THE EFFECTS OF CONTINGENCY CONTRACTING
ON STUDENT PERFORMANCE
IN A PERSONALIZED SYSTEM OF INSTRUCTION

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THE EFFECTS OF CONTINGENCY CONTRACTING ON STUDENT PERFORMANCE IN A PERSONALIZED SYSTEM OF INSTRUCTION

An abstract of a Thesis by Victoria J. Grochocinski

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The problem. A large body of evidence indicates that the self-pacing feature of PSI may result in a high frequency of incompletes and postponed work by students, oftentimes leading to a high withdrawal rate in personalized systems of instruction. In addition, student procrastination results in massed testing at the end of the semester, putting additional burdens on both students and staff, thus reducing the effectiveness and efficiency of the system. The present study proposed to examine the effectiveness of contingency contracting across an entire semester in a PSI course as a procedure to reduce procrastination, withdrawal rate, and logistic problems.

Procedure. Students determined their own deadlines for taking unit tests by making an appointment with the graduate assistant at the learning center for one test attempt at a time. A comparison was made of the performances of students with low, medium, and high high school class ranks within and across semesters.

Findings. The major effect that contingency contracting had on student performance was the steadier rate of unit completion for all groups, when compared to student performance in a non-contracting semester. The percentage of students withdrawing from the course did not change with the contingency contracting system, nor was there a reduction in performance differences among the three different groups of students within each semester.

Conclusions. A contingency contracting procedure which retained the self-management aspects of PSI and was manageable within a large university course resulted in a steadier rate of unit completion when compared to the pacing pattern of students in a semester without contracting. Classroom logistic problems were reduced to the extent that testing was more evenly distributed across the semester. However, students in the low groups continued to perform less satisfactorily than other students in the course.
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TABLE OF CONTENTS

INTRODUCTION AND REVIEW OF THE LITERATURE .......................... 1
METHODS .................................................................................. 5
RESULTS .................................................................................. 9
DISCUSSION ............................................................................. 20
REFERENCE NOTES ................................................................. 26
REFERENCES ............................................................................. 27
LIST OF TABLES

TABLE

1. Performance scores of students in three high school percentile rank groups in non-contracting and contracting semesters 12

LIST OF FIGURES

FIGURE

1. Final grade distribution for low (L), medium (M), and high (H) groups in non-contracting and contracting semesters 10

2. Final exam score distribution for low (L), medium (M), and high (H) groups in non-contracting and contracting semesters 15

3. Cumulative mean number of units completed by course completers and non-completers in non-contracting semester 16

4. Cumulative mean number of units completed by course completers and non-completers in contracting semester 17
CHAPTER I

INTRODUCTION

In an attempt to apply a behavioral technology to the teaching process, Keller (1968) devised a course organized around certain principles of behavior. The basic features of this personalized system of instruction (PSI) as originally listed included self-pacing, unit-mastery, a minimum of lectures, a stress on written assignments, and the use of undergraduate proctors.

A number of studies have investigated the differences between PSI and traditionally taught courses, both in academic performance and student evaluations. Generally, academic comparisons have demonstrated that students in PSI courses perform superior on final exams as compared with students in a lecture course. Also, final course grade distributions differ. A normal curve is found in traditional courses whereas in PSI there are a large number of A's and B's and relatively fewer C's, D's, and F's. Results of consumer evaluations indicate that students overwhelmingly prefer the PSI to traditional courses (Kulik, Kulik, & Carmichael, 1974). Further, the self-pacing feature was rated as the most liked aspect of the course (Kulik et al., 1974).

In addition to these positive consumer evaluations, PSI also seems to meet one of the prime objectives of our educational system. According to Homme (1972, p. 4),
self-pacing is one step toward the goal of teaching stu-
dents to manage their own behavior. The student is
responsible for taking tests at his or her own rate in
order to complete the course.

However, a large body of evidence indicates that the
self-pacing feature of PSI may result in a high frequency of
incompletes and postponed work by students (Keller, 1968;
Lloyd & Knutzen, 1969; Sheppard & MacDermot, 1970). In
fact, the two most frequently cited problems in PSI are
the high withdrawal rate and procrastination (Sherman,
1972). Ancillary to procrastination is the problem of
classroom logistics. Student procrastination results in
massed testing at the end of the semester, putting addi-
tional burdens on both students and staff, thus reducing
the effectiveness and efficiency of the system.

