*AMOUNT AND DISTRIBUTION OF STUDY IN A
PERSONALIZED INSTRUCTION COURSE AND IN A
LECTURE COURSE¹*

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The rapid proliferation of courses based on Keller's Personalized System of Instruction (PSI) calls for a prompt evaluation of the relative costs involved in PSI and more traditional forms of college instruction. To determine the cost in student time required by a course taught with PSI relative to lecture, students did their studying in a special Study Center where course materials could be used but not removed. Students in the PSI section spent an average of about 50% more time in the Study Center (46 hr) than did students in the lecture section (30 hr), but that difference was made up by the lecture students spending an average of 20 hr attending lectures. Thus, total preparation time was about the same. PSI students scored slightly higher on common course exams, and while college entrance exam scores correlated highly with course exam scores, Study Center time was reliably related to course exam score only for PSI students. An analysis of the study records of individual students revealed that PSI produced fairly regular patterns of study by all students, while lecture students varied greatly in their patterns.

Although the Personalized System of Instruction (PSI) described by Keller (1968) is currently enjoying growing popularity (Green, 1971), whether that system will survive as a viable alternative to more traditional forms of instruction may depend upon considerations more closely related to economics than to instructional effectiveness. It seems likely that through the use of student proctors who volunteer their efforts, work for course credit (Keller, 1968), or who are selected from the course they are taking (Bostow and Blumenfeld, 1972; Sherman, *unpublished a, b*), the dollar cost of PSI need not greatly exceed the amount budgeted for more traditional instruction. However, even with nearly equivalent dollar cost it seems likely

that the time demands imposed on the instructional staff in the two systems will be different, and that this difference will have to be considered in decisions about adoption of PSI. In addition, the impact on students must be considered. From questionnaire ratings, PSI would appear to demand considerably more effort than comparable lecture courses (Born and Herbert, 1971; Gallup, *unpublished*). If true, this additional cost in student time may considerably weaken the argument for PSI.

The present experiment attempted to compare the amount of studying that occurs in a PSI course and in a lecture course using the same written materials. Briefly, the amount of studying is assessed directly by locating all written course materials in a special study area where they may be checked out by students for use in that area; study time is then assessed through the difference between checkout and checkin times for the various units of course material. By comparing the total amount of time invested in a PSI course and a lecture course, one can do a tentative "cost" analysis of these two general instructional strategies from a student's point of view. Further, with records of studying by

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individual students it becomes possible to compare the patterns of study that develop over an academic term in courses taught with PSI and lecture-type instruction. Data of this sort may eventually help us understand some of the diverse effects of PSI (Born and Whelan, 1973).

METHOD

Subjects

The 66 students in Psychology 101-3 and the 31 students in Psychology 101-9, both sections of beginning psychology at the University of Utah during Autumn Quarter, 1971, participated in the present experiment. Three students withdrew from Section 101-3, leaving 63 students who completed the course. Both sections of the course were scheduled to meet Monday through Friday at noon, and both were formally scheduled with the senior author as the instructor. The difference in size of the sections is a result of different enrollment ceilings put on the two sections before registration.

Procedure

Instructions to students. At the first class meeting all students were told that the course would be taught in unconventional ways, the procedures were explained briefly and questions were answered, and a written statement of course policies and procedures was distributed. Subsequently, students were told that one of the current items of interest was their evaluation of a prepublication draft of a new type of textbook. The instructor then explained that these text materials would be available for use in a special Study Center in the Behavioral Sciences Building in much the same way that text materials are often placed on reserve in a reading room in a library where they may be used but not taken out.

Course material. The written course material, for which all students were responsible on examinations, was packaged in units and made available to students in folders located in the Study Center. Each folder contained the 10 to

30 pages comprising the reading assignment and a unit study guide; the reading assignment was stapled on the right side of the opened folder and the study guide was stapled on the left side of the opened folder. The study guide consisted of a short introduction to the unit reading assignment and a list of study items (range = 15 to 44 items, median = 23 items) designed to focus the students' study effort on relevant parts of the text, and to encourage the kind of preparation (*e.g.*, giving examples, distinguishing between key concepts, *etc.*) that seemed most appropriate to the objectives of the course. Students were not required to use the study guides but they were told they would probably be helpful in preparing for examinations.

