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ABSTRACT

This study investigated the cognitive and affective student learning outcomes of 36 semesters (equivalent to 18 years) using the mastery learning approach in high school distributive education classes (n=7,179 students). Student achievement in the cognitive area is reported by increasing grade point averages, and test scores are presented to show the consistent high level of academic achievement of students. Affective information (attitudes toward school and learning) has also been elicited from the entire sample and is presented to show positive changes. Additionally, more recent information regarding students' (n=843) learning styles and the use of those styles to facilitate learning is reported. This investigation provides information regarding the effectiveness of mastery learning in real world classroom experience. An appendix summarizes mastery learning and teaching strategy. (Contains four references.) (Author/SLD)

Mastery Learning in the Classroom

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ABSTRACT

This report investigates the cognitive and affective student learning outcomes of thirty-six semesters (18 years) using the mastery learning approach in high school distributive education classes (N=7,179). Student achievement in the cognitive area is reported by increasing grade point averages, and test scores are presented to show the consistent high level of academic achievement of students. Affective information (attitudes toward school and learning) has also been elicited from the entire sample and is presented to show positive changes. Additionally, more recent information regarding students' (N= 843) learning styles and the use of those styles to facilitate learning is reported.

This investigation provides information regarding the effectiveness of mastery learning in real world classroom experience.

Introduction

Everyone wants successful schools. Ideas of how to reach this goal range from implementing the newest technology to embracing traditional ways of learning and discipline, but none of these methods seem to alleviate the unfortunately common student experience of frustration and failure. Educators are inundated with miracle cures that promise gains in student productivity without altering their basic approach to teaching, but we know that dramatic improvement cannot come without dramatic change. If educators do not alter their approach to teaching, students cannot improve their learning. If what educators are doing does not work, then they must change what they are doing. Mastery learning is one positive change toward a new way of teaching and insuring student learning.

Research has shown that implementation of mastery learning techniques in the classroom can produce a significantly higher rate of success in all students than previously experienced. This report provides continuing evidence of the efficacy of mastery learning as in previous studies (Whiting, Render & Devoe, 1979; Whiting & Render, 1982).

The first report examined the notion that the implementation of a mastery learning approach to the teaching of distributive education (DE) would produce 80% successful learning as predicted by mastery learning researchers. Successful learning (achieving a grade of A) was accomplished by up to 97% of the students involved. The mastery learning experience however, was of limited time (one quarter), by an inexperienced teacher in a short term situation (student teaching) and included a limited sample size (N=53).

The second report (Whiting & Render, 1982) reviewed the cognitive and affective outcomes of nine semesters of a mastery learning approach with 1,279 students in DE classes. The study found successful learning (achieving a grade of A) occurring in up to 98% of the students involved. The successful learning occurred in all students regardless of previous learning success or failure. The 1,279 students had an average cumulative GPA of 2.41, but a 3.92 grade average in DE classes. Of the students involved, 98% expressed positive feelings about the effectiveness of their learning and desire to have other classes taught via mastery learning.

This report investigates the cognitive and affective student learning outcomes of 36 semesters using the mastery learning approach in DE classes (N=7,179). Helping students identify their learning styles (LS) (N=843) resulting in students becoming more efficient in their use of study time and lessening the need for remediation was also investigated and reported. The present report provides strong evidence that a mastery learning approach will result in at least 80% successful learning. This report adds reliability to the previous reports due to a much larger sample (N=7,179).

Procedure

The senior author (Bryan) involved in this program initially taught for six years at the 500-student Brush High School in Brush, Colorado. At that school he taught Consumer Business (CB), Business Law (BL), Economics (Econ), Distributive Education 1 (DE 1) , and Distributive Education 2 (DE 2). Bryan has since moved to the 550-student Glenwood Springs High School in Glenwood Springs, Colorado, where he established another Distributive Education program. At Glenwood

Springs he teaches Career Shadowing (CS), DE 1, DE 2, and Coop G. Bryan has used a Bloom/Block model of mastery learning for a total of 18 years. The data collected has been both extensive and consistent. The second author has used mastery learning at the junior high level and the third author has used mastery learning with university students, with comparable results.

