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ABSTRACT

During 1971-72, of 487 students in 2 Introductory Educational Psychology classes, 123 students chose to take a lecture course and 364 students chose a mastery learning class. Despite constraints on interpretation, it was concluded that in this particular situation students acquired a knowledge of vocabulary, principles and concepts at least as well by mastery learning as by lecture-discussion methods. In addition, even in a class of more than 200, in contrast to lecture procedures, the mastery learning procedures provided for vastly increased one-to-one interaction between the student and instructor. More than 90% of the student respondents to an opinion survey felt that mastery learning should continue to be offered as an option for this course. Mastery learning students liked the clarity of goals, the chance to work at their own speed in their own time, and the attainment of course credits by means of unit tests with immediate reinforcement. In contrast to lecture students, many mastery learning students expressed self-change in terms of their own learning processes rather than in terms of course content. (Author/HS)

CONTINGENCY CONTRACT TEACHING (MASTERY LEARNING) IN INTRODUCTORY EDUCATIONAL PSYCHOLOGY

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SUMMARY

During 1971-72, of 487 students in two introductory Educational Psychology half-classes, 123 chose lectures and 364 chose mastery learning.

Despite constraints upon interpretation, it was concluded that in this particular situation students acquired a knowledge of vocabulary, principles and concepts at least as well by mastery learning as by lecture-discussion methods.

In addition, even in a class of more than 200, in contrast to lecture procedures, the mastery learning procedures provided for vastly increased one-to-one interaction between a student and his instructor - personalized instruction.

More than 90 per cent of the student respondents to an opinionaire thought that mastery learning should continue to be offered as an option for this course.

Mastery learning students liked the clarity of goals, the chance to work at their own speed in their own time, and the attainment of course credits by means of unit tests with immediate reinforcement.

In contrast to lecture students, many mastery learning students expressed self-change in terms of their own learning processes rather than in terms of course content.

Paid proctors, who had already taken the course, did not achieve any better results with their students than did the non-paid, volunteer proctors drawn from the class itself.

There were no statistically significant relationships between the academic averages of proctors, or their pre-test marks, and the achievement of their students on the post-test.

EDPSY 214A/B

Educational Psychology 214A/B is an introductory 36-hour half-class in classroom learning given in the Fall and again in the Winter to some 250 students in each term. Usually the course is given in several sections by several professors with assistants working quite independently. However, after some preliminary studies in the Spring and Summer of 1971, the three authors pooled their efforts and offered students three options: (1) somewhat traditional lecture-discussion, (2) mastery learning, and (3) for a few students who had already taken at least three psychological courses, the option of being a proctor in the mastery learning section.

The above arrangement was not primarily for research purposes. Rather, the intent was to better provide for individual learning preferences of students, and at the same time, to explore the possibilities of the mastery learning method.

Over the two terms, 123 students (25%) chose lecture and 364 students (75%) chose mastery, for a total N of 487. From the first to the second term there was a statistically significant reduction in the percentage choosing mastery: from 81 per cent to 71 per cent (chi square of 6.5 with one degree of freedom; probability less than .02).

The quantitative data reported below are based upon the second term, by which time any Hawthorne and John Henry effects would likely have somewhat diminished (see p. 17 below).

Students' Teacher Training Programs

The percentages of Edpsy 214A/B students in various teacher-training

programs were as follows: Elementary Standard A (a two-year program) (46%), B.Ed. Elementary (11%), B.Ed. Four Year Secondary (29%), B.Ed. (After Degree) Secondary (7%), miscellaneous (7%). There were no statistically significant differences between the lecture and the mastery learning sections as regards these categories (N: 284, chi square 7.78 with 4 degrees of freedom).

Course Content

Using the same textbook, the course content for lecture and mastery learning sections was as follows: (11 units each, 8 in common).

	Lecture	Mastery Learning
1. The scope of Educational Psychology		X
2. Attitudes and values		X
3. Personality integration; discipline		X
4. Learning theories and principles	X	X
5. Human abilities	X	X
6. Motivation	X	X
7. Factual information; verbal knowledge	X	X
8. Concept learning	X	X
9. Problem solving; creativity	X	X
10. Psychomotor abilities and skills	X	X
11. Retention and transfer	X	X
12. Characteristics of students	X	
13. Characteristics of teachers	X	
14. Classroom interaction and analysis	X	

The difference in content between lecture and mastery learning arose out of the individual preferences of the professors teaching the courses. Due allowance for this is made in the quantitative analysis given below.

