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PRECISION TEACHING OF THE DEAF
Morton Isaacs, Ph.D.
Rochester Institute of Technology, Rochester, New York 14623

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ACKNOWLEDGMENTS

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SUMMARY

Forty-eight deaf NTID students were randomly assigned to an introductory psychology course, 31 to a group which was conducted under a precision teaching method and 17 under the traditional lecture format. Although comparable initially in intelligence and hearing discrimination skills, the group which received the precision teaching scored 13.6 to 16.6 points higher in three written, multiple-choice examinations. They also indicated on a written questionnaire increased enjoyment of the course over the lecture group receiving identical material. It is hypothesized that both increased learning and motivational factors bring about the examination score differentials.

INTRODUCTION

Recently, Johnston and Pennypacker (1) have described a method of applying behavioral technology to teaching at the college level which has been termed "Precision Teaching" and which offers an alternative to the traditional teaching techniques. Rather than a lecture-discussion period only or the use of a computer-aided instruction sequence by the student, precision teaching involves certain unique features which
have emerged as influential in many different techniques used experimentally at the college level.

As summarized by Johnston and Pennypacker the common factors among these techniques were "...an increased personal contact for the students with another student... center(ing) around the subject matter of the course. The goals of the described courses, as well as the means for attaining them, were usually clearly defined in terms of directly observable student behavior. The assessment of the student's progress... was generally carried out quite frequently (even continuously), and feedback on student performance was immediately and frequently available to both student and teacher. Each student was usually allowed to progress in the course at his own pace, but he had to perform on each unit of subject matter to some stated minimum behavioral criterion..." (Ibid., p. 220).

The present research was conducted to determine whether these objectives, incorporated into a modified program based upon this model, could be adapted to deaf students enrolled at the National technical Institute for the Deaf (NTID) in an introductory psychology course.

Two specific hypotheses were tested:

1. Deaf students in a course taught by a modified precision teaching method will give objective evidence of an increase in comprehension of the course material over similar students in a traditional lecture class; and

2. Deaf students will enjoy the course more under a precision teaching method than under the traditional lecture procedure.

**TRAINING OF STUDENT MANAGERS**

During the Fall 1971 quarter, eight NTID students were given an intensive introductory psychology course by the investigator. The required material was divided into seven units (e.g., learning, emotion, etc.) based upon Kagan and Havemann's text, Psychology, An Introduction. When the student felt that he had mastered the material in the first unit he made an appointment with the instructor for a "Performance Session" (PS). During the PS the student answered fill-in (and occasionally true-false) questions which were presented to him on 3x5 index cards from a randomized series of questions on the
unit which had been created by the instructor. The student read the question aloud (or signed it if he felt more comfortable doing this), gave his response, and then turned the card over and read the correct answer.

The objective criterion for passing a unit was a rate of 3.2 items/minute correct with no more than 0.8 items/minute incorrect; since a five minute period was allotted for each PS, this meant that the student had to answer at least 16 items correctly with no more than 4 incorrect during the five minutes to pass the unit. The number of correct and incorrect answers for each PS was entered by the student upon a chart, so that his progress was immediately visible to him and to the instructor. The card items were randomized prior to each PS; the student might therefore encounter some items seen previously and some new items at each PS.

At the end of each PS the instructor reviewed with the student the items which had been answered incorrectly, explained why the answer was incorrect, and clarified any confusion on the part of the student about the material.

The student was permitted to take as many PS's as was necessary to pass a unit with two restrictions: he could not take more than one PS per day, and he could not proceed to the next unit of material until he had reached criterion on the preceding one.

A multiple-choice examination at the end of the quarter yielded scores ranging from 72-87 with a mean of 79.25, which was considered adequately high for these students to themselves serve as managers. Several "role play" sessions were then held during which each of the students acted as manager to other students by administering the PS questions, using the stop-watch, explaining "missed items," and encouraging or mildly chastising his students based upon their performance in these trial sessions. Following this training, each of the students stated that he was ready to become a student-manager to other deaf students.

PROCEDURE

Forty-eight NTID students were assigned randomly to one of two introductory psychology classes, with 31 deaf students placed in the experimental section, and 17 deaf students in the control section.
Fourteen hearing RIT students were also assigned to the control section, making a total N=31 in the student-managers by chance.