Consumer Business and Career Shadowing are essentially the same one-semester sophomore course; Business Law and Economics are one-semester junior/senior courses; Coop G is a one-year junior course; and DE 2 is a one-year senior course. No prerequisites exist for entry into any of these courses and courses are therefore open to all students. All classes are elective, which may have a positive impact upon student success. Individual class size averages are BL=34, Econ=32, DE 1=29, DE 2=21, and Other=24, with a low of 11 and a high of 41. All these classes were taught via the mastery learning approach. The particular approach used is an individual variation of that first developed by Bloom (1968).

On the first day of class, to introduce the mastery learning approach, Bryan gives a handout to each student and spends the class period (one hour) reviewing it and answering questions in an attempt to insure the students' understanding of mastery learning concepts and procedures (see Appendix A).

Cognitive Outcomes

The following tables reflect the outcomes of 36 semesters of classes taught via the mastery learning approach.

Table A. Students' cumulative grade point average prior to entering the course and their grade point average in the class taught by mastery learning.

Class	N	Before Mastery Approach	After Mastery Approach
DECA 1	2,946	2.28	3.92
DECA 2	1,657	2.52	3.96
Bus. Law	486	2.61	3.94
Econ.	472	2.63	3.90
Other	1,618	2.08	3.88
Totals	7,179	X = 2.34 Overall GPA	X = 3.92 GPA in DE class

Before - Overall GPA
After - GPA in classes taught by mastery learning
Other includes: consumer Business, Career Shadowing, Coop G
Totals are weighted for N

Table B. Students' grade point average on summative examinations.

Class	N	Average Grade
DECA 1	2,946	96.9% / 3.87
DECA 2	1,657	98.8% / 3.95
Bus. Law	486	97.6% / 3.90
Econ.	472	97.5% / 3.90
Other	1,618	96.1% / 3.84
Totals	7,179	97.2% / 3.84

Table C. Percentage distribution of student course grades (rounded to nearest whole percent).

Class	N	%Achieving Grade of A	% Achieving Grade of B	% Achieving Grade of C	%Achieving Grade of F
DECA 1	2,946	97%	1%	1%	1%
DECA 2	1,657	98	1	0	1
Bus. Law	486	98	1	0	1
Econ.	472	96	2	0	2
Other	1,618	96	1	1	2
Totals	7,179	97 (N=6,963)	1 (N=72)	.5 (N=36)	1.5 (N=108)

Table D. Indicates that the teachers' choice of level of mastery has no effect on the grades the students receive.

	All Classes 90% = Mastery	N = 2014 95% = Mastery	N = 1238 100% = Mastery
% Achieving A	97%	97%	97%
Time Spent	X	X+11 min.	X+78 min.
Average Test Score	93.2%	97.1%	100%

A small additional investment of time is required to move from a 90% level of mastery to a 95% level. A large additional investment of time is required to move from 95% mastery to 100% mastery level. Obviously it is not a good use of 78 more minutes to move from the 95% mastery level to a 100% level considering that most students will remediate on their own. Also given limitations of teacher-made tests a 5% margin of error is certainly acceptable. Level of mastery has no effect on the grade the student receives. Students will work to achieve whatever mastery level the teacher designates.

Affective Outcomes

The non-overt indicator of affective satisfaction with mastery learning lies in the steady increase in and total number of students voluntarily enrolling in these courses. As is evidenced by the large average class size previously noted, students desired to achieve a successful learning experience. This large enrollment is especially noteworthy considering that in both schoo' the Distributive Education program did not exist prior to the arrival of Bryan and mastery learning. In addition, a large percentage of students take more than one class offered via this teaching metnod during their high school careers. This outcome also speaks well

for positive feelings being generated by participation in a mastery learning class. The following responses were to anonymous teacher/course evaluations completed by the students at the end of the courses.:

- 6,873 of 7,179 (97%) students rated their level of learning at 9 or 10 on a 10 point scale.
- 7,054 of 7,179 (98%) students would like other classes taught with mastery learning.
- 7,164 of 7,179 (99+%) felt they received the grade they deserved.
- 4,166 of 7,179 (58+%) indicated they attended this class the same amount of time as their other classes.
- 2,955 of 7,179 (41+%) indicated they attended this class more than other classes.
- 6,869 of 7,179 (97%) felt their knowledge of and success with mastery learning positively affected their learning in other classes.