THE LECTURE-DISCUSSION SECTION

This was carried on by one professor and one graduate assistant in pretty much a traditional fashion with, however, considerable emphasis upon small group discussion (40% of class periods), and individual work (15%).

Lectures themselves took up about 30 per cent and demonstrations about 15 per cent of the 36 class periods in each of the two terms.

THE MASTERY LEARNING SECTION

The method used was very much like the system of college teaching developed by Fred Keller and often referred to as personalized instruction. Michaels (1971) describes this as:

> ...the first widely known attempt to deal with college instruction from a deliberately behavioristic point of view, a point of view very similar to that underlying much of the behavior modification movement. A number of experiments have shown Keller's 'personalized instruction' to be generally more effective and better liked than more conventional instruction. This system is now being widely applied in other academic areas as well as psychology. Its main features are a de-emphasis of the lecture as a means of presenting information and emphasis on written materials, small units of work, study objectives, a mastery requirement for advancement, the extensive use of undergraduate student assistants, self pacing, and immediate grading.

The mastery learning method used in this study is of the family of methods described by Becker (1971), Block (1971), Born (1971, 1972), Homme (1970), Keller (1971), Mayo (1969, 1970), Sulzer and Mayer (1972), Ulrich, Wolfe, and Bluhm (1968), Hapkiewicz (1972).

Organization of the Section

Using Edpsy 214B, for example, there were 188 students, 41 proctors, and two professors. Thus each proctor had four or five students in his group. Some proctors preferred to work to a considerable extent with their students as a group; most proctors worked with the members of their groups as individuals. In either case, a proctor met with his students at whatever times were convenient.

From time to time, all of the students, proctors and professors met together for such purposes as orientation and explanation, pre-test, student evaluation, post-test.

In the Fall term, several films were shown. However, not more than 20 per cent of the students attended such films at the beginning of the term, and the numbers dwindled as time passed.

The student evaluation of the Fall term expressed the desire for class discussions led by a professor. Consequently, in the Winter term a series of lectures were scheduled. At the first lecture, out of some 188 students, three showed up. At the second lecture there were two students; at the third lecture, one. The lectures were cancelled.

The Student Contingency Contract Procedure

When a student working on his own considered that he had sufficiently mastered the contents of a given unit, or chapter, he met with his proctor and did an exam on that chapter (20-item multiple-choice, short answer, oral quiz). If the student attained at least 80 per cent on the exam he moved on to the next unit of work. If he did not attain 80 per cent, the proctor would discuss with him his areas of weakness, suggest sources where a given point was discussed, and generally try to be as useful as possible. The student would then study the materials of the unit again, and, when he considered himself ready, would again present himself to the proctor for examination. This repeat exam could be the same as before, or the proctor could vary it. Once again the student would need to attain the required 80 per cent mastery, or go back and re-study the materials. (Very few students needed three tries to attain the 80 per cent.)

For each unit there was a student study guide with a 20-item multiple-choice self test, discussion questions, a summary of the main points of the unit.

About 20 per cent of the students were tested by oral quiz covering the same points as the multiple-choice items. However, most of the testing was done by written multiple-choice exams. One unit was tested by essay questions.

Ten per cent of the students failed at least 9 out of the 11 units on the first try; 36 per cent failed at least five; 80 per cent failed at least two. Out of 143 students in the Fall term, only five managed to attain 80 per cent mastery of all 11 units on the first try.

The Rating of Students: Criterion Referenced Plus Normative Testing

Successful completion of the first seven units gave a student a rating of 55 per cent; nine units - 62 per cent; eleven units - 7[illegible] per cent.

In addition, there was a final 60-item multiple-choice exam to enable each student to try for a higher mark than that he had already obtained as above. The final exam mark could not lower a mark already obtained by completion of the unit tests; it could, however, raise it, but by not more than one division level. For example, a student obtaining 62 per cent on the units could raise his mark to as high as 79 per cent, if he did well enough on the final exam.

