a weekend and installed a closed circuit television camera which scanned the seats of the four subjects. The camera and tripod were so concealed that
the only portion visible to the class was an opening for the lens. On the first morning when the camera was in the room, the teacher told the class that it was a piece of scientific apparatus to be used in a night class held in the room, and it was generally disregarded thereafter. In a small enclosed booth outside the classroom, a television monitor was installed whereby the student therapist, utilizing the console and television monitor, measured the amount of time spent "working" by the four children without their knowledge.

At the onset of Phase VIII, the student therapist repeated Phase I. The student therapist, with console, walked into the room and, without using lights, measured the amount of time spent "working".

At the end of each session during phases when reinforcement was available, the students would gather around the console and compare their timer time against their criterion time, which was written on the data sheet. If they had met or exceeded criterion for reinforcement, they were given a small blue ticket on which they could write any activity in which they wanted to engage. The following morning, immediately after classes began, the children who had tickets from the day before were allowed fifteen minutes in which to engage in the activity that they had chosen. In order to avoid social isolation, the children were given the option of taking a friend with them for the fifteen minute periods. If, at the end of the daily sessions, the students had not met criterion, they were told "I'm sorry, you did not keep your light on long enough today. Please take your seat." Thus, the following morning, they would not
have the necessary blue ticket to be excused from class. After the four students returned from their reinforcing activity, the class was instructed in the daily arithmetic session and the experimental session commenced.

The student therapist was a fifth-grader whose own classroom was operated on a token economy. The student therapist evidenced a great deal of interest in his role in this study which led the experimenter to speculate that the Premack Principle (Premack, 1965) could be utilized to modify the academic behavior of the student therapist. Therefore, prior to each of the experimental sessions, each of the student therapist's teachers were consulted relative to his academic performance for the previous day. If his performance was above average in all classes, he was given a token by the experimenter for good academic achievement and at the end of the session was given an additional token for operating the console. If, on any occasion, his work was not above average in any of his classes, he was not given a token for academic performance but was given a token for operation of the console. It was also stated to the student therapist that he would not be allowed to operate the console if his academic performance in any class was less than above average for any two consecutive days. The latter never occurred.

Reliability checks were conducted throughout the study by having a second observer record "time working" for one of the four subjects. These observations were made by the classroom teacher and the experimenter. The larger of the two "times" thus derived was then divided into the smaller and the quotient multiplied by 100,
yielding percent agreement. Reliability checks for the entire study averaged 95% agreement.

RESULTS

Figure 2 shows the percentage of time spent "working" for each of the subjects. During the baseline phase, the average amount of time spent "working" was 52.8% with a range from 78% to 15%. At the onset of Phase II when lights were placed on the desks of Ricky and Dennis and baseline was continued for Tim and Lisa, a slight increase in time spent working for all subjects was evident but no general upward trend occurred. At the onset of Phase III, when a reinforcement contingency was established for Ricky and Dennis, and lights with no programmed consequences were given to Tim and Lisa, a dramatic increase in study behavior was evidenced by Ricky and Dennis. The mean percent "working" time for Ricky and Dennis was 95.8 and 95.5 respectively. In a less dramatic fashion, Tim and Lisa also increased their time spent "working" during Phase III even though programmed reinforcement contingencies were not in effect for these two subjects.

During Phase IV when all four of the children were being rewarded for increased time "working", the mean percent time spent "working" for the four children was 95.0.

During Phase V when the dro contingency was in effect, the percent time spent "working" decreased dramatically. The mean time spent "working" for the last three sessions of Phase V for all four subjects was 2.8%.
Fig. 2. Graph showing percent "time working" for all students.
During Phase VI when all four children were again reinforced for increased study time, studying returned to a high and consistent level.

The students were observed without their knowledge, in Phase VII, approximately six weeks after the last session in Phase VI. The dotted lines in Figure 2 indicate the four children's baseline mean from Phase I. The mean percent time spent "working" for the four subjects in Phase VII was 76.7%. At the onset of Phase VIII when the student therapist observed within the room, mean time "working" increased to 94.5%.

In addition to the desired changes effected in the academic performance of the four first-grade students, the student therapist was also performing at a higher academic level within his classes. Due to infrequent testing and occasional subjective progress evaluations, no satisfactory quantitative measurement was available.

DISCUSSION

This study indicates clearly that maladaptive behaviors of individuals or small groups of students can be modified within the regular school classroom utilizing another student as the behavioral engineer. Teachers frequently report that there are many times when they cannot spend a sufficient amount of time with a single individual even though they may have at their disposal sufficient control techniques to work with the problem. The present study demonstrates that it is not necessary to work on a one subject, one experimenter basis and further, that the behavioral engineer working with a small
group need not be an adult or an individual with considerable training in behavior control techniques.