Average overall GPA after Sophomore year before being exposed to mastery learning was 2.28.

Average post-Senior year cumulative GPA after being exposed to mastery learning at the beginning of their Junior year was 2.86.

Average Senior year only GPA after being exposed to mastery learning at the beginning of their Junior year was 3.42.

In response to the question, "What do you like best about mastery learning," the following are some representative responses:

- Why aren't all classes taught this way?

- I don't have to guess what to study.
- This is the first A I've ever gotten.
- It's easier to learn.
- I look forward to coming to this class.
- I don't cut this class.
- It makes me feel special.

Learning style (LS) experiments with assessment methods (N=843).

Effect on student test scores, during 1st test:

music played	listener LS +4%	non-listener LS-2%
if student hears test orally	listener LS +5%	non-listener LS-7%
if student sees test on computer, in color, with appropriate graphics	watcher LS +4%	non-watcher LS-6%
if student must repeatedly do some overt, physical act	doer LS +5%	non-doer LS-7%

The information above shows that a teacher can help or hinder performance on tests by providing the right or wrong environment as appropriate for the student's individual learning style. Level of change, positively or negatively varies. Level of change is more graphic in a negative fashion. Most doers already do some sort of physical act, even though they are not consciously aware of it, because they are doers and their brains are taking care of them. Environmental components as mentioned above should be included to improve students' performance during testing, but care should be taken that other students are not affected. For example,

doers should not be placed near watchers or the watchers will be distracted by the doers' continual movement.

Furthermore, data indicate that students, over time, become more efficient at learning. They learn more in less time. Regarding study time per unit, outside of class, in preparation for testing, the following was found:

Year 1	Unit 1-134 minutes	Unit 10-73 minutes	Unit 20-42 minutes
Year 2	Unit 1-71 minutes	Unit 10-38 minutes	Unit 20-31 minutes

The previous statement is further strengthened by monitering students' test retaking patterns as follows:

Percent retaking test at least once:

Year 1	Unit 1-62%	Unit 10-28%	Unit 20-17%
Year 2	Unit 1-23%	Unit 10- 8%	Unit 20- 8%

Students become better at learning, more aware of their learning styles, and expect to learn. Over time, mastery learning virtually eliminates the need for prescribed correctives. Prevention has occurred. The students do not require remediation, because they learn better. This allows more time for enrichment, more units, etc. After time, students do not need to retake a test because they did not learn the material, but rather because personal experiences (fighting with parents, working late, returning from basketball trip late, play practice, fighting with girlfriend/boyfriend) hindered their ability to concentrate on the test or make the test a priority.

This report continued to show that mastery learning does produce successful learning experiences for at least 80% of the students. These results accentuate the

fact that the mastery learning approach produced learning far in excess of the 80% success level. More importantly, the results support the concept that mastery learning will be effective in subjects other than those hierarchically organized. The students' success on the summative evaluation (final) which is a 50 question short-answer test that cannot be retaken, illustrates the high level of learning and retention that mastery learning produces. Student success on the final also shows that students are learning throughout the semester and are remediating unlearned material even though they may not have to retake a test. Given the fact that the student must get a 90% or better on every unit, not just a 90% average to receive an A, the students are achieving a high level of learning in all units, as opposed to high in some and low in others. The mastery techniques, when combined with students' familiarity with their own individual learning styles, gives them the tools to succeed in independent learning situations. Students who are aware of their learning styles know how they learn best. The combination of mastery learning and learning style awareness can release more time for enrichment activities, more units, and most importantly allows the teacher opportunity for one-to-one contact.

The grade averages mentioned were semester grades. Grade distributions for first quarter grades were slightly lower (3-6%), and then increased as the students gained confidence and became familiar with the system and teacher. It could also be argued that some grade average benefit may be derived from a smaller school situation.

Another positive affective comment worth noting is that the students take a great deal of pride in their accomplishments under mastery learning. One fellow

teacher reported that, when asked whether students learned a lot in Consumer Business, the students replied,"Of course, we had mastery learning."

Over the course of 36 semesters there have been numerous other indicators of the success of mastery learning. Distributive Education students involved in DECA have consistently not only qualified for, but placed high in DECA District, State and National competitions.

