A COMPARISON OF TWO TESTING SCHEDULES
FOR PURPOSES OF STUDENT SELF-PACING

An abstract of a thesis by
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Problem: The educational procedure of PSI is often accompanied by student procrastination. Previous research on this problem has focused upon instructor control of student study and test-taking. The present study investigated the effects of manipulation of deadlines in order to decrease instructor control.

Procedures: The reduction of instructor control was accomplished by equalizing the amount of time and material between deadlines. An experiment was tested under a traditional schedule in which deadlines were set equal to intervals apart and covered similar amounts of material. Comparisons between the groups' patterns of test-taking were made over the last five weeks of each semester.

Results: Both groups waited until the last thirteen days of the semester to take the majority of their tests. However, the instructor control group completed slightly more work than the comparison period.

Conclusions: Neither the reduction of control schedule or the traditional schedule led to students progressing consistently through the semester. Although the reduction of instructor control resulted in slightly more work earlier in the period, the data may be influenced by other factors.

Recommendations: The present study changed deadlines regardless of pacing behavior. Future studies should take into account self-control and attempt to decrease instructor control dependent upon pacing behavior. Two possible techniques to utilize are pacing and self-control.
A COMPARISON OF TWO TESTING SCHEDULES
FOR PURPOSES OF STUDENT SELF-PACING

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Launa Medved
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FOR PURPOSES OF STUDENT SELF-PACING

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CHAPTER I
INTRODUCTION

In the 1960's a new method of instruction was introduced which was designed to facilitate learning in college courses. The beginnings of Personalized Systems of Instruction (PSI) may be traced partly to a study by Keller (1968) which contained five features or components distinguishing PSI from a traditional course. First, the focus of the lecture was no longer to 'tell' students information but rather to motivate them. Second, the student became an active participant in the learning process by working on his or her own with study guide questions. Third, student proctors graded tests, gave immediate feedback and help and increased the personal interaction between students and course personnel. Fourth, each unit had a set mastery requirement which the student met before continuing on to the next unit. Finally, students were allowed to move through a course at their own rate without the restrictions of test or semester deadlines (i.e., self-pacing).

Since Keller's initial work with PSI, research in the area has fallen into two broad categories: comparisons of PSI with traditional courses and tests of various components to determine their contribution to the total impact of PSI. The latter category also includes manipulations of different values of one component to achieve the greatest effect. Self-pacing is the component which has received the most experimental attention.

Keller believed self-pacing would teach students self-management skills (e.g., when to take a test or when to study). In addition,
self-pacing would consider an individual student's learning history and
time demands thus allowing the student to learn material at a rate which
was optimum for him or her. However, the use of self-pacing is often
associated with a 'procrastination problem' (Born & Herbert, 1971;
Henneberry, 1976; Lloyd & Knutzen, 1970; Semb, Conyers, Spencer &
Sanchez-Sosa, 1975). Students delay study and completion of units
rather than working at a sustained rate which is consistent with their
particular abilities. In order for total student self-pacing to work
(Hursh, 1976) one must assume that such behavior will be controlled by
the subject matter (that is, it will act as a discriminative stimulus
for study and test-taking responses).

The most obvious method to deal with procrastination is to pro-
vide control by assigning deadlines to ensure progress. However, this
tactic has not always eliminated procrastination. The important deter-
minant seems to be the frequency of testing (or unit size). With fewer
tests or larger units, study and test-taking behaviors scallop before a
deadline. Mawhinney, Bostow, Laws, Blumenfeld and Hopkins (1971) com-
pared daily, weekly, and three week testing schedules. With daily test-
ing students studied at a consistent rate and regularly attended a
study room. Weekly and three week testing resulted in study behavior
and attendance increasing as the test date drew near. Nelson and Bennett
(1973) also found results that suggested short units produced more con-
sistent progress.

Hursh (1976) has divided the pacing literature into several dif-
ferent procedures to deal with procrastination: point systems, minimum
rate of progress contingencies, availability of an early final, and graphic feedback on progress. In addition, another tactic has been the number of test opportunities available per unit. Research is not as extensive on the last three options. Henneberry (1976) offered an early final with the option of one re-take on it. He found that 80% of the students still waited until the final two weeks of the course to finish most of the units.