Workload: Student Time Spent

On an average, mastery learning students, lecture students, and proctors devoted 5.5 hours per week for 12 weeks to Edpsy 214B. There was no statistically significant difference among them (means of 5.50, 5.54, 5.60).

Individual Interaction Between Students and Proctors: Personalized Instruction

Each student met with his proctor for purposes of testing and discussion about one hour per week for 12 weeks. For the 188 students in Edpsy 214B this yielded a total time of some 2256 hours. If a professor spent 36 class hours on individual student tutoring, it would take some 60 professors to yield the same amount of interaction as that between students and proctors. It could be that this one-to-one interaction is a most significant component of the mastery learning approach to college teaching.

LECTURE AND MASTERY LEARNING ACHIEVEMENT

The Instrument Used

The same 60-item multiple-choice test was used for the pre-test and the post-test. These 60 questions were drawn at random from a pool of 401 test questions prepared by the same people who wrote the textbook and manuals (236 chapter test questions from the instructor's manual, and 165 questions from the student manual). The test was a measure of concepts, principles, and factual information requiring the students to have a recognition knowledge of some 240 items of test information in total.

The pre-test was administered during the first week of classes; the post-test on the last day of classes.

Results

There were no statistically significant differences between lecture and mastery learning sections as to teacher-training programs (p. 2), student time spent (p. 7); or as regards the pre-test (Table 1): Lecture mean of 26.7, mastery learning mean of 26.9.

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Insert Table 1 about here

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On the other hand, the post-test mastery learning mean was 37.7 and the lecture mean, adjusted for difference in course units covered, was 29.8 (Table 2). This difference was statistically highly significant (t: 13.9, P less than .001). The distribution of marks is shown in Figure 1.

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Insert Table 2 and Figure 1 about here

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In Figure 1 the distribution is shown by letter grades based on standard scores. On this basis, with a normal distribution, one would expect about seven per cent of students to get an A, 24 per cent to get a B, 38 per cent to get a C, 24 per cent to get a D, and seven per cent to get an E. Figure 1 shows that the lecture distribution is quite typical of results obtained in a traditional class with, however, a quite heavy weighting of C's with corresponding light weighting of B's and A's. In the mastery learning there is a heavy weighting of B's.

The difference between the results of the lecture and the mastery sections is emphasized when it is noted that if the letter-grade cutoff points of the traditional lecture section were used to rate the mastery section, then all of the mastery B's and three-quarters of the mastery C's would receive an A rating; half of the mastery E's would receive a C, and the remainder would get D with none getting E. On the other hand, if the mastery cutoff point for E were used, then more than three-quarters of the lecture C's and all of the lecture D's would receive an E rating (Figure 1).

In any event, in reporting final marks to the university, each section

worked out its marks independently. For the mastery learning, the distribution of these final marks is given in Table 3. It will be noted that some 80 per cent of the mastery students received a B rating of from 70 to 79. For the mastery learning sections combined final marks, the mean was 71.8 . This compares with an overall College of Education mean of 71.7 in 1970-71.

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Insert Table 3 about here

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Although there were confounding variables which constrain interpretations as regards the differences between the lecture and the mastery learning sections, reported above, none the less it should be noted that studies in the recent literature report the same kind of results both as to the difference in favour of mastery learning, and as to the shape of the mastery distributions, negatively skewed, heavily weighted to high-score frequencies. For example, Keller (1971), Hapkiewicz (1972), Michael (1971), Mayo et al (1969, 1970), Block (1971), Airasian (1967), Collins (1971), Born (1972). It is worth recording that Born's study used essay type exams as the instrument. Born also reports that Sheppard and McDermot (1970) found that personalized procedures produce better performance on essay questions.

All things considered, it would seem reasonable to conclude that if the purpose of a course is to have the students acquire a knowledge of specific concepts, principles, vocabulary, and facts, the mastery learning method will accomplish this at least as well as will the traditional lecture method.

