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PSI AS A SUPPLEMENT TO COLLEGE CLASSROOM LECTURE INSTRUCTION

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INTRODUCTION

The systematic application of learning theory to teaching at the postsecondary level is a relatively recent field of research (Johnston and Pennypacker, 1971). Traditionally, most educational classroom-based research has been directed toward elementary education (Meacham & Wiesen, 1969).

A previous study by one of the authors (Isaacs, 1973) investigated the feasibility of teaching a college level course in Introductory Psychology to deaf students by supplementing classroom lectures with a teaching method called “Precision Teaching” or “Personalized Student Instruction” (PSI) which incorporates principles derived from behavior modification theory (Meacham & Wiesen, 1969). That study showed that subjects (Ss) receiving a PSI supplement to classroom lectures scored approximately 14 points higher on a multiple-choice final exam than Ss receiving only the classroom lectures (p< .001), and in addition indicated on a questionnaire that they had enjoyed the course significantly more than the control group (p < .05 one-tailed).
The present study was designed to vary several of the parameters of the previous research design in an effort to assess how important they were to the results obtained and/or to obtain convergent validity for the use of the PSI method. The hypotheses tested in this research are, therefore, similar to those of the previous one. Hypothesis 1 was that Ss who receive both class lectures and the PSI supplement will demonstrate greater learning of the course material than will Ss given class lectures only. Hypothesis 2 was that those Ss receiving the PSI supplement would enjoy the course more than those not receiving it.

SUBJECT SELECTION

The Ss used were deaf students enrolled in the National Technical Institute for the Deaf (NTID) program at the Rochester Institute of Technology (RIT) who were taking an Introductory Political Science course as part of their normal program. Due to the broad range of differences in the abilities of students all of whom are classified as "deaf", 17 pairs of Ss were pre-matched with respect to their receptive and expressive skills as measured by a Communication Skills Profile (developed by the NTID Communication Center, 1972), following which one member of each pair was randomly assigned to the Experimental group and one to the Control.

METHOD

The course material was first broken down into six units of material based upon the instructor's notes, and then into small items of important information within each unit. Fill-in (and some multiple-choice and true-false) questions were then constructed based upon these bits of information and were typed on 3 x 5 index cards with the correct answers on the reverse side of the card. There were approximately 40 index cards per unit. Six students who had previously taken the course from the instructor and successfully completed it were recruited to serve as "Student-Managers" (SM), each SM being thus responsible for approximately three students. The SM's function was to meet with the student at the student's request for a "Performance Session" (PS).

At the PS, the SM would shuffle the index cards for the unit that the S was working on, and time the student while he proceeded to read aloud or sign a question, give his answer, turn over the card and
read the correct answer, and place it in a pile of correct or incorrect answers. The S was permitted five minutes by stop watch to cover as many items as he was able. The SM then had the S enter his score on a Progress Chart for the unit based upon the rate of correct and incorrect answers per minute. When the S had attained a rate of 3.2 or more correct answers per minute along with 0.8 or less incorrect answers per minute, he was considered to have passed the unit and was permitted to make an appointment for the next unit.

If the S did not pass the unit he made an appointment for another PS on that unit with the SM, after he had presumably reread the class material and notes or had sought help from the tutoring service normally provided by NTID. The SM's function was two-fold: (a) to "run" the students; i.e., shuffle the cards, time the Ss, enter the data, etc., and (b) to act as a reinforcing agent. In this second function, he administered positive social peer reinforcement for progress by the S in understanding the material and mild social peer negative reinforcement if it became apparent that the S was not studying or giving the effort expected to absorb the material. The SM also served to clarify the meaning of any words not understood by the S on the index cards, and if he wished could also exercise a partial teaching function: i.e., he was permitted to review with the Ss those incorrect answers that they gave and point out why they were incorrect. It was emphasized to the SM, though, that they were not to function as tutors in any extensive sense but were to refer the Ss to the tutoring service offered by NTID, or to the course instructor.