Graphic feedback on a student's progress through a course may serve as discriminative stimuli for studying. Croft, Johnson, Berger and Zlotlow (1976) found that biweekly external monitoring of progress by a discussion leader and self-monitoring by students both led to an increase in the rate of quiz-taking. Lloyd and Jacobi (in press) conducted a study which compared self-pacing with self-pacing plus self-monitoring. The latter resulted in a reduction of the scallop pattern.

Barkmeier, Duncan and Johnston (1978) measured study time and test scores when two different retest opportunities were available to students. They were allowed to take either two or five tests per unit. The authors found that with two test opportunities, scores on the initial test attempt were higher and students studied more (over an hour more) as compared to the first test for five attempts. Thus, students spent less time in preparation for initial tests when more attempts were available to them.

Point systems generally give points for mastery of a unit on or before a specified date which is commensurate with a sustained rate of progress through the course. Hursh (1976) has suggested that this
technique is used in two different ways. One is to give a fixed number of points for each unit completed by a certain date. Results from various studies (Buford, 1976; Burt, 1975; Riedel, Harney, LaFief & Finch, 1976; Semb et al., 1975) indicate that use of such a fixed point system can reduce procrastination. For example, Buford (1976) offered one bonus point for a unit mastered within a specified time. The author found that 78% of students completed units faster during the bonus condition than without such points.

The second tactic is to offer fewer points for units finished later in the term. Bitgood and Segrave (1975) divided a course into three intervals with a possibility of 8, 10 or 12 bonus points available during any one interval. The effects of three different point schedules were observed—increasing (8, 10, 12), decreasing (12, 10, 8) and fixed (10, 10, 10). The decreasing point schedule reduced procrastination while more work was completed later in the semester for fixed and increasing schedules. Other studies have also found decreasing points to be effective in dealing with procrastination (Bijou, Morris & Parson, 1976; Lloyd, 1971; Powers, Edwards & Hoehle, 1973).

Minimum rate of progress contingencies (Hursh, 1976) employ loss of points, grades or course credit contingent upon not completing units at a minimum rate. Results indicate that procrastination is reduced (Malott & Svinicki, 1969; Miller, Weaver & Semb, 1974; Semb et al., 1975; Sutterer & Holloway, 1975). For example, Miller et al. (1974) established target dates for completion of lessons. The first two times a student failed to complete a lesson he/she received a warning. The
third time they were given the choice of either withdrawing from the course or receiving an F. Students completed lessons at a higher rate during periods with target dates. Semb et al. (1975) manipulated point availability in several ways including loss of points for not completing a course on schedule. This tactic also reduced procrastination.

The techniques mentioned previously all depend on control from the instructor in some form (from points, established minimum rates, graphs, deadlines). The question remains whether once the control is reduced or removed, the student will still pace rather than procrastinate. No studies have dealt with this idea across semesters although Miller et al., 1974, found that when no target dates and no minimum rates of progress were used, students completed fewer lessons. In terms of practicality, better techniques might be those which eventually resulted in self-pacing. (That is, instructor control is faded to control by other stimuli within the student's environment. These stimuli are not specified by the experimental procedure but could include the test, the weekly printout of student point totals or lectures.) Hursh (1976) suggests that one possibility is to fade out instructor control and fade in self-pacing.

Initially, the instructor would set frequent deadlines and then would fade the use of deadline dates. If students did not meet a deadline they would have to contract with the instructor for an accelerated quizzing rate. A benefit of such fading (Henneberry, 1976) is that students would be made to begin work for the course and thus experience success in completion of units.
The present study will compare two testing schedules. The first gradually fades instructor control of test-taking and is based upon Hursh's (1976) original suggestion. (However, no contracting component is involved in the study.) The second schedule is one in which test deadlines occur at equal intervals thus approximating a traditional test schedule. Comparisons between the two schedules will be made in terms of the pattern of test-taking. The comparison will determine if following the reduction of instructor control procedure, students exhibit self-management skills.
CHAPTER II

METHOD

Subjects

The subjects were students enrolled in an introductory psychology course at Drake University. The fall section had an initial enrollment of 249 while 185 students enrolled in the spring. By the end of term, enrollment was 199 and 171 students respectively. Students were not assigned to any particular section but rather registered themselves according to their own particular schedule needs.

Procedure

The course was taught in a modified PSI format. Points toward the final grade were earned by attending a certain number of classes, participating in a discussion section and taking the chapter tests and final exams. In addition, bonus points could be received by reading extra material and then taking a quiz or by participating in psychology experiments.