To discourage memorization of specific items, additional PS item cards were created comparable to the initial ones; these were placed in a second set, and the managers alternately used randomly selected cards from first one and then the other set. Both the experimental and control courses were taught by the same instructor, had the same interpreter, and viewed the same accessory material (movies, slides, etc.). Both groups were required in addition to acquire the text's Study Guide and to use it in preparing for class and examinations. All students were informed that all customary ancillary help was available if the student wished, including tutorial assistance from the NTID staff.

During the training of the managers, it became apparent that as the term continued other interests tended to interfere with arranging of appointments for the PS sessions. To avoid this problem, the experimental students were informed that those students who successfully completed all seven units would receive one letter grade higher for the course than their test marks would otherwise indicate, those who completed six would receive the grade that they were otherwise entitled to, and five one letter grade lower. In order that this factor not influence the student's liking for the course, the control class was instructed to produce a term paper which, if good, would raise the student's letter grade one unit higher than his examination scores indicated, if adequate keep it the same, and so on. All statistical comparisons within this paper, however, are based upon the examination scores and not on letter grades received.

Weekly meetings were held with the managers during which the students' performances were reviewed, and any difficulties in handling the students, the material, or other factors were resolved by the instructor.

Before presenting the examination score results, the comparability of the experimental and control groups prior to the experimental manipulations must be assessed.

The hearing control students were included in the research design primarily to permit an evaluation of the quality of the examinations and the classroom lectures. If the lectures in the control class were in some way poorer than those normally presented by the instructor, the average examination grade for the hearing students would have been lower than those in previously taught hearing
sections of the same course. This did not occur; the hearing students received no lower examination grades than previous groups of hearing students in the course.

To compare whether there were systematic differences in any major parameters of the experimental and control deaf groups, five major factors were measured (Table 1). These were Verbal Reasoning and Abstract Reasoning scores, both used to assess intelligence comparability of the groups [the Verbal Reasoning and Abstract Reasoning scores are sub-tests of the Differential Aptitude Test 3.4 and were obtained from test data on file at NTID for each student], and Hearing Discrimination (the degree of hearing loss), Speech Reading skills (the degree of ability to "read lips"), and Manual Communication Receptivity (the degree of ability to understand signs and finger spelling), scores used to measure degree of physical disability. The Hearing Discrimination, Speech Reading skills, and Manual Communication Receptivity scores were taken from the Communication Profile developed by the Communication Center, NTID, 1971, and were obtained from test data on file.


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**TABLE 1**

COMPARISON OF EXPERIMENTAL AND CONTROL NTID GROUPS ON VARIOUS MEASURES

<table>
<thead>
<tr>
<th></th>
<th>EXPERIMENTAL</th>
<th>CONTROL</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=30</td>
<td>N=17</td>
<td></td>
</tr>
<tr>
<td>VERBAL MEAN</td>
<td>23.40</td>
<td>18.35</td>
<td>1.45</td>
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<tr>
<td>VERBAL S.D.</td>
<td>12.56</td>
<td>9.14</td>
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<tr>
<td>ABSTRACT MEAN</td>
<td>35.23</td>
<td>34.65</td>
<td>0.19</td>
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<td>ABSTRACT S.D.</td>
<td>10.34</td>
<td>8.89</td>
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<tr>
<td>HEARING MEAN</td>
<td>3.30</td>
<td>3.24</td>
<td>0.15</td>
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<tr>
<td>HEARING S.D.</td>
<td>1.32</td>
<td>1.39</td>
<td></td>
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<tr>
<td>SPEECH MEAN</td>
<td>3.53</td>
<td>2.88</td>
<td>2.36*</td>
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<tr>
<td>SPEECH S.D.</td>
<td>1.04</td>
<td>0.60</td>
<td></td>
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<tr>
<td>MANUAL MEAN</td>
<td>2.00</td>
<td>3.53</td>
<td>3.25*</td>
</tr>
<tr>
<td>MANUAL S.D.</td>
<td>1.49</td>
<td>1.66</td>
<td></td>
</tr>
<tr>
<td>RECEPTIVITY</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

* p<.05

No significant differences were found in Verbal or Abstract Reasoning scores between the two groups, with neither t-test result significant(two-tailed unless otherwise noted) reaching the .05 levels, nor was there a significant difference at the .05 level in Hearing Discrimination ability between the two groups.