Study Center. A large room equipped with tables and chairs for about 60 students was used as the Study Center. Adjacent to the only door was a desk attended by a monitor. On the opposite side and facing the door was a set of shelves on which students were to leave briefcases, books, *etc.* as they entered the room. The student then approached the monitor, requested a specific unit of study material, and filled out a slip of paper that asked for both the student's name and the number of the unit he was requesting. The monitor then handed the student the folder containing the reading material and study guide, and noted on the checkout slip both the number of the folder and the time of day (determined from a large wall clock). The student left his University I.D. card with the monitor. Upon finishing with the folder, the student returned the unit to the monitor who returned the I.D. card and noted the time on the checkout slip. A student could not have more than one folder in his possession at a time. Each time a new study unit was requested, the student was required to fill out a new checkout slip. The Study Center was open for student use from 8:30 a.m. to 5:30 p.m. and from 7:00 to 10:00 p.m. Monday through Friday, and from 9:00 a.m. to 12:30 p.m. on Saturday.

Lecture-course procedures. Although class attendance was not required, the 31 students in

the lecture section (101-9) could attend lectures on Monday, Wednesday, and Friday concerned with clarifying and elaborating important points in the text material. A record of attendance at these lectures was obtained by circulating a sign-up sheet through the class at the beginning of the hour; at the end of the class hour a head count of students in the class was compared to the number of names on the sign-up sheet and discrepancies were corrected. On Tuesday and Thursday, students in the lecture section could join the 63 students in the PSI section (101-3) for the special series of films, lectures, and demonstrations that was developed for the PSI course. Generally, the 18 events in this series were nontechnical descriptions of applied research programs and findings. For example, this series included: a lecture on token economies, with a discussion of the rationale, procedures for implementation, and a brief summary of settings in which these procedures have been used; a live demonstration of language training with severely retarded children; a film on rehabilitation of delinquent boys (Achievement Place)³.

PSI-course procedures. The procedures used with the PSI section are very similar to those described by Keller (1968) and with a few exceptions have been reported previously (e.g., Born and Zlutnick, 1972). Briefly, each student was required to pass an 8- to 10-item written test over each unit of course material. These tests consisted of predominantly short-answer essay questions, with an occasional fill-in item asking for a key term. Completed tests were immediately evaluated by a student proctor who judged each written answer correct or incorrect and interviewed the student in connection with things he/she had written on the unit exam. To pass a unit exam, a student had to answer each question correctly; when an item was missed, the student was asked to restudy the material and report at a later date to take a different unit

exam over the same course material. Examinations could be taken on Monday, Wednesday, or Friday of each week. Because there were approximately 50% more days scheduled for unit exams than there were examinations to be taken, students had some opportunity to progress at their own rate. Students in the PSI course could attend the series of lectures, films, and demonstrations that occurred on Tuesday and Thursday class days, but attendance on these days was never required.

Major examinations. Students in both the PSI and lecture classes took the same 1-hr midterm and final examinations. Each of these exams was made up of 20 multiple choice and 25 short-answer essay items, and each exam was given at two different times, about one week apart, to permit students to select their own examination date. Presumably this would allow different study patterns to emerge in the two classes. Students in the PSI section were told that they had to complete the first nine units of course material before taking the midterm examination over that material. One student failed to complete the ninth unit exam before the second administration of the midterm because of extenuating circumstances, and was given permission to take the midterm before demonstrating mastery of the ninth unit of material.

The questions comprising the midterm and final examination were made up by both authors and two graduate assistants. Final selection of questions was made by both authors since each author managed one of the two sections. In an effort to avoid unintentional bias in items favoring one of the class sections, questions were included on the examinations only if they were selected by both authors. None of these questions had previously appeared among the unit study items or as questions on the unit exams taken by students in the PSI section.

Testing procedure and exam scoring. As mentioned previously, both the midterm and final examinations were given twice, and students from both sections met in the same room at the same time to take these exams. Each student was

³Available from Audio Visual Center, University of Kansas, 746 Massachusetts, Lawrence, Kansas 66044.

given a numbered test to which a numbered slip of paper was attached. The students were instructed to write their name only on the numbered slip of paper, detach it, and return it to the course assistant. These slips were then placed in an envelope until grading of the examinations was completed.