MASTERY LEARNING: STUDENTS' COURSE EVALUATION

Reliability of the Evaluation

In the Fall term, and again in the Winter term, the students were

requested to complete a voluntary, annonymous opinionaire. Except for one item, no statistically significant differences were found between the student evaluations of the two terms. Hence, in this report, the evaluations of the Fall and Winter terms are combined.

[The item of difference: the method of determining student grades for the course. It was half way through the Fall term before the method was finally decided upon. Some students reacted negatively to this uncertainty, as indicated in the following comparisons: student opinion as to marking system (Fall term in brackets) - Very Good - 13% (18%); Good - 53% (40%); Average - 29% (19%); Poor - 5% (16%); Very Poor - 1% (7%). (Chi square of differences: 15.8, 3 df, P less than .005.) Student opinion of the marking system was in general, good: only 6% of the students in the Winter term rated it as poor or very poor.]

Combined Results: Edpsy 214A/B

Of the total of 359 students, 224 completed the opinionaire, a 62 per cent return. This was consistent for both terms (61 per cent in the Fall; 63 per cent in the Winter). The course evaluation by these 224 students follows:

Ninty-three per cent of the respondents thought that providing mastery learning as an option was a good idea; that it should be continued.

Eighty-two per cent of the respondents stated that they would do the course again by the mastery learning method, if given the option.

When asked about the work load, 16 per cent thought that it was much heavier than in other Education half-classes, 37 per cent - somewhat heavier, 30 per cent - about the same, 12 per cent - somewhat less, and 4 per cent - much less. However, as noted above, p. 6, when we obtained an actual statement of hours spent on the course, there was no difference between the mastery

learning and the lecture sections (5.5 hours per week, each). Maybe both the sections were somewhat heavier in work load than other Education half-classes, a possible reflection of the Hawthorne and John Henry effects (p. 17).

Sixty-two per cent of the students rated the amount of individual help received as good or very good, 31 per cent - average, 7 per cent - poor or very poor. This supports the finding of a high measure of one-to-one interaction, p. 6, above.

In general it could be said that the majority of the students taking the mastery learning option liked doing it this way, and favoured the continued offering of a course of this nature for Edpsy 214A/B

Students' Written Evaluation of the Mastery Learning Course

Part of the opinionaire consisted of questions which asked for students' written replies; for example: "We would appreciate it if you would tell us in a few words why you chose this Mastery Learning section rather than the Lecture section." Content analysis of the replies yielded the following percentage frequencies:

Opportunity to work at one's own rate in one's own time	35%
Curiosity; the chance to try a new approach	26
It would be better than a lecture approach	17
Liked the method of evaluation of students	10
Other reasons	12

The following results were generated by the question, "What were the good points of the course?":

Emphasis on student self-discipline, chance to work at one's own speed; clarity of goals	55%
Student evaluation system eliminated examination stress; must attain criterion before proceeding; immediate reinforcement	12
Learn more, increased vocabulary, instils desire for further learning	9
Individual help received	6
Miscellaneous: proctors helpful, relevent	18

Suggestions for improvement of the course:

Improve the chapter examinations: include a larger component of oral quizes and written essays	40%
Get a better textbook	16
More group discussion	15
More films and lectures	15
Have more professor involvement	4
Miscellaneous	10

What appealed to a student most was the chance it gave him to work at his own speed, in his own time, with a method of student evaluation that eliminated much of the final-examination stress. Curiosity, trying a new approach, the chance to get away from the usual lecture-discussion methods were also potent factors.

Although some 20 per cent of the students had had oral quizes as their chapter tests, none the less, 40 per cent of the opinionaire respondents thought that the emphasis upon oral quizes and written essays should be increased.

The students did not appear to be particularly worried about the lack of direct professor involvement: only 4 per cent of respondents mentioned the desirability of increasing this component. Perhaps the heavy emphasis upon one-to-one interaction between students and proctors accounted for this.

While some 15 per cent of students expressed the desire for more group discussion, in practice this was difficult to reconcile with the individual timetable that most students used. As a matter of fact, proctors had been told to make use of group discussions at their own discretion. However, not much in the way of group discussion was carried out.