Clearly this report presents compelling information regarding the efficacy of mastery learning. Some could argue that these results are produced by a gifted teacher who would be successful with any method. That may be true, however, we are convinced that mastery learning can make an excellent teacher outstanding, and certainly any teacher more effective.

The use of mastery learning has negative aspects with which the teacher must deal. The investment of time is essential. It takes approximately 15 hours to write one complete unit and get it ready for use. Daily preparation is extensive whether it is preparing an entertaining presentation of the objectives, organizing an activity or grading 150 short answer tests in one night. The writing of higher level cognitive objectives and appropriate test questions is very difficult. Some teachers will not understand mastery learning nor its success and will question the method. Teachers employing mastery learning must be prepared to justify their students' high level of achievement to administrators, other teachers and parents. Many feel that only students with previously demonstrated high aptitudes are capable of learning and consequently only a small percentage of students either should or can

receive an A. Some students expect to fail and it is difficult to fight through this barrier that has been developed and reinforced for many years. One's success with mastery learning may make one less tolerant of poor educators, because it becomes clear that all students, who choose to, can learn if taught in a manner consistent with the way they learn.

There are a number of items that may help a teacher who has decided to implement mastery learning deal with problems and make the transition to mastery learning more successful. It may be desirable to implement mastery learning in one or two subject areas per year because of the time involved. A mastery learning teacher must sincerely believe that all students can and will learn! Every student can be reached if teachers are only smart enough to find the correct way. If teachers allow themselves to believe that some students are not capable of learning, then it becomes too easy for teachers to dismiss a student's failure, and teachers may not try as hard as they should to determine that student's individual learning needs. Teachers implementing mastery learning must expect to succeed. They must not succumb to the temptation to feel a sense of satisfaction when they give a test that many of their students fail. When a student says a course is hard, it is not a compliment. It means that the teacher has not done a very good job of teaching and presenting the material to that particular student. Efficient and successful learning will not seem difficult to the student.

There are many advantages to mastery learning even beyond the 80% success rate that is not only possible but is documented. A teacher will receive tremendous backing and support of students. A concern about adequate enrollment will be

replaced with attempting to get more desks into the room. It is truly uplifting to see such learning success in all students, especially those who have not experienced that feeling before. It is an eye-opening revelation to realize that all students can learn. Potential for students becomes unlimited. Mastery learning teachers develop a great confidence in their own ability, possess very positive self worth and feel good about what they are doing. Because the mastery learning teacher relates achievement directly to the specific student learning objectives, being accountable for grades given or documentation of student learning ceases to become a concern. This is especially true given the students' success on the not-retakable final, summative examination.

This report reinforces the concept that all can and will learn if students know what they are expected to learn, are taught in the learning style best suited to them, are given the individualized correctives needed to alleviate previous learning failures or errors, and are given the opportunitiy to take another test over the same objectives. It seems tragic in a society that cries out for greater achievement on the part of students that mastery learning is used so rarely. If educators want to create high levels of learning in all students, they can feel secure that methods to facilitate growth and learning are available. Educators must believe that all can and will learn, they must believe in their own abilities, and when learning does not approach the optimal, educators must look first at themselves and their methods before they assume that some students cannot be successful.

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APPENDIX A

MASTERY LEARNING/TEACHING STRATEGY

1. The material will be presented in units.

2. For each unit, specific learning objectives will be written by the teacher and given to the students. These objectives are what is important to be learned in that unit.

3. For each unit, certain teacher activities and student activities will be used to present material appropriate to that unit's objectives. These objectives will help the student learn the objectives.

4. Mastery of objectives will be the goal.

5. Mastery will be determined by the taking and passing (95%) of a formative examination (unit test) on the objectives.

6. The formative examination will be taken from the objectives. Each item on the formative examination can be directly related to a particular objective.

7. Material appropriate to each unit will be presented to the student in each of the four basic **learning styles**. Everyone will learn something from each learning style, but each student will have one primary learning style by which they will be able to learn the quickest and the most completely. The four basic learning styles are:

a - **Readers** - those who learn best by reading (9%);
b - **Listeners** - those who learn best by listening (14%);
c - **Doers** - those who learn best by doing (38%);
d - **Watchers** - those who learn best by watching (29%).