Scoring of the essay portion of the completed examinations was done independently by the second author and the two graduate assistants. Each item was scored either 0, 1, or 2 on a separate grading sheet by each grader, and the sum of these scores for each grader was obtained for each exam. These sums were subsequently correlated to determine grader reliability. The mean of the three grader scores combined with the score from the multiple choice items produced the student's score on each examination.

Determination of grades. In both classes, letter grades were awarded to students on the basis of the total number of points they earned in the course. In the lecture class there were only two examinations, a midterm and a final, and 50% of the course points could be earned on each exam. In the PSI class, the midterm and final together accounted for only 40% of the course points; the remaining 60% of the points were earned by passing unit exams.

In addition to credit for examination performance, students in both sections could earn a few points of extra credit by (a) serving as a volunteer subject in research projects in the Psychology Department, and/or (b) attending a specified number of the special Tuesday and Thursday events in the lecture-film-demonstration series.

Study time reliability. Reliability checks on the recorded time at which course materials were issued to students and returned to the monitor were obtained for four of the five Study Center monitors. The fifth person was familiar to the other monitors and was used as a reliability checker in an effort to minimize the likelihood that the precision of the data system would change during reliability checks. The reliability checker was frequently in the room near the

monitor summarizing data, and during reliability checks she assumed her usual position from which she could unobtrusively see both the wall clock and the monitor as she/he delivered or received the student's requested folder. The resulting data records were not compared until after the monitor's work shift was over and he/she had left the room.

Study behavior. Although there were several procedures designed to minimize all but the study of beginning psychology while in the Study Center (*e.g.*, only notebooks in the room, no talking, *etc.*), a time-sample procedure was used to verify that the room was used primarily for study. Generally speaking, two major categories of behavior were scored: (a) Studying—defined as looking down at the table or course related materials (folder or notebook) with the head not on the table or on the arms; (b) Nonstudy—behavior other than studying as defined above; *e.g.*, sleeping, talking, *etc.* For a few observation periods, talking and sleeping were defined and recorded separately, but they occurred so infrequently they were subsequently combined with other forms of nonstudy behavior.

During observation periods two observers would enter the Study Center, scan the students to note the seating distribution, and meet briefly to identify student groupings for observation. These groups might consist of "the four students at the table in the south corner", or the "three students at the second table in the middle", and so forth. Group size was variable in part because of the natural grouping of students and corresponding convenience to observers, and in part because students were free to come and leave at any time during the observation period. Once student groupings were identified, the observers separated and made independent observations of each group according to a pre-arranged order. Every 10 sec a specified group of students was observed by both observers, who scored each interval as an instance of study or nonstudy for each student in that group. An interval was scored as a study interval only if studying oc-

curred for the full 10 sec. A total of six such observation periods occurred during the term at different times during the open Study Center hours.

RESULTS

Reliability

Intergrader agreement. The reliability of examination scoring was determined by correlating the total scores assigned to each examination by each of the three graders. Three such correlations could be calculated for both the midterm and final exam, and across the two exams the range of these six correlations was from $+0.94$ to $+0.83$, with a median value of $r = +0.90$.

Study time recording. Of the total of 397 separate times recorded by both the Study Center monitor and the reliability checker, there were 15 disagreements. Only three of these disagreements were greater than 1 min, and one was as great as 3 min.

Student behavior in the Study Center. The results of systematic observations of student behavior confirmed informal observations that the room was used almost exclusively for studying. Across all observation days, 70 to 95% of the observation intervals were scored as study intervals, and the median value was 88%. Conversely, a median value of 12% of the intervals were scored nonstudy, with a range from 0 to 18%. Since the most common nonstudy response was a glance away from the materials when a student was entering or leaving the Study Center, and since a student had to be observed studying for the entire 10-sec interval for the interval to be scored a study interval, it is clear that considerable studying was occurring. The extreme brevity of many instances of nonstudy probably contributed to the lower reliability (73% agreement) on nonstudy intervals than on study intervals (98% agreement). Both of these reliability values were calculated by dividing the number of intervals the observers agreed in scoring a behavioral category by

the total number of intervals at least one observer marked that category, and multiplying by 100.

Lecture Attendance

Excluding holidays and a course organization meeting, there were 27 Monday, Wednesday, and Friday lectures given for students in the lecture section. The median number of lectures attended was 20.