The Ss were permitted to take as many PS as they wished to pass a unit, with the stipulation that no more than one PS could be scheduled for the same day. The incentive to the Ss to complete the PS was that successful completion of all six units would result in a course grade one letter higher than that to which their examination grades would ordinarily entitle them; completion of five of six would entitle them to the grade they would normally have received; four would cause them to receive one letter grade lower; and so on.

Ss in the control condition were required to write a term paper for the course on an assigned outside reading. Those control Ss who produced reports judged excellent by the instructor would received a course grade one letter higher than the examination scores would indicate; those whose essays were adequate would receive the grade the examinations indicated; those whose essays were poor would receive one lower, and so on. For the purpose of comparison of the
groups, the letter received as a final course grade by each S was not used in any computations.

The SMs received Independent Study credit at RIT for participating in the research, and for learning the principles and theory behind the experimental research design.

PROCEDURE

The entire Introductory Political Science class was told that they had been divided into two groups, one of which would do a term paper and the other which would have meetings with assigned SM. A short explanatory sheet was passed out to each of the Experimental (Exp) Ss, and they were introduced to their SM. All Ss in both groups then filled out a personality questionnaire (not used in the present research). The course instructor, who was not one of the investigators, was kept blind as to which group each student was assigned.

Due to the fact that RIT is on the quarter system, there are only 10 weeks of classes. Since no PS was permitted until a unit had been completed, the first PS actually took place approximately two weeks into the course, and continued from then on at the initiative of the Ss with the exception listed below.

The SM met once a week with the researchers during which time they discussed the progress of their Ss, brought up any difficulties or personality conflicts between the Ss and themselves, and clarified any points of procedure on which they had questions. If, during this meeting, a SM indicated that one of his Ss was not scheduling PSs with reasonable regularity, one of the researchers contacted the S and explained the necessity for his scheduling PSs and the results for his final letter grade if he did not actively participate. This was generally sufficient to stimulate the S to schedule appointments. The problem arose mainly at the beginning of the course (within the first three weeks). Charts of S performance were also collected by the researchers at the weekly meetings.

At the end of the quarter, all Ss in both groups again filled out the personality questionnaire, and a Survey of Student Opinion on Teaching (SSOT) Form (1968) which is standard at RIT. This form asks the student to evaluate the teacher, content, materials and other aspects of the course he has just taken. Two questions were added to this form for all Ss; one asking an evaluation of the notetaker in the
course and one of the interpreter. A notetaker assigned by NTID was present throughout the course to take notes and distribute them to all Ss, and an NTID interpreter was present throughout the course and all examinations to clarify any examination questions as well as to sign all lecture materials. The Exp Ss in addition, answered five questions regarding their feelings towards the PSI method.

RESULTS

The mean scores of both groups for the midterm essay exam*, the midterm multiple-choice exam, the final essay exam, and the final multiple-choice exam, and a test for the significance of their differences** are shown in Table 1.

The differences between the means of the two groups on the midterm essay and multiple-choice examinations were not significant. The mean scores of the two groups on the final multiple-choice examination differed by 16 points, which was highly significant (p< .001). The mean essay numerical-equivalent scores also differed significantly (p< .01). In both cases the differences were in favor of high scores for the Exp group.

A cumulative frequency chart of grades given by the course instructor for essays on the final exam is shown in Figure 1.

As may be seen, the median letter grade of the Exp group was approximately 3 units higher than that of the Control group. A Wilcoxin T-test (Bruning & Kintz, 1968) of the difference in the ranks of the two groups on the essays showed them to significantly differ (p<.01), agreeing with the numerical conversion data described above.

To assess the degree of enjoyment of the course by the two groups, a comparison of the direction of the ratings on the student evaluation questionnaire was made by comparing the number of items rated higher by the Exp group with the number rated equal or lower. Of the 15 items on the form, the Exp group evaluated the course more favorably on 10, lower on one, and equal on four. A chi-square test of this distribution against an expected equal frequency of distribution yielded a chi-square of 8.40 (2 df), p < .02. Eliminating the four on which the two groups evaluated equally yielded a chisquare of 7.36 (1 df), p< .01, with the Exp group in both cases rating the course as more enjoyable and better than the Control group.
The Exp Ss were asked five questions in addition to those on the Survey of Student Opinion on Teaching (SSOT) questionnaire, concerning specific evaluations of the Precision Teaching approach (Table 2).