In an attempt to alleviate these problems, several
modifications of the self-pacing feature have been imple-
mented. One obvious alteration is instructor pacing.
Semb, Conyers, Spencer, and Sosa (1974) gave bonus points
for maintaining a minimum rate or withdrew points upon
dropping below the minimum rate. Malott and Svinicki
(1969) initiated a "doomsday" contingency in which each
test had to be taken by a certain date; failure to do so
resulted in mandatory withdrawal from the course. Miller,
weaver, and Semb (1974) also set target dates for each unit
exam with a course withdrawal contingency if those target dates were missed. Others have administered unit tests in class each week, doing away completely with the self-pacing feature (Bostow & O'Connor, 1973; Cooper & Greiner, 1971).

The aforementioned instructor-pacing contingencies are similar in their reliance on the threat of penalties for non-performance. Somewhat more positively, Born (1974) offered an early final exam for students completing unit exams quickly, and Bitgood and Kuch (Note 1) gave points for work turned in early.

All of these pacing contingencies changed student response rates across a semester. Some even resulted in solving the classroom logistics problem (i.e., testing is spread out evenly over the semester). However, as Wood and Wylie (1974) pointed out, the effects of some of these contingencies are different for different students. Some students appear not to be motivated by bonus points and continue to have a high probability of withdrawal. Waller (Note 2) showed that instructor-paced contingencies reduced procrastination and improved the final grades of students with below average high school class rank, but did not reduce the withdrawal rate. In addition, substituting instructor-pacing for the self-pacing feature defeats the educational objective of teaching behavioral self-management.

What appears desirable, then, is a modified self-
pacing contingency which will retain the self-management aspects, reduce procrastination and the attendant classroom logistics problems, reduce the withdrawal rate, and is manageable within large university courses. Wylie (Note 3) successfully employed the use of contingency contracting with procrastinators in a personalized system of instruction. The terms of these contracts were determined by both the student and the manager, thus retaining most of the self-management aspects of PSI. The percentage of students successfully completing the course was higher for contracting than non-contracting groups, suggesting a lower withdrawal rate. In addition, the rate of unit completion was steadier for contracting than non-contracting groups, suggesting a reduction of the massed testing at semester-end inherent in self-paced courses. However, the groups in this study were quite small and a question remains whether this form of contingency contracting will be an effective technique for controlling pacing in a large personalized system of instruction.

The present study proposes to examine the effectiveness of contingency contracting across an entire semester in a personalized system of instruction as a procedure to reduce procrastination, withdrawal rate, and logistic problems.
CHAPTER II

METHOD

Course Description

The course, Introductory Psychology, was based on a modification of the Keller Plan (Keller, 1968), including the five features of PSI. Briefly, the course was designed as follows. Students earned points for unit tests, activities completed, and a final exam. The text was Vernon's *Introductory Psychology* (1974). All testing and tutoring was conducted at a learning center located in the basement of a dormitory on campus.

Students could earn a maximum of three points for each unit exam and could attempt each unit three times. Exams consisted of 20 four-item multiple choice questions. Point distribution was as follows, according to an 85% mastery criterion:

<table>
<thead>
<tr>
<th># correct</th>
<th>1st attempt</th>
<th>2nd attempt</th>
<th>3rd attempt</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-20</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>11-16</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0-10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

If a student answered only 16 correct on a third attempt, an oral question given by the graduate assistant could be attempted, earning that student two points for the third attempt, if answered correctly.

Other activities contributing to the course grade were topical seminars and enrichment lectures and films. Performance on these latter activities helped determine a
student's pre-final grade as follows:

<table>
<thead>
<tr>
<th>Points Earned</th>
<th>Completion of Optional Activities</th>
<th>Pre-final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-36</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>27-29</td>
<td>+</td>
<td>C</td>
</tr>
<tr>
<td>24-26</td>
<td></td>
<td>D</td>
</tr>
<tr>
<td>0-23</td>
<td></td>
<td>F</td>
</tr>
</tbody>
</table>

Students who did not complete the activities received a pre-final grade based on points alone, which was one letter grade lower than those indicated above.

The score earned on the final exam changed the pre-final grade according to the following scale: 85-100 raised the pre-final grade one letter, 64-84 maintained the pre-final grade, and 0-63 lowered the pre-final grade one letter.