Exam Scores

Scores earned on the midterm and final examinations by students in both class sections were entered into a 2×2 repeated measures analysis of covariance, with the GPA accumulated at the time of registration for the course serving as the covariate. The superior performance on each exam by students in the PSI section resulted in a statistically reliable ($p < 0.05$) main effect of class sections ($\bar{X}_{PSI} = 73\%$, $\bar{X}_{LECT} = 69\%$). It may be noteworthy that the PSI section was superior on each exam

Fig. 1. Proportion of students in each class section whose total time in the Study Center fell in each 10-hr study bin.

even though two considerations favor superior performance by the lecture section: (a) the combined midterm and final exam scores accounted for only 40% of the final grade for students in the PSI class, and (b) a much larger proportion of PSI students took the earlier of the two midterm and final exams; thus, if there was a communication about the exam from early to late examinees it could have had a greater effect on the mean of the lecture section.

Total Study Time

Figure 1 shows two histograms representing the total number of hours of study by students

in the PSI and lecture sections. Because of the difference in size of the sections, the number of students falling in each study time interval has been converted to a proportion of the total class to facilitate visual comparison of the data. The difference in these two distributions is statistically reliable ($\chi^2 = 48.11, p < 0.01$).

Cumulative Study Time

Figure 2 shows mean cumulative hours of study over successive days of the academic term for students in both PSI and lecture classes. Because there were both early and late midterm and final examinations, it was possible to plot

Fig. 2. Mean cumulative hours in the Study Center for students taking early and late midterm and final examinations in the PSI and lecture sections. The day of the midterm and final examination is indicated with a "hash mark" and an arrow. Data from students who took one of the exams early and the other late were omitted in construction of this figure. Mean total study time by students in the PSI section who took either early exams ($\bar{X} = 46.59, n = 19$) or late exams ($\bar{X} = 45.14, n = 39$) was higher than that of corresponding students in the lecture section ($\bar{X} = 23.30, n = 4; \bar{X} = 31.39, n = 25$).

separately, for both classes, the mean cumulative hours of study by students who took both exams early, and the study records of students who did not. Because of the small number of students who took the midterm early and the final late, and *vice versa*, for both exams (five in this category from PSI, two from lecture), these data were omitted in preparing this figure.

Several features of the data shown in Figure 2 are of interest. First, as reflected in the slope of the cumulative study records, the average rate of study is surprisingly steady over the entire term for students in both PSI and lecture sections. Second, as determined from the ending point of each of the four plots, students taking late exams in the lecture section invested more total study time in the course than students taking early exams, but for students in the PSI section, average total time of study was virtually identical for students taking both early and late exams. Further, these similarities and differences in total time of study are apparent even at the point of the midterm exam; students taking late exams in the lecture section have invested more study time in preparation for the midterm than students taking early exams, and students taking early exams in the PSI section have invested about the same amount of time in preparing for the midterm.

Figure 3 shows individual study profiles over the academic term for students in both PSI and lecture classes. Student study profiles were selected for inclusion in this figure on the basis of records of total study time spent in the Study Center; *i.e.*, total study times were ranked separately for each class, and the top, bottom, and middle ranks were selected to be included in the figure.

As one might expect, there are great differences in the rate (slope) of study by students within and between classes. Also, it is important to notice that in comparison with the lecture class, there were no extremely "late starters" in the PSI class; even students who invested little total time of study in the PSI course commenced working fairly early in the term. Further, among

students in the middle and low regions of the study time distribution, those from the lecture class showed much longer periods of absence from the Study Center than those from the PSI class.

DISCUSSION

Because a different instructor managed each of the two class sections, the reader should note that there is a potential confounding of instructor differences and teaching procedures in the present experiment. However, because of the markedly different role of an instructor in these two teaching formats, the possible influence of instructor differences is probably eliminated only through replication (*e.g.*, McMichael and Corey, 1969). However, it may be helpful to a reader to know that the authors were aware of this problem in advance of the experiment, that both of us had prior experience with both teaching formats, that our ratings as teachers were well above average, and that neither of us deliberately influenced the outcome of the experiment except through teaching method.

Examination Performance

The superior performance on midterm and final examinations by students in the PSI section is consistent with previous reports (*e.g.*, Born, Gledhill, and Davis, 1972; McMichael and Corey, 1969; Sheppard and MacDermot, 1970) and, for that reason, need not be discussed in detail. In the present case, superior exam performance by students in the PSI section: (a) helps to establish the effectiveness and similarity of the present PSI system and those used by other investigators, and (b) provides a solid justification, along one important dimension for evaluating educational systems, for preferring the present PSI procedures over the lecture procedures.