Although no statistical analysis is offered here, examination of the results shows that students found it helpful and would themselves volunteer as SM. A record was also kept of the amount of tutoring time the Ss requested and received from the NTID staff. Seven Ss in the Exp group came in for tutoring for a total of 18.5 hours, while three Ss in the Control (Cont) group came in for a total of 4 hours of tutoring. Comparing the variation in the number of hours of tutoring requested by the two groups with a chance hypothesis by chisquare yielded a p < .005, \( \chi^2 = 9.34, 1 \text{ df} \), with Exp group requesting and receiving significantly more hours of tutoring assistance than the Cont Ss.

**DISCUSSION**

The present research differed from the first study (Isaacs, 1973) in five major design parameters:

(1) In the previous research, the Exp Ss were in one class along with hearing RIT students, while the Cont Ss were in a different all-deaf class (although both groups were taught by the same teacher). In the present research, both Exp and Cont Ss were intermixed within a single class with no hearing Ss present.

(2) In the previous research, the researcher himself broke down the subject matter into items, created the items cards, and taught the two classes, leading to the possibility of experimenter bias in test construction and teaching performance. In the present research, the material was broken down by a staff member of NTID who had no professional training in the field (working from the instructor's notes), the teaching was done by the instructor normally assigned to teach the course who had no part in the experimental design, and the teacher was blind as to which S was in which group.

(3) In the previous study, the Ss' learning was assessed solely by means of multiple-choice examinations; in the present study, both multiple-choice examinations and essay examinations were employed in the assessment.
(4) In the previous research, the subject matter was Introductory Psychology; in the present study, the subject matter was Introductory Political Science.

(5) In the previous research, the Ss were assigned to the two groups on a random basis; in the present study, efforts were made to match Ss upon variables considered especially important to the performance of deaf Ss.

Despite these large differences in design between the two studies, the results are remarkably similar. The difference of 16 points in the final examination multiple-choice mean scores in favor of the Exp group in this study is almost identical with the 14 point difference found previously. It is both statistically significant and pragmatically important, since it means that the average Exp S received a 76 (C grade on his final exam) while the average Cont S received a 60 (F grade).

The final essay examinations administered in class give a measure of convergent validity to the belief that it is learning and not simple memorization that occurred, in that they also yielded significantly higher scores for the Exp group than for the Con (a C + versus a roughly D + median). Combining the multiple-choice and the essay scores, the average Con S would have received an "F", the average Exp S would have received a "C". Hypothesis 1, that Ss receiving the PSI supplement would demonstrate greater learning in the course than those who did not receive it, would appear to be strongly supported.

The results also indicate support for Hypothesis 2; the Exp group found the PSI supplement and the SM helpful, they prefer PSI to a term paper, and they are in favor of having another course with PSI and even serving as volunteer SM themselves. In addition, the fact that the Exp group rated the course higher than the Control in significantly more items on the SSOT would also indicate that the course was more enjoyable to the Exp group.

An interesting comparison is that between the midterm and the final examination scores. As previously mentioned, the nature of the quarter system used at RIT is such that there are barely 10 weeks of classes in a course. The first unit of material, as designed by the instructor in the course, was approximately two weeks long. Since (a) no PSs were permitted until the instructor has completed a unit, (b) it required a week or so before the Ss became comfortable with the
method and (c) the midterm examinations were given approximately four weeks into the course, most students in the Exp group had not yet completed Unit 1 prior to taking the midterm examination. As can be seen from the mean midterm scores listed in Table 1, the two groups were roughly comparable in knowledge at that point. By the final examination however, at which time the Exp Ss had finished all the PSI units, there was a 16-point difference in their favor on the multiple-choice examination. This difference is clearly therefore not due to prior knowledge of course material by the Exp group.