Again, while some 15 per cent of students suggested a greater use of lectures and films, in practice, when these were scheduled, very few students showed up. Once a student was embarked upon his own timetable, he seemed

primarily interested in getting on with his work, of passing his tests and getting immediate credit for them.

WHAT THE STUDENTS SAID THEY GOT OUT OF THE COURSE: A COMPARISON BETWEEN LECTURE AND MASTERY LEARNING SECTIONS

Data were also obtained towards the end of the Winter term by asking both the mastery learning and the lecture sections to "list the three facts or items of information gained from this course, that from your own point of view, are the most important to you (content, facts, information)." There were 122 mastery respondents (62% returns), and 72 lecture respondents (80% returns). The results in rank order were as follows:

Lecture Section	Mastery Learning
Motivation	Motivation
Flanders' Interaction analysis	Values and attitudes
Bruner and Piaget: levels of development	Creativity (divergent-convergent thinking)
Driekurs' tape	Learning theories
Discipline	Psychomotor skills
Evaluation	Problem solving
Methods of teaching	Concept learning
Arousal levels	Piaget's theory
	Reinforcement
	Retention, forgetting, transfer
	Maslow
	Individual differences (evaluation, instructional techniques)

The comments were of much greater breadth in the mastery learning than in the lecture method responses. Whereas, in the lecture method certain general topics had obviously made a great impression, e.g., Flanders' Interaction Analysis and Motivation, in the mastery learning approach, the emphasis was on the details of the processes, e.g., discipline and goal setting as related to motivation. This may be a direct reflection of the time spent on the topics and the obvious concentration on detail in the mastery approach. The main difference, then, could possibly be summed up by the saying that the

comments in the mastery learning approach tended to emphasize the underlying theoretical processes rather than the practical outcomes.

There was an obvious greater facilitation with psychological terminology by students in the comments in the mastery approach.

WHAT THE STUDENTS SAID WERE THE MOST IMPORTANT CHANGES IN THEMSELVES THAT RESULTED FROM TAKING THIS COURSE

It was thought by the authors that perhaps the most important differences between the two methods would be in the changes that took place within students. Hence, students were asked to "list the three most important changes in yourself that resulted from this course (habits, attitudes, skills)." The results in rank order were:

Lecture Section	Mastery Learning
Awareness of self and own teaching methods	Study habits improved: budgeting of time, concentration, selecting important material, reading with understanding
Awareness of students as individuals	Self-discipline: goal setting, learning to think and work independently
Changes in personal techniques: evaluation, large and small group discussion, motivational, disciplinary	Self-awareness: responsibility for one's actions, increase in incentive, feeling of accomplishment, feeling of self achievement, realization of poor study habits
Increase in critical thought	Feeling of having learnt a body of knowledge
	Futility of memorization
	Learning to do multiple-choice exams
	Increase in interest in and respect for Educational Psychology
	Able to relate information, for the first time
	Realization of the place of examination in the learning process

The main difference was in terms of object of reference. In the lecture method, the comments were on the whole, in terms of the course of study,

e.g., I have changed my evaluation on motivational techniques, whereas, in the mastery learning the comments were in terms of the students' own learning processes as they (the students) came to know them through the course method. Whereas, many students in the mastery learning were aware that they had acquired the skill of memorization and answering multiple-choice questions, there were many who said that they had for the first time experienced a sense of self-achievement and accomplishment, i.e., having learnt a body of knowledge which resulted in an increase in incentive and self-discipline. The comments section suggested a greater respect for Educational Psychology as a subject as a result of the mastery learning technique.

NOTE: These comments are generalizations. If it is said that on the whole students liked a certain thing, it is implied that there were more that liked it than didn't

THE PROBLEM OF PROCTORS

Michael (1971) had said that his best results were obtained by using as proctors those students who had successfully completed the same course which they would be called up to "proctor". It was not possible in this present study to obtain a sufficient number of such proctors, so other students were taken on. In the winter term, Edpsy 214B, then, the proctor group of 41 persons consisted of (1) 18 "pay proctors" (13 of whom had already taken Edpsy 214A by mastery learning and who were paid an honorarium of $50.00, and 5 of whom were senior and graduate students with an Edpsy background who received class credit for Edpsy 591B, an experimental behavior modification class); (2) 23 "credit proctors" who were students drawn from the Edpsy 214B class itself. These proctors had had at least three previous psychological courses and had volunteered to act as proctors. They received the same term

credits as any student who successfully completed the 11 units of work. To get a higher mark they had to merit it as a result of the marks they made on the final examination.