Total Study Time

From the standpoint of an analysis of student time invested in PSI and lecture courses, it is

Fig. 3. Individual study profiles for several students in the PSI and lecture classes. The students selected were the three students from each section who spent the fewest total number of hours in the Study Center, the most total hours, and the students closest to the median number of study hours in each section. The day each student took the midterm and final examination is indicated with a "hash mark". Three (or four) student records are in each panel.

clear that textbook-contact time is much greater in the PSI course than in the lecture course. In fact, students in the PSI section spent on the average about 50% more time in the Study Center than students in the lecture section. Thus, at first glance it would appear that improved learning is acquired at the expense of greater study time. However, in a PSI course, study time is largely restricted to textbook-contact time; in a lecture course, time in attendance at lectures may (should) also be considered study time in the sense that it represents a form of preparation for exams. If one adds the median number of Monday, Wednesday, and Friday 1-hr lectures attended by students in the lecture section (Median = 20) to mean textbook-contact time ($\bar{X} = 30$ hr)⁴ for those students, the resulting total time (50 hr) invested in preparing for exams is approximately the same as that of students in the PSI section ($\bar{X} = 46$ hr). Thus, preparation time was very similar in the two sections. However, because students in the PSI section were also required to complete the set of 18 unit exams (average time to write answers is 16.4 min and interview duration averages 8.3 min), their total time investment in the course was slightly higher than that of students in the lecture section.

Anticipating the argument that the previously reported study records were incomplete because students had access to notes they had taken about the course material outside the Study Center, volunteers⁵ were solicited from

both classes who agreed to keep all of their notes in the Study Center and to check them in and out in much the same way they checked out course units for study. (For tolerating the inconvenience, we awarded these students the small amount of course credit set aside for participation in experiments.) In other words, when these students entered the Study Center, they were required to check out both a study unit and their notebook; if they only wanted to review notes, they could simply check out their notebooks. For students in the lecture section there was a further source of notes from the lectures. In order to include use of lecture notes in the study record, the volunteers from the lecture class also took all their lecture notes in the notebooks. These notebooks were checked out of the Study Center by the lecturer and distributed to these students at the start of the class hour; at the end of the hour the lecturer collected the notebooks and promptly returned them to the Study Center where they could again be checked out by their student owners. Students in both sections with Study Center notebooks averaged about 3 hr more Study Center time than the average of their respective sections ($\bar{X}_{\text{psi}} = 48.17$ hr, $n = 19$; $\bar{X}_{\text{lect}} = 33.00$ hr, $n = 15$), suggesting that the study of lecture notes did not contribute appreciably to total study time.

Study Patterns

A comparison of average cumulative study records (Figure 2) and individual study records (Figure 3) of (especially) students in the lecture section emphasizes the difficulties inherent in trying to analyze patterns of study behavior with grouped data. The increase in rate of study before major exams by students in both the lower and middle sections of the lecture class is effectively masked by a simple averaging across all students in that class. From the mean cumulative study records, it would appear that both lecture and PSI procedures produce steady rates of study over the academic term, but a difference in the total amount of textbook-contact time; from individual records, a differ-

⁴The reader may find it interesting to note that over the 10-week academic term, students in the lecture section averaged only 3 hr of textbook-contact time per week. This is considerably less "outside work" than might have been expected in a course that represented about one-third of a normal academic load.

⁵Although the authors are aware of the hazards of using information from volunteers to draw conclusions about nonvolunteers, practical considerations made it unreasonable to require all students to leave their notes in the Study Center. Further, assuming some information is better than none, information from volunteers permits at least a crude estimate of the extent that notes might have been used outside the Study Center.

ent picture emerges, in which it appears that both the amount and distribution of study differs for students in the two classes. By showing both sets of data, the authors hope to emphasize the need for more frequent analyses of individual performance in the area of undergraduate instruction.