The question which arises then is: "What is the cause of this increase?" There are several ways in which these results may be explained. These explanations are not necessarily mutually exclusive:

(1) The experimental Ss put in additional work in the course; i.e., devoted additional time to studying for it, reviewed the materials more on their own, and paid more attention in class to the instructor's lectures than the control. There is support for this viewpoint in that more Exp Ss did ask for and receive more hours of tutoring than did the Cont Ss. However, this only throws the question one step further back: Why did the Exp Ss devote more time to this subject than they would normally have given it. Additional studying time should not be considered an originating cause but rather only a mediating cause in the increase in learning that resulted. If the Cont Ss had wished they could also have used the tutoring services more than they did (announcements were made in the class that tutoring was available to all Ss), could have studied the material more, etc., but they didn't.

(2) The Ss felt threatened to study more as a result of the knowledge that, if they didn't pass the units, their course grade would be lowered. This probably was a factor for some of the Ss (as reported by the SMs); however, if it were a strong factor in all of they Exp Ss it might be expected that they would resent this negative pressure on them and register this resentment when they filled out the SSOT questionnaires (which were anonymous) at the end of the course. On the contrary, the Ss in the Exp group rated their liking for the course higher than the Cont Ss, and on the five additional questions which asked for their specific opinion about the Precision Teaching Supplement overwhelmingly indicated that they felt it helpful and were willing to have it used again in a different course. This is not likely to have occurred if the Ss had felt unhappy about being pressured by the method.
(3) Knowledge that they could increase their final grade in the course if they passed all the units. It was to prevent just this advantage for the Exp Ss that the Cont Ss were also permitted to increase their final letter grade by writing a term paper on an outside reading. Since the outside reading that was assigned was relevant to the course and used some of the principles taught in the course, working on this term paper should have aided the Cont Ss to increase both their knowledge of the course material and their final grade. That it didn't, relative to the Exp Ss, is shown by the examination grades.

(4) Some idiosyncrasy of the Ss, experimental design, course instructor, interpreter, notetaker, or subject matter favored the Exp Ss over those in the control group. The argument against this cause of the differences is very straight-forward: the Ss were matched as far as abilities were concerned prior to being placed randomly in one or the other group so that there was little likelihood of pre-existing advantage for one group over the other. The experimental design, course instructor, interpreter, notetaker, and subject matter all differed from those of the previously reported research and yet the results were almost identical. In both studies, the Exp group scored significantly higher than the Cont group. Convergent validity would, therefore, appear to have greatly weakened this possible explanation.

(5) It is the PSI supplement that has brought about the differences in the two groups. It would appear that this explanation best accounts for the results. The question can be taken further, though, as to what within the supplement is the major parameter in producing the effect. There appear to be several possible elements either by themselves or in combination which might have contributed to the effect:

(a) The SM may be exercising social peer positive and negative reinforcement on the Ss, selectively reinforcing them for responses leading to increased learning of the course material.

(b) The SMs may be serving as models for the deaf Ss, since they were deaf students themselves who had successfully completed the course and were now appearing in the role of a "quasi-teacher," thereby encouraging the Ss to learn more by imitation of the peer model.

(c) The breakdown of the material into small chunks of information might have clarified some of the more difficult concepts of the course and rendered them more easily assimilable by the Ss.

(d) The results might have been due to the "Hawthorne effect," since the Exp group knew that this was not the
normal class method, and may therefore, have learned more through devoting more time to the course because of a novelty factor.

Certainly, therefore, further research into which, if any, of these is the key element in the dramatic improvement of the Exp Ss over the Cont Ss would seem to be warranted. However, in a practical sense, it is almost irrelevant what is the "real" internal cause of the effect. It has now been twice demonstrated, in very different situations, that using a PSI supplement in a normal college-level lecture course will produce significant and important increases in the amount of learning that takes place and in the enjoyment of the course and the material by the Ss. Particularly for the deaf, where many because of linguistic limitations find themselves on the edge of failure in abstract courses, the use of this powerful technique as an aid to the educational process would seem to be well indicated.

REFERENCES


Survey of Student Opinion on Teaching Form. Rochester Institute of Technology Instructional Development staff, 1968.