During the semester students could earn up to three points for attendance at chapter reviews (one point for each) and twelve points for attendance at lectures in which films were shown or guest lecturers spoke (again, one point for each). The discussion groups were worth up to twenty points and covered a variety of topics within psychology (e.g., business applications, psychopharmacology, and nursing applications). The discussion groups were a requirement of the course. There were eleven chapters or units and a maximum of ten quiz points could be
achieved for each chapter. Students were allowed to drop their lowest quiz score thus receiving points for ten units. Fifteen points were available on the final exam. In order to receive an A, students needed to obtain 135-150 points, 120-134 for a B, 105-119 for a C, 90-104 for a D, and below 90 for a F.

Units had a mean length of thirty-six pages and ranged from twenty-nine to forty pages. Tests over the units were multiple choice (twenty items) and the questions came from a bank of quiz items originating in the student mastery guide and the instructor's manual. Each test had questions which were selected randomly from the test bank and no two tests were identical. However, second and third attempts of tests could contain items previously presented to the students. In addition, from chapter seven on, exams contained review items (zero to three questions) from chapters one, three and/or four. A maximum of three tests were taken over any chapter and only two attempts were allowed per day. No mastery was required to proceed to the next chapter. However, once mastery had been shown (seventeen correct out of twenty) no further tests could be taken for credit over the chapter. The number correct for each test was converted to point scores. The points assigned depended upon the number of previous attempts over that particular chapter. On the first attempt, seventeen and eighteen correct earned nine points; nineteen or twenty received ten. Even if mastery was not shown on the first attempt, it was possible to raise the total points to nine on succeeding attempts. See Table 1 for the point distribution for each attempt.
Table 1

Point Distribution for Each Attempt

<table>
<thead>
<tr>
<th>1st Attempt</th>
<th>2nd Attempt</th>
<th>3rd Attempt</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-20</td>
<td>17-20</td>
<td>17-20</td>
</tr>
<tr>
<td>10 pts.</td>
<td>5 pts.</td>
<td>3 pts.</td>
</tr>
<tr>
<td>17-18</td>
<td>14-16</td>
<td>14-16</td>
</tr>
<tr>
<td>9 pts.</td>
<td>2 pts.</td>
<td>1 pt.</td>
</tr>
<tr>
<td>13-16</td>
<td>11-13</td>
<td>below 11</td>
</tr>
<tr>
<td>4 pts.</td>
<td>1 pt.</td>
<td>0 pts.</td>
</tr>
<tr>
<td>10-12</td>
<td>below 11</td>
<td>below 10</td>
</tr>
<tr>
<td>3 pts.</td>
<td>0 pts.</td>
<td>0 pts.</td>
</tr>
</tbody>
</table>
Each unit had a deadline established for it during the course of the semester. Once that point in time had been reached, no further test attempts were allowed over the chapter. Students could, however, work ahead of those deadlines.

Chapter tests could be taken throughout a semester at the Learning Center. The Center was composed of two rooms one of which served as a testing room. The other was a combination study center and grading area and also held the records for the course.

The final examination consisted of 100 multiple choice items and covered the eleven course units. The test items were generated from the same item pool used for unit quizzes. Students could take the final at the regularly scheduled time or they could take an early final which was given approximately two-thirds of the way through the term. If students chose the latter option, no further test attempts were allowed over the chapters.

The fall section of introductory psychology served as the experimental group (reduction of instructor control of pacing), while the spring section served as the control group. Deadlines for the fall group are given in Table 2. Such a schedule involved the reduction of instructor control of pacing, i.e., one week-one chapter deadline; one week-one chapter deadline; two weeks-one chapter deadline; two weeks-two chapter deadline; three weeks-two chapter deadline; and five weeks-four chapter deadline. As instructor control was faded, other stimuli within the environment could acquire more control over test-taking behavior due to the longer time and greater amount of material
Table 2
Deadline Dates for Each Semester

<table>
<thead>
<tr>
<th>Fall Section</th>
<th></th>
<th>Spring Section</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Chapter</td>
<td>Date</td>
<td>Chapter</td>
</tr>
<tr>
<td>September 12</td>
<td>1</td>
<td>January 23</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>3</td>
<td>February 1</td>
<td>3</td>
</tr>
<tr>
<td>October 3</td>
<td>4</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>17</td>
<td>7 &amp; 8</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>November 8</td>
<td>9 &amp; 10</td>
<td>March 1</td>
<td>8</td>
</tr>
<tr>
<td>December 14</td>
<td>11, 12, 13, 14</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>29</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>May 3</td>
<td>11, 12, 13, 14</td>
</tr>
</tbody>
</table>
between deadlines. The control group (spring section) also had a final five week block over the last four chapters which served as the comparison point with the experimental sections. However, the remaining chapter test deadlines occurred approximately eight days apart and only covered one chapter. The deadlines for the spring are also presented in Table 2.