The following learning style variations are also possible:

a - Combinations - people may be a significant combination of two learning styles (10%). Over 90% of those who learn best in combination have listening as one part of the combination;

b - **Subject matter specific learning styles** - it is very possible for people to be one learning style when learning one type of thing and another learning style when learning another type of thing. For example, a person may be a doer for everything except he/she is a reader when dealing with numbers. A person may be a listener for everything except he/she is a watcher when dealing with a physical skill (21%).

c - **Location specific learning styles** - It is very possible for people to be one learning style when learning in one location and another learning style when learning in another location. A reader inside and a doer outside, a watcher at home

and a listener at work (3%).

d - **Specific presence inspired learning** - it is very possible for people to be any of the four basic learning styles, but additionally require the presence of one specific thing to both accelerate and cement that learning for the long term. Examples would include:

1. **Personality specific** - the person learns best if their learning is directed by one specific person or type of personality (23%);
2. **Creativity - Innovation specific** - the person learns best if she/he is allowed to be creative and generate an innovation that is applicable to what is being learned (41%);
3. **Example specific** - the person learns best if he/she is given an actual example that is applicable to what is being learned (41%);
4. **You specific** - the person learns best if she/he is given an "if you" situation that is applicable to what is being learned (11%).

8. Each of the activities that occur in any given day, is structured toward one of the different learning styles, so that the student will, eventually, be exposed to the objectives in each one of the four learning styles. This is done in the following manner:

Procedure 1 - Specific learning objectives and objective fulfillment will be handed out to the students (READERS). The teacher will go over, orally, each of the objectives (LISTENERS). The teacher will not just repeat what is found in the objective fulfillment, but will present the same material in different words. The teacher will tell the student of the pages in the textbook that are appropriate to these objectives (READERS). In the course of orally going over the objectives the teacher may put items on the board or demonstrate (WATCHERS). The teacher will also use real life examples in this presentation (WATCHERS). At this time, students may also take notes, tap a finger or other physically associated activity (DOERS).

Procedure 2 - Specific activities designed by the teacher to help the student learn the objectives will be done by the student (DOERS & WATCHERS). These activities will be made as physically oriented as is feasible.

Procedure 3 - The students will take the formative examination over the objectives of that unit, to determine what objectives the student does and does not know. Mastery or non-mastery will be determined when the teacher grades the test.

Procedure 4 - The students will be given back the test. The students who achieved mastery (95%) will do specific activities designed to allow the student to use the objectives. These enrichment activities allow the students to expand, use and reinforce their knowledge of the objectives. These activities are designed to enhance retention of the material and higher level learning.

The students who failed to achieve mastery will identify the non-learned objectives by relating the missed test question to the objective key that the teacher will put on the board. The student will then relearn these objectives by whatever method is appropriate, given his/her particular learning style. The teacher will make one-to-one contact with each student.

Procedure 5 - Mastery students will continue with specific enrichment

activities designed to allow the students to use the objectives. Mastery or non-mastery will again be determined.

9. This cycle will be repeated each unit.

10. You may retake the formative examination for each unit, without limit and without penalty, until mastery is achieved.

11. The deadline for retakes is the last day of each six-week grading period.

12. The first formative examination for each unit will always be offered in class. If the student requires additional retakes or misses this test time, the retake must be taken on the student's own time on specified retake days and times.

13. An individual Mastery Learning Unit Record of Level of Learning will be given to the student, upon which the student can record their examination scores. This will enable the student to see at any time how he/she is progressing toward a particular grade. The student must keep all her/his tests and see that his/her individual scores are recorded on the computer and signed for by the teacher in her/his individual learning record in his/her objective book. At the end of each semester the student will turn in all her/his tests and claim her/his grade. The student must have a test for each unit, if credit is to be received. Any test lost must be retaken. This is your responsibility.

14 . The semester grading procedure will be as follows:

To obtain a grade of C - all units must be mastered at a level of 75% or better.
To obtain a grade of B - all units must be mastered at a level of 85% or better.
To obtain a grade of A - all units must be mastered at a level of 95% or better.

It should be noted that these grades are minimums for all units and are not an average. All tests must be above 95% to get an A, for example.