There was a significant difference in Speech Reading Skills in favor of the experimental group, and in Manual Communication Receptivity in favor of the control group; those who possessed Speech Reading skills tended to have developed less signing ability than those whose Speech Reading skills were more limited. However, the design of the present investigation called for the instructor to verbally present
the material while the interpreter (who was himself an experienced psychologist) signed the same material at the same time. Insofar as one communicative mode can transmit somewhat equivalent information to the other, there should have been no great difference between the two groups in their ability to receive information during the classroom lectures. In addition, neither Manual Communication Receptivity nor Speech Reading skills have been found to be significantly correlated with intelligence.

Since, therefore, no difference was found that would significantly bias the results in favor of either group, it was concluded that for the purposes of this research both groups could be considered comparable in potential learning ability prior to the experimental manipulation.

RESULTS

Three multiple-choice examinations were given to both groups throughout the term. The means, standard deviations, mean differences and t-test results for each of these are shown in Table 2.

<table>
<thead>
<tr>
<th></th>
<th>EXPERIMENT</th>
<th>DEAF</th>
<th>CONTROL</th>
<th>DEAF</th>
<th>DIFF</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=31</td>
<td></td>
<td>N=17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIRST</td>
<td>MEAN</td>
<td>67.25</td>
<td>56.65</td>
<td>13.60</td>
<td>3.18**</td>
<td></td>
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<tr>
<td>EXAM</td>
<td>S D</td>
<td>13.98</td>
<td>14.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SECOND</td>
<td>MEAN</td>
<td>65.62</td>
<td>49.06</td>
<td>16.56</td>
<td>3.98***</td>
<td></td>
</tr>
<tr>
<td>EXAM</td>
<td>S D</td>
<td>14.68</td>
<td>12.13</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>FINAL</td>
<td>MEAN</td>
<td>63.56</td>
<td>49.53</td>
<td>14.03</td>
<td>3.10**</td>
<td></td>
</tr>
<tr>
<td>EXAM</td>
<td>S D</td>
<td>16.13</td>
<td>12.80</td>
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<td></td>
</tr>
</tbody>
</table>

** p<.005
*** p<.001

______________________________

TABLE 2
Comparison of Experimental and Control Group Scores on the Three Multiple-Choice Examinations
A comparison on the experimental and control deaf groups scores for the three examinations yielded t-test results of 3.18, 3.98, and 3.10, all significant beyond the .005 probability level in favor of the experimental group. In absolute terms, the differences ranged from 13.6 to 16.6 points.

The students also filled out a standardized questionnaire at the end of the course called "Survey of Student Opinion on Teaching." This contains 13 printed questions directed to the manner in which the course was conducted, the quality of the course, etc. The results of this questionnaire are shown in Table-3. Only two items showed a significant difference between the groups. Of the 26 mean scores (2 groups, 13 items each) on the questionnaire, all but three were well above the midpoint of the scale. The total item responses had a general mean of 3.94, with a mean of 3.97 for the experimental group and 3.84 for the control group.

Item 10, "Your overall evaluation of the course," attained a one-tailed p=.05, with the group rating the course significantly better than the control group; and item 11, "Your overall evaluation of the instructor," attained a one-tailed p=.05, with the experimental group rating the instructor as significantly better than the control group.

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TABLE 3

Mean Ratings on the "Survey of Student Opinion on Teaching" Questionnaire for the Experimental and Control Deaf Groups

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>MEAN RATINGS</th>
<th>MEAN RATINGS</th>
<th>MEAN DIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXPERIMENTAL GROUP</td>
<td>CONTROL GROUP</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4.2</td>
<td>4.0</td>
<td>0.2</td>
</tr>
<tr>
<td>2</td>
<td>3.8</td>
<td>3.9</td>
<td>-0.1</td>
</tr>
<tr>
<td>3</td>
<td>3.3</td>
<td>3.3</td>
<td>0.0</td>
</tr>
<tr>
<td>4</td>
<td>4.1</td>
<td>4.2</td>
<td>-0.1</td>
</tr>
<tr>
<td>5</td>
<td>4.3</td>
<td>4.3</td>
<td>0.0</td>
</tr>
<tr>
<td>6</td>
<td>4.0</td>
<td>3.8</td>
<td>0.2</td>
</tr>
<tr>
<td>7</td>
<td>4.5</td>
<td>4.5</td>
<td>0.0</td>
</tr>
<tr>
<td>8</td>
<td>3.9</td>
<td>3.8</td>
<td>0.1</td>
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<tr>
<td>9</td>
<td>3.8</td>
<td>3.7</td>
<td>0.1</td>
</tr>
<tr>
<td>10</td>
<td>4.2</td>
<td>3.7</td>
<td>0.5*</td>
</tr>
<tr>
<td>11</td>
<td>3.9</td>
<td>3.3</td>
<td>0.6*</td>
</tr>
<tr>
<td>12</td>
<td>4.1</td>
<td>3.8</td>
<td>0.3</td>
</tr>
<tr>
<td>13</td>
<td>3.6</td>
<td>3.7</td>
<td>-0.1</td>
</tr>
</tbody>
</table>
DISCUSSION