Subjects

The subjects were students enrolled in two semesters of Introductory Psychology (498, Fall 1974; 444, Fall 1975). Each student each semester was assigned to one of three groups on the basis on high school class rank. High school rank was used as a classification method rather than the frequently used measure of grade point average for two reasons. First, since a majority of students in Introductory Psychology are freshmen, GPA is unavailable for many. Second, Paine, Wylie, and Wood (Note 4) and Paine (Note 5) have shown that class rank is an effective predictor of student performance in this course. The three groups
included the following percentile ranks: high: 67-100; medium: 34-66; and low: 0-33.

Procedure

Students in the Fall 1974 semester experienced the course as described previously (non-contracting semester). The course in the Fall 1975 semester was conducted exactly the same, with the addition of the following self-pacing contingencies (contracting semester). Students determined their own deadlines for taking unit tests by making an appointment with the graduate assistant at the learning center for each test attempt. Only one exam was scheduled at a time. The only stipulation was that the deadline had to be made on a date within ten class days of the last unit test taken. Exams could be taken on or before the date specified. Three deadlines could be changed throughout the course of the semester without a penalty if exams were rescheduled within five class days of the original date. A one-point loss resulted for exams not rescheduled and for each deadline changed beyond the third.

At the conclusion of each semester the following data were collected for all students:
1. high school class rank
2. course grade
3. date of withdrawal from course
4. number of units completed
5. number of retakes on unit tests
6. points earned on unit tests
7. activity completion
8. final exam performance
9. rate of unit completion
10. number of pacing points lost
11. grades affected by pacing
12. student evaluations
CHAPTER III
RESULTS

High School Class Ranks

All students for whom high school class rank was available were included in the data analysis. The performances of approximately 12% of the students in the non-contracting semester and 22% of the students in the contracting semester were not included in the present investigation because their high school class ranks were not available. The percentages of students in each of the three high school rank groups (low, medium, and high) for the non-contracting semester were 17, 32, and 51, respectively. The percentages for the contracting semester were 21, 27, and 52, respectively.

Course Grade

Figure 1 illustrates the final grade distribution for the three groups of students each semester. The percentages of students in each group receiving a grade of B, D, F, I, or W were similar for both semesters. A greater percentage of students in each of the three groups in the non-contracting semester received A's while a greater percentage of students in all groups in the contracting semester received C's. When an additional comparison was made between overall passing (A, B, C, D) and not passing (F, NC, I, W) grades, no obvious differences were found between semesters, although within semesters
Fig. 1. Final grade distribution for low (L), medium (M), and high (H) groups in non-contracting and contracting semesters.
the students in the high groups received slightly more passing grades than those in the low or medium groups. The percentages of students receiving passing grades in each of the three groups (low, medium, and high) for the non-contracting semester were 58, 80, and 89, respectively. The percentages for the contracting semester were 54, 75, and 92, respectively.

Course Withdrawals
The percentage of students withdrawing from the course is also shown in Figure 1. There is no difference between semesters, although the proportion of low to high students withdrawing was approximately three to one for each semester. The percentages of students each semester withdrawing from the course was 9.3 in the non-contracting semester and 11.0 in the contracting semester. Of those students withdrawing, 87.5% in the non-contracting semester and 94.1% in the contracting semester withdrew within the last three weeks of the semester. There were no differences in date of withdrawal among the three groups in either semester. University policy allows students to withdraw from a course without penalty until the last day of class.

Number of Units Completed
The mean number of unit tests completed by each group each semester is given in Table 1. There is no
TABLE 1

Performance Scores of Students in Three High School Percentile Rank Groups in Non-contracting and Contracting Semesters

<table>
<thead>
<tr>
<th>High School Percentile Rank</th>
<th>Low 0-33</th>
<th>Medium 34-66</th>
<th>High 67-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>non-con</td>
<td>con</td>
<td>non-con</td>
<td>con</td>
</tr>
<tr>
<td>Mean number of units completed (12 maximum)</td>
<td>8.4</td>
<td>8.7</td>
<td>9.5</td>
</tr>
<tr>
<td>Mean number of retakes per units completed</td>
<td>.57</td>
<td>.71</td>
<td>.39</td>
</tr>
<tr>
<td>Mean number of points per units completed (3 maximum)</td>
<td>2.9</td>
<td>2.6</td>
<td>3.0</td>
</tr>
<tr>
<td>Percentage of students completing optional activities</td>
<td>52%</td>
<td>50%</td>
<td>62%</td>
</tr>
</tbody>
</table>
appreciable difference between semesters, but within semesters, the groups differed from one another by approximately one unit, with the high group averaging 10.9 units, the medium group averaging 9.8 units, and the low group averaging 8.5 units.