No explicit instructions were given to the students regarding pacing techniques. It was merely pointed out in the syllabus that chapter deadlines were not evenly spaced and that some would cover more than one chapter. In addition, before the first multiple deadline, the instructor stated in a lecture that the deadlines would be for several chapter tests rather than a single test over multiple chapters. The course syllabus also stated that procrastination may be a problem and suggested that students should not put off taking the chapter tests until the last few days.

To assess the effects of the experimental procedure, a between groups design was employed in the present study. Equivalence between groups was measured in terms of their performance on the chapter one test (i.e., mean number of points). The fall section scored a mean of 6.57 points and the spring a mean of 6.85 points. The difference between scores was not statistically significant (t=0.91, p>0.05).

The primary dependent measure was the pattern of test taking over days or weeks with respect to the deadline. Collateral data include withdrawal scores and grades.
CHAPTER III

RESULTS

Figure 1 illustrates a cumulative graph which approximates the ideal rate of test-taking for chapters 11, 12, 13 and 14 over the last five weeks of the term. A general pattern exists for all four chapters and consists of a very low rate, followed by a high steady rate over a six to seven day period which in turn is followed by another low rate of test-taking. The important point is when the high rate of test-taking begins and ends for each unit. Test-taking on Chapter 11 starts at the beginning of the five weeks and ends seven days later (or when Chapter 12's high rate begins). For Chapter 12, the high rate of test-taking terminates at the same time 13 commences and so on. Such a pattern would occur if students were progressing consistently through a course.

Figure 2 indicates the cumulative number of tests taken for chapters 11, 12, 13 and 14 in the fall and spring sections. Each data point during the comparison period represents a seven day period with the exception of the last data point which is six days. These periods are not calendar weeks but rather seven consecutive days in which the learning center was open. Since the number of subjects was different for each group, the important aspect of the graphs is not the absolute number of tests taken but rather the slopes of the curves for each chapter. For the fall section (left hand side of Figure 2), the Chapter 11 curve is at a steady, high rate over the first three periods and then tapers off to a low rate over the last period. The curve for
Figure 1. Ideal rates of chapter completion for chapters 11, 12, 13, and 14 during the last four weeks of the semester.
Figure 2. Cumulative number of tests taken during the five week comparison period for the fall and spring sections. (The first three periods represent seven days; the fourth period is six days long.)
Chapter 12 has a low rate over the first two periods which changes to a high rate for the last two periods. Chapter 13 and 14 curves are very similar. A low rate of test-taking occurs during the first period followed by a flattening of the curve in the second. The third period exhibits a low rate with a sharp increase in the final period.

The spring section is on the right hand side of Figure 2. The rate for Chapter 11 was high and consistent over the four periods. The rate is low in the first two weeks for Chapter 12, then becomes high in the third and fourth periods. Chapter 13 exhibited a low rate during the first period which was followed by a flattening of the curve in the second. The third period was low and the fourth was characterized by a sharp increase to a high rate. The rate for Chapter 14 was low in the first period followed by a flattening of the curve in the second and third periods and a high rate in the fourth period. The slopes between the spring and fall sections are very similar.