How much did the "credit proctors" learn as a result, in part at least, of being proctors?

On the pre-test there was no statistically significant difference between these proctors and their other students of the class: means of 27.27 and 26.9, respectively (t: .35, n.s.).

On the post-test the results were similar: means of 37.91 and 37.70, respectively.

The maxim that "one learns something best by teaching it" was not born out here. On the other hand, these "credit proctors" seemed to have achieved as well as the regular students insofar as course content is concerned, as measured by multiple-choice examinations.

Was there any difference in the performance of students of "credit proctors" and students of "pay proctors"?

On the post-test, 98 "credit proctors'" students had a mean of 37.77 with a standard deviation of 3.978, whereas 72 "pay proctors'" students had a mean of 37.70 with a standard deviation of 4.277. There was no statistically significant difference between the two groups of students (t: -0.10, n.s.).

Thus it would seem that as far as student learning results in Edpsy 214 are concerned, it would be satisfactory to draw the proctors directly from the class. (This of course, has financial implications for those who might be called upon to pay proctors at the customary rates of student-assistant pay.)

What is the best way of selecting proctors from the class itself?

Would proctors with high academic averages produce the best results? No

evidence was found to support this. A Pearson product-moment correlation was calculated for proctors' academic average (based on the last 10 university classes taken) versus students' post-test average mark. (For each proctor, the average post-test mark of his own group of five students was calculated.) Result: Proctor academic average versus student post-test, N: 17, r: .07; n.s.

Would proctors with a high mark on the pre-test produce the best results? No evidence was found to support this either. The proctors' pre-test versus the students' post-test average mark yielded a correlation coefficient of .10, not statistically significant.

It would seem then that the method of selecting proctors from the class, which was described above, might be as good as any: locate the students who have the best background in Psychology and Educational Psychology, and from them obtain volunteers.

CONFOUNDING, CONSTRAINING FACTORS

Constraint is placed upon the interpretations of this study because of the following considerations:

1. There was no control for the Hawthorne effect (Roethlisberger and Dickson, 1947) which would reflect the stimulating effect of the overt experimental treatment -- mastery learning -- upon the mastery section, with consequent increased performance.

2. There was no control for the John Henry effect (Heinrich, 1972) which would result in an above average performance by the lecture section as a result of its being in competition with the experimental mastery section which could be construed as threatening to replace it.

Note, however, that the Hawthorne and the John Henry effects would tend

to cancel each other out, would tend to produce no significant difference, whereas in fact, a significant difference between mastery and lecture achievements was found.

3. The lecture and mastery learning students were neither randomly assigned nor carefully matched. Thus, factors other than the differences in method could have accounted for an indeterminate portion of the variance between the two groups. However, the fact of the mastery and lecture sections having no significant differences as regards students' teacher-training programs, pre-test results, and time students devoted to the programs, would tend to indicate equivalent groups for purposes of this study.

4. The different attainments of the two groups might have been a function of the particular professors used, not so much as regards the mastery learning, where the professor instructional function was minimal, as regards the lecture section where the instructor teaching role could be regarded as crucial.

Because of the above four constraints, and other considerations, generalizations as to the comparative effectiveness of the mastery learning procedures should be made only with great caution if implemented:

-- by other professors or teachers;

-- for a period of more than one school term;

-- by measurement instruments other than multiple-choice tests;

-- in other courses in the same or other fields, or at different school levels

CONCLUSIONS

Despite these above constraints, it could be concluded with some assurance that for this particular introductory Educational Psychology course,

under these particular circumstances:

1. Students acquired a knowledge of specific background data -- vocabulary, principles, concepts -- at least as well by mastery learning procedures as by lecture-discussion methods.

2. Under the mastery learning procedures the great majority of students attained high course marks. The evidence indicated that even those few students making poor scores would be able to achieve high levels of information possession if they were given a longer period of time in which to attain the mastery desired: a student's lack of success was a function not so much of conceptual barriers as of student motivation and time commitment.