In Phase I, a decrease in time "working" was evidenced by all four of the subjects. It does not seem likely that this is the diminishing result of a Hawthorne Effect, as the four experimental subjects had no way of knowing that they were to be in a study at that time. In addition, the student therapist and the experimenter had been in the classroom for several days prior to the onset of Phase I. Phase II for Tim and Lisa is a continuation of baseline (Phase I) and the downward trend does not continue. At this time, no adequate explanation of this phenomenon is available. This trend, while interesting, does not jeopardize the validity of the present study as the direction of the predicted change was in the opposite direction of the trend that was occurring.

During Phases IV-VI, the data for Tim are less orderly than those for the other subjects. Throughout the study, Tim seemed to be very apathetic relative to the reinforcing activities as evidenced by a much longer latency when asked what he wished to do the following morning (sometimes as long as two minutes as compared to approximately 3-5 seconds for the other three children). In addition, he almost always chose an isolated activity (such as playing with clay, painting, etc.) as compared to an activity that involved more than one child, such as going to the gym with a friend. On mornings when he failed to meet or exceed criterion, he exhibited no behavior that indicated that this was an aversive experience. In spite of the less dramatic control seen with this subject, the
teacher reported that there was a greater generalization to other study settings with this subject, than with the other three.

When response contingent lights were placed on the desks of Ricky and Dennis in Phase II, there was no noticeable change in "working" behaviors. At the onset of Phase III, when a reinforcement contingency was instituted for these two subjects, there was a considerable and consistent increase in "working" behaviors.

When lights were placed on the desks of Tim and Lisa at the onset of Phase III, there was an increase in "working" even though there were no programmed consequences beyond the lights themselves. At the same time, Ricky and Dennis both had lights and were being rewarded for "working". One possible explanation of Tim and Lisa's increase could be that the reinforcement contingency for Ricky and Dennis served as a setting event (Bijou and Baer, 1966) which increased the reinforcing function of lights alone for Tim and Lisa.

During Phases IV-VI when reinforcement contingencies were in effect, all four of the subjects show consistently appropriate "working" behaviors (Phases IV and VI) and "non-working" behaviors (as in Phase V). During these phases, the children worked intently on the assigned problems, and noises within the classroom which distracted most other members of the class were not attended to by these children.

The present study utilized a rather unique method of obtaining follow-up data on the behaviors modified. The surreptitious observation by way of closed-circuit television ruled out the possibility of the observer's presence serving as a discriminative stimulus for
the behavior of the subjects during the follow-up. By contrast, most studies have utilized the same method of obtaining follow-up data as was used during the study itself. For example, Hall, Lund, and Jackson (1968), after having modified the studying behavior of several elementary students obtained follow-up data by having the observer enter the room at a later time, and record the behaviors in a manner not unlike that in the experimental phases of the study. Similarly, Hawkins, Peterson, Schweid, and Bijou (1966), having modified the tantrum behavior of a four year-old boy at home while an observer recorded the data, obtained follow-up data by simply sending the observer to the home again to record as he had during the modification of the behavior. Neither of these studies could show, with objective data, that the follow-up reflected the children's "usual" behavior (though subjective reports may have suggested that such was the case).

If the observer's presence could act as a discriminative stimulus for the behaviors in question, one would expect the frequency of occurrence of these behaviors to increase when this observer entered the classroom for a post-experimental check. The results of the present study (Phases VII and VIII) clearly show such an increase. It should be noted that while these data do not necessarily indicate a lack of validity for standard post-check methodologies utilizing observer presence within the classroom, they do suggest that an observer's presence can bias the results that will be obtained. In order to minimize the effects of observer presence, not only during follow-up, but during all phases of a study, the
optimal observing technique would be one where the observer is undetected by the subjects throughout.

The actual contingencies in effect in the present study were on topographical behaviors closely associated with studying even though there were no programmed consequences for academic performance. Even so, the number of problems completed and the proportion of those problems correct increased during reinforcement phases of the study and continued at a higher level once the study was completed. In addition, the teacher reported a generalized effect during other class sessions throughout the day when the children were less disruptive and were more appropriately oriented toward school work. These children are now in the second grade and their current teacher reports that they exhibit appropriate behavior when the class is asked to study individually at their desks.

Because of the novelty of utilizing a child to systematically modify the behavior of other children, the experimenter attempted to monitor the behavior of the student therapist very closely in order to be assured of the manipulations and results reported here. Results to date, in this and other studies, indicate that it is indeed feasible to use students to modify the behaviors of other students. They have proven to be reliable observers of behavior, and have shown considerable understanding of the principles underlying the manipulations which occur.

A procedure, such as the one described in the present study, is desirable to the teacher because it does not require a large amount of her time. In addition, she can spend less time as a "policeman"
within the classroom, and can devote more time to teaching activities.

Finally, the four children who were involved, responded in a more effective and efficient manner, and at last indication were obtaining reinforcers for academic achievement within the home and the classroom which they had seldom been exposed to prior to this study.

While further research in this area is certainly called for, it would appear to be extremely feasible for teachers, social workers, and school psychologists to begin exploring the utilization of students as behavioral engineers.
REFERENCES