The previous two graphs have dealt with cumulative test attempts and the emphasis was on the pattern of test-taking. In Figure 3 this data has been transformed into a percentage to permit standardized comparisons of different frequencies for the fall and spring sections. The number of tests taken in a given period over one chapter is divided by the total number of attempts in all four periods and then multiplied by 100 to yield a percent. The percent of tests taken in a period are given for each of the last four chapters for the fall and spring sections. In the fall, Chapter 11 percentages varied little over the first three periods ranging from 26% to 29% to 34%. However, in the final period
Figure 3. Percent of tests taken during the five week comparison period for the fall and spring sections. (Calculated by the number of chapter tests taken during one period divided by the number taken in all four periods.)
the percent of attempts dropped to 11%. Chapter 12 showed a variable percentage with the fewest attempts in the second period (13%) and the most in the third (37.5%). The percentage decreased to 32% in the final period. The percent of tests taken for Chapter 13 decreased from the first to the second period (16% to 3.5%) then increased to 19% and 61.5% in the final two periods. The data for Chapter 14 showed the same pattern as Chapter 13 (16.5% to 4% to 12.5% to 67%) except that the percentage of tests taken for Chapter 14 was lower than thirteen in the third period but higher in the fourth period. The spring section's data are shown in the bottom half of Figure 3. The percentage of tests taken for Chapter 11 show little variation over the first three periods (25% to 25% to 28%) but decrease slightly to 22% in the fourth period. The percentages in each period for Chapter 12 yield a different pattern as they go from 10.5% to 8.5% to 33.5% and finally 47.5%. Chapter 13 percentages decrease (9% to 4%) then increase (4% to 14.5% to 72.5%). Chapter 14 results are similar in pattern (8% to 4% to 4% to 84%).

Figures 4-6 indicate the cumulative number of tests taken over days for deadlines approximately eight days apart. The pattern for Chapter 1 is a moderate, consistent rate followed by a high rate over the final two days. The patterns for chapters 3, 7, 8 and 10 are similar. Initially, tests are taken at a low rate followed by a moderate rate (beginning at day twelve for Chapter 3, day twenty-eight for Chapter 7, thirty-six for Chapter 8 and fifty-three for Chapter 10) which then changes to a high rate in the last days before the deadline (day fourteen for 3, day twenty-nine for 7, day thirty-eight for 8 and day
Figure 4. Cumulative number of tests taken for chapters 1, 3 and 4 in the spring section. (One chapter deadline approximately every eight days.)
Figure 5. Cumulative number of tests taken for chapters 7 and 8 in the spring section. (One chapter deadline approximately every eight days.)
Figure 6. Cumulative number of tests taken for chapters 9 and 10 in the spring section. (One chapter deadline approximately every eight days.)
The pattern for Chapter 4 changes from a low rate to a high rate (at day twenty-three). Unlike the previous chapters, no moderate rate exists between the low and high rates. Chapter 9 exhibits a change from a low to a moderate rate (day forty-one) to a low rate (day forty-five). The high rate occurs on day forty-eight as more attempts (127) were taken in one day than were taken in all of the previous days combined (113).

Figures 7-10 present data from the fall semester. Figure 7 data are the cumulative number of tests taken over days as a function of one week deadlines. Both Chapter 1 and 3 data start at the same time but Chapter 3 covers a longer time span due to the later deadline. Chapter 1 tests are taken at a high and consistent rate until the deadline. Few tests are taken over the first four days for Chapter 3 (when the deadline for Chapter 1 is approaching), but a moderate, consistent rate is established for approximately the next four class days and day nine. The final four days the rate of test-taking is high and consistent. Figure 8 presents data from Chapter 4 which is a two week deadline over one chapter. From day twelve, the rate of test-taking is consistent and moderate over-all until the last two days when the rate is high. Figure 9 data is from a two week deadline over chapters 7 and 8. Chapter 7's rate is consistent over the first five days. After a sharp increase on the sixth day, the rate is low or moderate for three days followed by three days of a high rate. The final four class days are characterized by a mixture of low and moderate rates. Chapter 8's pattern of test-taking tends to be a moderate and consistent rate until
Figure 7. Cumulative number of tests taken for chapters 1 and 3 in the fall section as a function of one week deadlines.
Figure 8. Cumulative number of tests taken for Chapter 4 in the fall section as a function of a two week deadline over one chapter.
Figure 9. Cumulative number of tests taken for chapters 7 and 8 in the fall section as a function of a two week deadline over two chapters.
Figure 10. Cumulative number of tests taken for chapters 9 and 10 in the fall section as a function of a three week deadline over two chapters.
the final two days when the number of attempts increases sharply. Figure 10 covers data from chapters 9 and 10 with a three week deadline. The rate for both chapters is initially low. The number of attempts over Chapter 9 accelerates before that of Chapter 10 (day forty-five compared to day fifty) and drops off on the last two days. At day fifty Chapter 10 increases and remains at a high rate.