3. The mastery learning procedures, in contrast to a traditional lecture class, provided a vastly increased time for one-to-one interaction between a student and his instructor. Even in a class of 200 students, instruction can become personalized through mastery learning procedures.

4. When given the chance, three-quarters of the students chose mastery learning in preference to a lecture-discussion type of class.

5. More than 90 per cent of the mastery learning opinionaire respondents thought that mastery learning should continue to be an option available to students taking this class.

6. The mastery learning students liked the course because of the clarity of goals, the emphasis upon self-discipline, the chance to work at their own speed in their own time, the lack of stress on final exams, the attainment of course credits by means of sequential unit tests with criterion-referenced marking and immediate reinforcement.

7. Self-change was expressed by lecture students in terms of the course content, but by mastery learning students in terms of their own learning

processes: self-changes were more direct, more internalized and inner directed in the case of the case of the mastery learning than the lecture students.

8. Volunteer student proctors drawn from the class itself achieved the same course marks in both pre-test and post-test as did the regular students.

9. Paid proctors who had already taken the course did not achieve any better results with their students than did the non-paid, volunteer proctors drawn from the class itself.

10. There were no statistically significant relationships between the academic averages of proctors, or the pre-test marks of proctors, and the achievements of their students on the post-test.

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TABLE 1

Edpsy 214B: Pre-test Results of Mastery Learning and Lecture Sections, January 10, 1972

Group	No. of Students	Mean	Standard Deviation
Mastery Learning	182	26.9	4.395
Lecture	68	26.7	3.259

Difference between groups: $t = .41$ ($p > .05$), not significant

TABLE 2

Edpsy 214B: Post-test Results of Mastery Learning and Lecture Sections, March 29, 1972

Group	No. of Students	Mean	Standard Deviation
Mastery Learning	193	37.7	4.243
Lecture	81	26.9	4.335
Lecture, adjusted[1]	81	29.8	4.335

Difference between Mastery Learning and Lecture, adjusted:

$t = 13.9$ ($P < .001$), highly significant

Note: The same test was used for the pre-test and the post-test: 60 multiple-choice questions chosen at random from the total pool of 401 questions provided with the textbook (236 items from the Instructor's Manual and 165 items from the Student Manual.)

[1]Adjustment: the post-test covered topics 1 through 11 (p. 3 above). The Lecture Section did not cover topics 1 through 3 which accounted for 16 out of the total of 60 test items. On these 16 items, the mean expected, based on the Pre-test mean, would be 26.7/60 X 16 = 7.12. However, the mean expected, based on the Mastery Learning Post-test mean would be 37.7/60 X 16 = 10.06. Difference: 10.06 - 7.12 = 2.94. Hence, the adjusted Lecture Post-test mean was taken to be 26.9 + 2.9 = 29.8.

TABLE 3

Edpsy 214 A/B: Mastery Learning Section Final Marks

(Term Mark plus Final Test Raises)[1]

Mark	Number of Students getting marks	Per Cent
Dropped the class; incomplete	27	7.3
Less than 50 per cent	2	0.5
50 to 59 per cent	8	2.9
60 to 69 per cent	23	6.2
70 to 79 per cent	297	80.5
80 to 100 per cent	12	3.2
TOTAL (Section A - 158; B - 211)	369	100.6

[1]Successful completion of unit tests, at the 80 per cent level of mastery, gave a student the following marks: 7 units -- 55; 9 units -- 62; 11 units -- 70. A mark so obtained could not be reduced by the final examination, but it could be raised to the final-exam mark. (See Figure 1 for distributions.)

Note 1: differences between Section A and Section B results were tested by chi square and were found to be statistically insignificant. Hence, the results of both sections were combined to yield the above table.