Retakes on Unit Tests

The mean number of retakes per units completed per group each semester is illustrated in Table 1. Students in the low groups attempted less units but more retakes on those units than students in the medium and high groups. Students in the medium groups attempted more units and required slightly fewer retakes than those in the low groups, while students in the high groups attempted the most units and had fewest retakes on those units.

Points Earned on Unit Tests

Comparisons in Table 1 of the mean number of points per units completed reveal little differences between the two semesters. These results indicate that the majority of students earned the maximum three points on the units they completed. However, students in the low group in the contracting semester earned only an average of 2.6 points per unit completed, a factor contributing to this group's lowered course grades.

Activity Completion

Only half the students in the low groups each
semester completed the optional activities to raise their final grade one letter, whereas approximately 63% and 78% of the students in the medium and high groups respectively each semester completed these activities.

Final Exam Performance

A greater percentage of students in the high groups took the early final exam (completed their course requirements four weeks before the end of the semester) than students in the low and medium groups. Performance on the final exam also differed among the three groups as well as between semesters, as illustrated in Figure 2. The medium group performed better during the non-contracting than in the contracting semester. Students in the high groups each semester performed similarly to each other. A greater percentage of students in the low group in the non-contracting semester received high scores on the final exam than during the contracting semester.

Rate of Unit Completion

Figures 3 and 4 illustrate the cumulative mean number of units completed per three-week periods for completing and non-completing students in the three groups in the non-contracting and contracting semesters, respectively. The data in Figure 3 are based on a sample of the population from the non-contracting semester. Students completing the course were those receiving a grade of A, B,
Fig. 2. Final exam score distribution for low (L), medium (M), and high (H) groups in non-contracting and contracting semesters.
Fig. 3. Cumulative mean number of units completed by course completers and non-completers in non-contracting semester.
Fig. 4. Cumulative mean number of units completed by course completers and non-completers in contracting semester.
C, D, F, or NC; students not completing the course were those receiving a grade of I or W, for all groups. Students in the contracting semester performed at a steadier pace than those in the non-contracting semester, for all groups. Although in the non-contracting semester students in the low and medium groups showed almost identical pacing, in the contracting semester the pacing patterns of students in these two groups were clearly differentiated from each other. However, the students in the low groups of each semester showed similar pacing of unit completion. The non-completers in the contracting semester performed at a higher and steadier pace and completed more unit tests before withdrawing than did the non-completers in the non-contracting semester. The percentages of students from each group included in the non-completer category were similar between semesters. The average percentage of students in the low groups not completing the course was 23.5, for the medium groups, 13.3, and for the high groups, 4.7.

Pacing Contingency

The mean number of pacing points lost for each of the groups in the contracting semester was as follows: .8 points in the low group, .7 points for the medium group, and .5 points in the high group. Only 5.7% of all subjects' grades were affected by the pacing contingency.
The percentage breakdown by groups was as follows: 8.1% of the low group was affected, 6.5% of the medium group, and 4.4% of the high group.

Summary of Results

The major effect that contingency contracting had on student performance was the steadier pacing of unit completion for all groups, when compared to student performance in a non-contracting semester. The percentage of students withdrawing from the course, however, did not change with the contingency contracting, nor was there any appreciable difference between percentages of students in each semester receiving passing and no passing grades. Although few differences in student performance between semesters were found, there were obvious differences among the three different groups of students within each semester. These differences were not reduced, however, with the contingency contracting system.
CHAPTER IV
DISCUSSION

The results of this investigation lend further support to the findings of other researchers who initiated pacing contingencies in an attempt to modify student response rates in PSI courses (Bitgood & Segrave, 1974; Miller et al., 1974; Semb et al., 1974). In the present study, contingency contracting resulted in a steadier pacing of unit completion when compared to the pacing patterns of students in a non-contracting semester. An analysis of response characteristics of students on the basis of high school class rank yields clear differences among the three groups each semester. This study replicated the findings reported by Paine (Note 5) that low students continue to perform less satisfactorily than other students in PSI courses. The present investigation went one step further and compared the different groups of students under two different contingencies, non-contracting and contracting. There is some evidence that the different groups were affected differentially by the contracting contingency.