The distribution of withdrawals and grades was computed for the fall and spring section. The fall had a 20% withdrawal rate; 48% of the students earned A's, 29% B's, 13% C's, 3% D's and 7% F's. In the spring section, 18% of the students withdrew and the grade distribution was as follows: 49% A's, 21% B's, 16% C's, 5% D's and 10% F's.
CHAPTER IV
DISCUSSION

The educational procedure of PSI is often accompanied by student procrastination. Numerous techniques have been tried in the attempt to foster a more sustained rate of progress through the semester, e.g., graphic feedback, minimum rate of progress contingencies, early finals and bonus points. They have had various degrees of success but one feature they have in common is their reliance upon the instructor to control student behavior. Use of a technique has little practical value unless it eventually results in self-pacing. The present study attempted to fade control of test-taking behavior from the instructor to other variables within the student's environment. Instructor control was faded by manipulation of the amount of material and the length of time between deadline schedules. Initially, deadlines were close together and involved only one chapter. Gradually, however, the deadlines covered longer periods of time and more course material thus allowing other variables to assume control over test-taking behavior. The nature of the variables would depend upon what stimuli were initially paired with such reinforcers as completion of a unit, point totals and verbal praise from proctors, to name a few.

In an approximation to an ideal test-taking rate, the majority of work for a given chapter would be done during a specific time period. Work on other chapters would occur at a low rate during the period. The end result would be a consistent progression through the course in which
work is completed on one unit and then begun on another. Neither the traditional deadline schedule nor the reduction of instructor control schedule resulted in cumulative test-taking which resembled the ideal curves. Chapter 14's rate peaks for both sections during the final period as does the rate ideally. However, chapters 12 and 13 also peaked during the third or final period indicating that students put off most of these tests until the end of the comparison period. Chapter 11's test-taking was consistent throughout the comparison period for the spring section rather than a negatively accelerated curve which would peak about the seventh day of the five week deadline. The fall section's Chapter 11 test-taking is negatively accelerated but the negative acceleration begins at a period much later than would be ideal for continuous progression.

If either schedule resulted in self-pacing for some students, a consistent progression pattern should have begun to appear for chapters prior to the final four. For the experimental group, curves resembling the ideal curve should have appeared in the deadlines which covered two chapters (7 and 8 or 9 and 10). That is, work over one chapter should have been at a consistent rate until midway through the deadline when work would begin on the other chapter. However, neither set of deadlines showed this pattern. Chapter 7's curve was negatively accelerated but the curve did not peak until the final few days rather than at the midpoint. Chapter 8's pattern was a scallop. The same was true of Chapter 9 and 10 although over-all the rates were lower.
For the traditional schedule, the greatest number of tests were taken on the final one or two days prior to the deadline. Little work was done on a particular chapter even after the prior chapter's deadline was completed. If students were pacing their work, they should have then begun to consistently work towards the next deadline but this was not the case. The scallop pattern is evident in every chapter. (These results for test-taking support Mawhinney et al.'s, 1971, findings of a scallop pattern for study behavior in weekly and three week deadlines.)

One other factor present in the data also indicates that the experimental procedure had no effect. The fall section showed high consistent test-taking rates for chapters 1 and 3. (Both chapter deadlines were over periods of six days following either the beginning of the term or a deadline.) Self-pacing was present. Control by the instructor set deadlines only needed to be faded to other variables. It did not occur as is evident both during the experimental procedure and the comparison periods.

Previously, the pattern of test-taking was compared to the ideal pattern. Since the spring section was a traditional schedule, its pattern may be assumed to be representative of an abrupt transfer from instructor to total self-pacing. Comparisons between the spring and fall, therefore, represent comparisons between the pattern which is typically obtained and the experimental procedure. Students in the fall paced themselves slightly better since Chapter 11 was a negatively accelerated curve for the fall section rather than the straight line shown in the spring. In addition, a lower percentage of Chapter 11
tests was taken in the final period for the fall (10%) as compared to
the spring (22%). The fall section, therefore, appears to have com-
pleted more work earlier on Chapter 11 than the spring section. For
Chapter 12 the percentage of tests was greatest in week three for the
fall rather than the final week for the spring. Again, the data sug-
gest that the fall section completed more work earlier for Chapter 12.
The greatest percentage of tests was taken during the last week on
chapters 13 and 14 for both sections. However, once again the percen-
tages were greater for the spring section indicating that less work was
completed earlier in the comparison period.