Note 2: Mastery learning and lecture section combined final marks:

Fall Term: 214A: mean 73.51 N 190

Spring Term: 214B: mean 70.08 N 275

214A/B mean 71.80 N 465

Mean of all marks, College of Education, 1970-71: 71.7

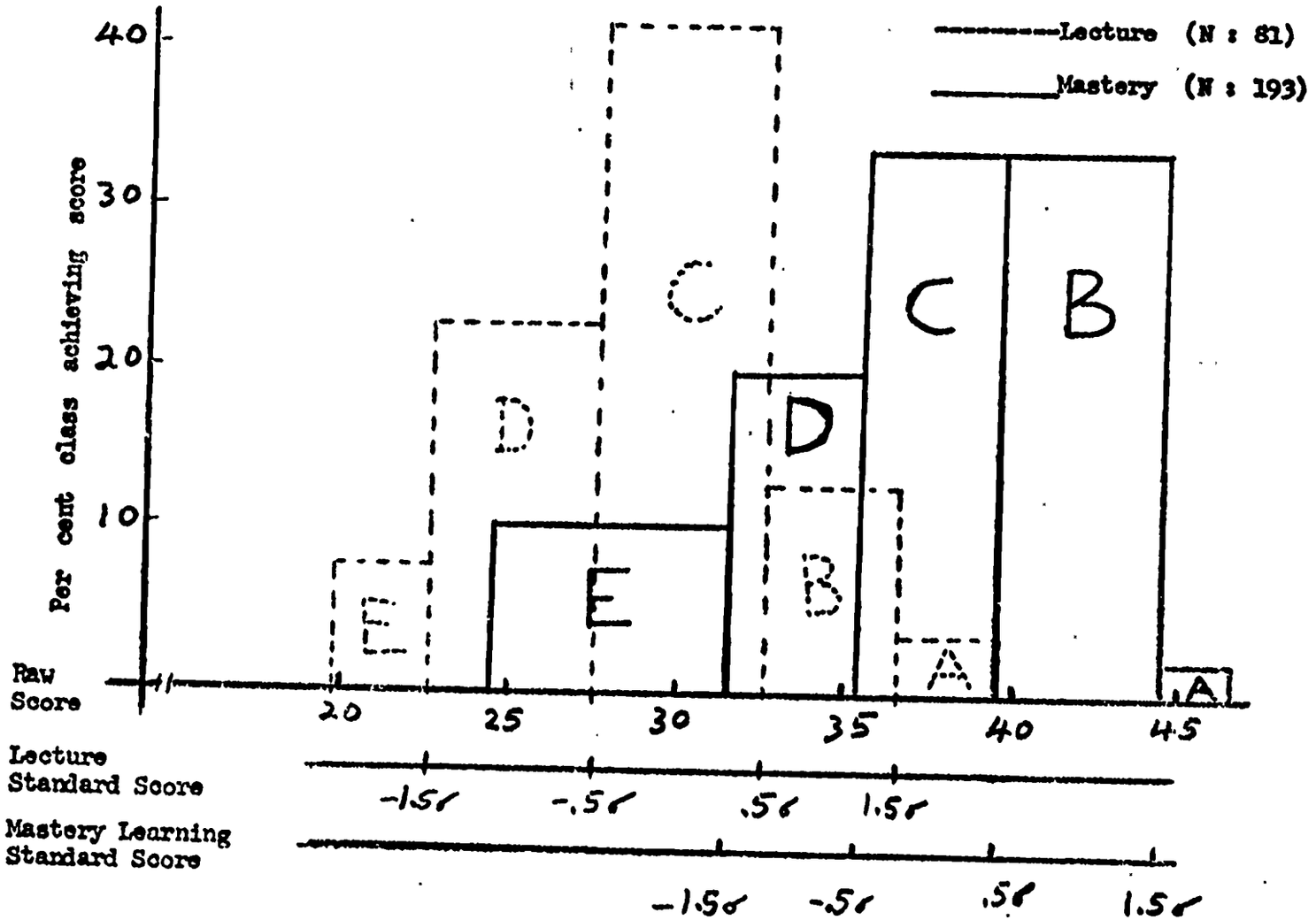

FIGURE 1

Figure 1. Histogram showing lecture and mastery learning post-test distributions by letter grades, March, 1972.

Note: Adjusted lecture mean : 29.8, standard deviation 4.335
Mastery learning mean : 37.7, standard deviation 4.243
Difference: t : 13.9
P less than .001