Performance Variables

Course grade distribution. The course grade distributions obtained each semester in this study were quite similar to each other, as well as to those previously reported in PSI courses (Born & Herbert, 1971; Keller, 1968). Students in the high and medium groups received
considerably more high grades than those in the low groups, while more of the low or failing grades were given to students in the low groups. The introduction of the pacing contingency did not seem to have any appreciable effect on the course grade distribution. The results indicate that students in the low groups earned lower grades because of a number of contributing factors. These students completed less units than other students, earned slightly fewer points, completed less of the optional activities, and took longer to complete the units as indicated by the slower pace. Students in the low groups had to retake more tests than other students also, but it is questionable whether this factor contributes to lower course grades.

Course withdrawals. The finding in the present study that the percentage of withdrawals did not differ between the contracting semester and the non-contracting semester is at odds with the findings of Miller et al. (1974) and Semb et al. (1974) who found that the pacing contingencies they initiated did successfully reduce the withdrawal rate from their courses. However, others have found that various pacing contingencies had little or no effect on withdrawal rate (Sutterer & Holloway, 1974; Waller, Note 2). The inconsistencies of these results suggest that there may be factors operating other than or in conjunction with poor self-pacing skills which contri-
bute to the high withdrawal rate in PSI courses. The fact that a majority of the students who withdrew each semester were in the low groups supports the findings of other researchers who have attempted to characterize students who withdraw (Born, Gledhill, & Davis, 1972; Born & Whelan, 1973; Wood & Wylie, 1974). In the present study, non-completers were best characterized as students with low high school class ranks. This finding is understandable since high school class rank represents past academic performance which should be the best predictor of subsequent academic performance.

Rate of unit completion. The major effect that contingency contracting had on student performance when compared to student performance in the non-contracting semester, was the steadier pacing of unit completion for all groups in the contracting semester. The medium group was most affected by the pacing contingency in terms of showing a definite increase in rate of unit completion over the non-contracting semester. The high group slowed down somewhat, but maintained a steady pacing pattern throughout the semester, and eventually surpassed the high group in the non-contracting semester in terms of mean units completed. The low group, however, was not differentially affected by the pacing contingency; these students performed at the same pace both semesters, but earned lower
grades than students in the other groups because they completed fewer units. One interesting outcome that contingency contracting had was its effects on course non-completers. These students completed more units and at a much steadier pace before withdrawing than the non-completers in the non-contracting semester. Students in the non-completing groups began completing units later than did competing students, and, as a group, worked at an insufficient pace to complete all the course work. Possibly mid-course intervention strategies could be implemented to facilitate course completion by these students.

Unit and final exam performances. The present findings indicate that the pacing contingency or lack of one (in contracting and non-contracting semesters, respectively) did not produce any appreciable differences in unit test or final exam performances. This finding supports the findings of others that pacing contingencies usually result in a change in student response rates but not exam performances (Miller et al., 1974; Semb et al., 1974; Waller, Note 2). However, it is possible that exam performance in PSI courses should not be the sole basis upon which to judge the effectiveness of pacing procedures, for it has been found (Kulik et al., 1974) that final exam performance in Keller sections always equals, and usually exceeds, performance in lecture sections.
Advantages of Steady Pacing

Sutterer and Holloway (1974) have suggested that the use of contingency management should be justified on the basis of improved student performance and not simply to smooth out logistical problems. However, this recommendation is more complicated than it appears. Others (Bostow & O'Connor, 1973; Lloyd, in press) have pointed out that test performance is not a basic dimension of behavior; Keller courses seek to develop specific behavioral repertoires, not just performance on pencil and paper tests. Self-pacing, or self-management, is one such behavior. A pacing procedure which generates a relatively uniform rate of progress may be beneficial for the student. For example, large amounts of uncompleted course work are not left at the end of the semester. In addition, a uniform rate means that the teaching staff is confronted by about the same demands on its time throughout the semester, thereby possibly increasing its efficiency. Proctors can spend more time tutoring and less time grading tests, emphasizing the individualized instruction aspect of PSI. Cheating is minimized because monitoring is easier than in massed testing situations. It should also be pointed out that the pacing contingency did allow students to move quickly through the course, and allowed considerable flexibility in students' scheduling of course work. In
addition, ratings on a course evaluation indicated that a majority of students in the contracting semester recommended that the contingency contracting procedure be used again in the course.
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