It is clear from the results of this study that the students who were taught under the precision teaching approach scored consistently higher than the control group taught solely by the standard lecture-plus-interpreter methods. An average difference of 14.7 points on multiple choice test scores is not only statistically significant but educationally important, too. What is perhaps not clear is why this difference began so early in the quarter and continued throughout the term.

It cannot be that the experimental subjects profited from the mere exposure to multiple-choice questions during the PS, since (a) the questions on each of the examinations differed from those used in the PS, (b) the PS items closely paralleled those in the Study Guide which students in both groups possessed, (c) the examination questions themselves were of the multiple-choice type familiar to almost all college students, and (d) if experience with the multiple-choice format were the deciding factor the difference in the mean scores of the two groups should have lessened from the first exam to the last due to practice effects (which did not occur). Also ruled out were initial differences in intelligence in the two groups as measured by the Abstract Reasoning and Verbal Reasoning sub-tests of the Differential Aptitude Test, as were differences in Hearing Discrimination and the other specifically hearing or speech parameters, for the reasons previously discussed.

It became apparent during the course of the experiment that the major variable manipulated through the precision teaching method was a motivational one. The students enjoyed the course more, as shown by the significant difference in the two questionnaire items. They felt that they were more in control of the learning situation, and expressed a great sense of responsibility for their preparation for the PS's.

This increased involvement of the student in the learning process was manifested in several behavioral indices. For example, students in the experimental group used the support services of NTID, which were available to all the students, to a greater extent than those in the control group. Several of the students in the control section came to the instructor's office requesting to be transferred into the experimental group, since they had friends who were in that group...
who said that they enjoyed the course more. Many students in the experimental group at the end of the course expressed a desire to serve as student-managers for another group of deaf students.

These findings with the deaf strongly support the findings of Johnston and Pennypacker that their hearing students learned more and enjoyed the course more under a precision teaching approach than under the standard course methods.

Equally interesting were the comments of the student-managers at the end of the course. They felt that they enjoyed helping the students to learn the material and while doing so often realized that they had not adequately grasped the material themselves beforehand. Explaining it to others helped them to clarify it in their own minds, and helped them to see "by reflection" the necessity of a careful prior reading of the material. They also stated that they felt that the experience helped them to become more selfconfident and self-assured.

There were several suggestions for follow-up research that grew out of this project. The generally high ratings on the Survey Questionnaire perhaps exerted a ceiling effect upon the differences in expressed liking for the two methods by the students. If a course were chosen that, unlike introductory psychology, was perhaps not so enjoyable to begin with, even larger difference between the enjoyment of the Precision Teaching and the lecture method would appear than was evident here, where even the traditional lecture course was given an overall rating of 3.84 out of a possible five.

Then, too, the student-managers reported quite large differences in the way in which their role was viewed by the students. Some students adopted a dependent attitude, doing very little reading or only studying prior to the performance sessions. These students seemed to expect the managers to act as "teachers" or tutors. Others viewed the role of manager (as it was designed) as a resource person to help understand material that was not clear to the student after studying had been done by the student himself. There might thus be an interaction between a personality factor such as dependency and enjoyment of and learning by a method such as precision teaching, where the emphasis is on self-investigation and self-pacing of the work. This relationship is being investigated and may prove especially important in the field of the education of the deaf, since dependency by the deaf is often inculcated from birth.
In conclusion, both hypotheses have been strongly supported: students do apparently learn more when taught under the precision teaching method then they do under the traditional lecture method, and they do give evidence of enjoying the experience more. It would seem therefore highly to be recommended that this method be further explored as to its extension into other courses.

References