15. A semester final will be given at the end of each semester. This final examination can either lower, maintain or raise the semester grade you have already earned. A score of 75 - 94% on the final will maintain your grade. A score of 95% or higher on the final will raise your grade one level. A score of 74% or lower on the final will lower your semester grade one level. A score of 100% on the final will assure the student of a grade of A, regardless of his/her previous level of performance on the unit examinations. The final will be taken directly from all the objectives covered during the semester. A retake of the final will not be available. It should be remembered that the average score on the final exam is higher than the average score on a unit formative examination. One of the positive points of mastery learning is that it facilitates a high level of long term retention.

16. You will be graded solely on what you do in regard to the objectives and the grading procedure. You will not be graded in competition with other students or

via some subjective criteria of the teacher's. It is not only possible for everyone to get an A, it is our responsibility to assure that everyone does by following Mastery Learning procedure.

17. You are encouraged to make comments about the course at any time. This is in regard to both the manner taught and the subject matter. Make a contribution. This is your course.

18. I will try and be available all day. This is not limited to class time. I am a teacher all day, every day.

19. I believe that everyone can learn and I will work as hard as you to achieve that end.

20. There is very little assigned homework. You and I both know what you need to learn: the objectives. It is our job to see that you learn those in whatever manner is most efficient for you. If you need to read the book to learn, for example, you do not need me to tell you to read the book. I am not concerned about how you learn, or the manner in which you learn, but rather that you do learn. You need to determine the specific procedures that activate your individual learning process (learning style)and then do them; no more, no less. Doing this will guarantee that you do indeed learn all you need to learn (the objectives).

21. Open discussion is urged and promoted. You need not raise your hand to speak as long as your comments are toward our current topic and not disturbing to others.

22. You need not have specific permission to leave the classroom, but only one person may leave the classroom at a time and you must sign out.

Classroom Rules

1 - This class will be run on an adult level.

Sources of Learning for Different Learning Styles

One of the reasons that Mastery Learning works is that the student is not limited to trying to learn the material in one manner. Learning can come from many sources:

Read objective fulfillment sheets
Read appropriate pages in textbooks
Read your notes
Read other student's notes
Listen to comments made in class by other students
Listen to information presented in class by teacher
Listen to objective fulfillments as read by fellow students, parents, siblings, friends
Listen to objective fulfillments as reread outloud by yourself
Listen to notes as reread outloud by yourself
Listen to notes as reread outloud by fellow students, parents, siblings, friends
Listen to a tape of what was said in class
Listen to an explanation by a fellow student
Listen to a fellow student answer your question
Listen to a teacher answer your question
Listen to videos presented in class
Listen to a real-life example provided in class
Do take notes in class
Do underline the objective fulfillment
Do underline the texts
Do type or rewrite your notes
Do type or rewrite the objective fulfillment
Do underline the texts
Do type or rewrite your notes
Do type or rewrite the objective fulfillments
Do questions at the end of the chapters
Do appropriate problems
Do workbooks
Do student hands-on activities throughout the week
Do work with actual items handed out in class
Do draw pictures that are representative of concepts (objectives)
Do tap your finger, touch your glasses, tap a foot, pace or other physical activity while doing any of the above, if you are a doer
Watch student hands-on activities throughout the week
Watch items put on board
Watch videos presented in class
Watch an image in your own mind of a real-life example provided in class
Watch an image in your own mind that represents a specific objective

Watch others working with actual items handed out in class
Watch pictures you drew that are representative of concepts (objectives)
Watch pictures in text
Develop a creative and/or innovative application of the objectives
Apply the objective to yourself
Develop a decision making situation, regarding the objectives, that is relevant to you
Use the formative examinations, themselves, to determine what you do and don't know
Use teacher at any time

Again, you should experiment and not only find the way you learn the best, but also, the specific learning methods within that learning style that are most effective for you. To be most efficient and make your learning as complete as possible, in the minimum amount of time, you must also, in effect, fine-tune your individual learning style. We will spend additional time in class, throughout the year, not only determining your learning style, but also fine tuning it in all aspects. All students will not learn the best in the same manner, but everyone can learn if they find their correct learning style and fine-tune it. Taken to this extent, learning will virtually become instantaneous, especially when compared to the students' learning rate and retention prior to their experience with Mastery Learning.