The individual study records in Figure 3 show several interesting things. First, in the PSI class, the weekly rate of study is fairly constant for all students once studying commences. Apparently, the combination of the PSI requirement that students demonstrate mastery of small units of course material, and the limited number of opportunities for test taking, tended to regularize study behavior before major exams. At the very least, these requirements prevent students from getting into a position where they have to learn large chunks of material at the last minute. In contrast, in the lecture class, where demonstrations of mastery were not required and checks on student performance were limited to a midterm and a final exam, there is much greater variation in study patterns. Also of interest is the fact that the average duration of each visit to the Study Center is virtually the same for both classes, so that the number of visits to the Study Center appears to be directly related to total hours of study. The average number of visits by students in the PSI class ($\bar{X}_{\text{visits}} = 36.5$) was about 50% greater than the average number of visits by students in the lecture class ($\bar{X}_{\text{visits}} = 23.9$).

A recent article by Mawhinney, Bostow, Laws, Blumenfeld, and Hopkins (1971) dealt with study behavior under daily, weekly, and three-week testing schedules, and bears an obvious relationship to the lecture portion of the present experiment where students had a four to five week "testing schedule". Generally speaking, the present results support the conclusion of Mawhinney *et al.* that long testing intervals are probably not appropriate for use when an instructor wants to produce consistent study behavior. However, we hasten to add that the term "scallop" appropriately describes the study

records of only some of the students in the lecture class (see Figure 3); other students studied regularly even with long-interval testing schedules. From our data it would appear that in at least some cases the relationship between long test intervals and study behavior defies simple description.

Among academicians the interest in study behavior arises from its presumed relationship to amount learned and, in turn, to traditional academic criterion measures. In both sections of the present experiment there was a disappointingly small correlation between total Study Center time and combined score from the two exams (lecture section $r = -0.13$, $p > 0.05$; PSI section $r = +0.42$, $p < 0.01$). At the same time, the relationship between predicted grade point average (determined from college entrance exams) and combined exam score was high in both sections (lecture section $r = +0.72$, $p < 0.01$; PSI section $r = +0.70$, $p < 0.01$). These data serve as a sobering reminder that the score a student earns on an examination is a result of many things besides the amount of time he spends studying.

REFERENCES

- Born, D. G., Gledhill, S. M., and Davis, M. L. Examination performance in lecture-discussion and personalized instruction courses. *Journal of Applied Behavior Analysis*, 1972, 5, 33-43.
- Born, D. G. and Herbert, E. W. A further study of personalized instruction for students in large university classes. *Journal of Experimental Education*, 1971, 40, 6-11.
- Born, D. G. and Whelan, P. Some descriptive characteristics of student performance in PSI and lecture courses. *Psychological Record*, 1973, 23, 145-152.
- Born, D. G. and Zlutnick, S. Personalized instruction, or what to do when they put a number on the back of your sport coat, issue you a bullhorn, and schedule your class in the football stadium. *Educational Technology*, Sept., 1972, 12, 30-34.
- Bostow, D. E. and Blumenfeld, G. J. The effect of two test-retest procedures on the classroom performance of undergraduate college students. In G. Semb (Ed.), *Behavior analysis and education—1972*. Lawrence, Kansas: University Printing Service, 1972. Pp. 400-415.

- Gallup, H. F. *Individualized instruction in an introductory psychology course*. Unpublished paper presented at the meetings of the Eastern Psychological Association, Atlantic City, New Jersey, May, 1970.
- Green, B. A. Is the Keller plan catching on too fast? *Journal of College Science Teaching*, 1971, 1, 50-52.
- Keller, F. S. "Goodbye teacher . . ." *Journal of Applied Behavior Analysis*, 1968, 1, 79-89.
- Mawhinney, V. T., Bostow, D. E., Laws, D. R., Blumenfeld, G. J., and Hopkins, B. L. A comparison of students studying behavior produced by daily, weekly, and three-week testing schedules. *Journal of Applied Behavior Analysis*, 1971, 4, 257-264.
- McMichael, J. S. and Corey, J. R. Contingency management in an introductory psychology course produces better learning. *Journal of Applied Behavior Analysis*, 1969, 2, 79-83.
- Sheppard, W. C. and MacDermot, H. G. Design and evaluation of a programmed course in introductory psychology. *Journal of Applied Behavior Analysis*, 1970, 3, 5-11.
- Sherman, J. G. *P. S. I., an historical perspective*. Unpublished paper read at the meetings of the Rocky Mountain Psychological Association, Denver, May, 1971. (a)
- Sherman, J. G. *Some permutations on an innovation*. Unpublished paper read at the meetings of the American Psychological Association, Washington, D. C., Sept., 1971. (b)
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