Thus, students in the fall section may have paced slightly bet-
ter than the spring but such small differences may not necessarily be
due to the experimental manipulations. Two other explanations also
exist to account for the data. The fall section had to contend with
greater student usage of the learning center due to more students with-
in the section and the existence of another introductory psychology
class which also used the learning center. If fall students waited
until a deadline day to take tests, the learning center would have had
more noise and longer lines. The combination may have been sufficiently
aversive to some students that they took tests before a deadline day and
the same strategy may have carried over into the comparison period. The
second explanation is simply that the sections differed in pacing at the
very beginning of the term and this difference accounts for the slightly
better pacing during the comparison period. Although the sections showed
no statistical differences academically (in terms of points on the first
chapter before any experimental manipulations were made), the pacing for
Chapter 1 is different between the two sections. The pattern for the
fall was steep and consistent whereas the pattern for the spring began
gradually and accelerated over the last three days (a scallop pattern).
These initial differences in pacing may account for the results in the
comparison period.

The experimental procedure did not appear to have a detrimental
effect upon student achievement. The distribution of grades for the
fall and spring sections were similar and the fall (experimental section)
had only a two percent higher withdrawal rate.

Given the present results, simple fading of instructor control
is not sufficient to result in self-pacing. Although Hursh (1976) sug-
gested manipulation of deadlines, he included a contracting component
and the data agree that more is needed beyond just a reliance upon the
amount of work and time between deadlines. Three factors could have
contributed to the ineffectiveness of the experimental technique.
First, the assumption was made that any pacing behavior would be main-
tained or strengthened by naturally occurring reinforcers (e.g., less
pressure to get a chapter done or higher point totals) but these were
not identified in the study. Secondly, the stimuli were not specified
which were to eventually assume control of pacing. Therefore, the pos-
sibility existed that no consistent pairing of a stimulus (or stimuli)
with a reinforcer occurred during the manipulation. Thus a stimulus
could not eventually control pacing behavior. Finally, deadlines were
changed regardless of actual pacing behavior.
A better technique might be to use a shaping technique and focus attention upon actual pacing behavior and a particular stimulus or set of stimuli. Deadlines would gradually lengthen and cover more chapters when pacing reached a certain criterion. Students could be reinforced with bonus points, optional chapter tests, coke socials or other reinforcers as they exhibited consistent progression. (External reinforcers would be faded over time.) If pacing faltered, the period could be shortened again, then lengthened and so on.

Another possible technique would be to teach students the principles of behavioral self-control. No procrastination studies in PSI have been devoted totally to self-control. However, use of these techniques has been suggested to manage employees in business settings and discussion from that area is relevant in the present case. Manz and Sims (1979) discuss self-management (i.e., self-control) as a possible substitute for leadership. Substitutes for leadership exist when contingencies to control behavior are available from sources other than the leader. In the case of PSI, rather than the instructor setting contingencies and goals for study and test-taking, the students would establish their own. Mischel (1973) suggests that the key is to adopt rules which guide behavior when no external contingencies exist. The process involves determination of goals, standards by which to evaluate progress towards or completion of goals, and selection of reinforcers. The reinforcers in self-control are of two types (Manz & Sims, 1979). The first are those directly involved in the self-control process (the reinforcers selected by the person for the target behavior). The second
are those which arise from the target behavior itself and are usually long-term in nature (e.g., completion of tests before other people, course grade and credit). Such consequences would reinforce both pacing and self-control behavior thus making them more likely to occur in the future.

Teaching students self-control would have several advantages. First, students would be learning a valuable skill for future classes (since procrastination is not unique to PSI only). Secondly, they could progress consistently through a course yet still have the flexibility to take into account unexpected assignments in other classes or activities. Finally, research on self-control exists in the behavioral literature (Thoresen & Mahoney, 1974 and Watson & Tharp, 1972) thus allowing the instructor to choose and to adapt a self-control procedure to the specific class and time frame. For example, Skinner (1953) states that one technique of self-control is to change the stimulus, that is, present stimuli to make a response more probable. Previous studies on graphs of progress (Croft et al., 1976; Lloyd & Jacobi, in press) use this technique (but not within the context of self-control). Students would be forced to observe their behavior because of the graphs but they would also be controlling pacing behavior because of their own deadlines and reinforceers.

In conclusion, simple manipulation of deadlines does not appear to lead to self-pacing. More profitable avenues of study might be strategies which focus upon the behavior and antecedent stimuli and manipulate consequences dependent upon that behavior. Both shaping of
pacing behavior and self-control techniques fall into such a category. They have the extra advantage of eventually resulting in behavior which does not depend entirely on instructor control.
REFERENCES


