THE RELATIONSHIP OF *MYMATHLAB* TO THE ACHIEVEMENT OF MATHEMATICS I STUDENTS AT MARION TECHNICAL COLLEGE

ABSTRACT OF APPLIED PROJECT

An applied project submitted in partial fulfillment
of the requirements for the degree of
Education Specialist at Morehead State University

by

Teresa Plummer

Committee Chairperson: Dr. Lola Aagaard

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Morehead, Kentucky

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Director of Applied Project: Lola Aagaard

The purpose of this study was to investigate the effect of *MyMathLab* on the achievement of Mathematics I students at Marion Technical College. Using the final exam for the Mathematics I class as the measuring instrument, student performance was measured. Data were collected from winter quarter 2005 through fall quarter 2007. The results suggest that test scores were significantly improved in three of five sections of the final exam for students using *MyMathLab*.

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APPLIED PROJECT

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Graduate School

Morehead State University

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Accepted by the graduate faculty of the College of Education,

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Education Specialist Degree in Adult and Higher Education

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Date

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Introduction

During fall quarter 2006, *MyMathLab*, a computer-based learning and testing tool, was implemented into Mathematics I (MH101) at Marion Technical College (MTC). The MTC catalog describes this course as the following:

"This is a course in beginning college algebra. Course content includes a review of real numbers, equations in one and two variables, graphs and functions, exponents, polynomials, and factoring polynomials. MH 101 is designed to provide an introduction to college algebra for students in all areas of study. Emphasis is given to solving applied application problems from the different curricula. 4 credit hours" (MTC Catalog, 2006, p. 116).

MyMathLab is an online tutorial that allows students to work through exercises which correspond to the textbook. Personalized study plans are created by instructors to give students practice in specific subject areas. *MyMathLab* allows instructors to customize study plans so that students can work through an unlimited number of practice exercises. *MyMathLab* automatically grades students' assignments and reports the results to an online grade book. This allows instructors to evaluate student progress at a glance so that problem areas can be addressed quickly and efficiently (Pearson Education, 2006).

With the addition of *MyMathLab* in the MH101 class, teaching methods were changed. Prior to the implementation of *MyMathLab,* classes consisted of two 110 minute lectures each week. In this more traditional classroom, all of the course information was presented to students through lectures. The computer-based version of the class using *MyMathLab* has only 50 minutes of lecture each day or

100 minutes each week. Students use the remaining class time, 120 minutes each week, to work on *MyMathLab* exercises.

Statement of the Problem

Pearson Education, Inc., the creator of *MyMathLab*, publishes reports on its web site indicating that the product has had a positive effect on both student retention and student success in courses using *MyMathLab*. However, these data do not yet appear in scholarly journals, so this project will question whether *MyMathLab* positively relates to student performance when used in MH101.

The research conducted in this applied project differs from existing published information. Prior research has focused only on student retention and overall student success (as defined by final grades) in *MyMathLab* courses. This applied research project will examine whether a positive relationship exists between the use of *MyMathLab* and student performances in five specific areas. Those skill areas include:

1. Solve problems using basic mathematical operations.
2. Use a calculator or computer to perform mathematical calculations.
3. Solve algebraic equations.
4. Create and interpret tables, graphs, and charts.
5. Demonstrate knowledge of basic statistical concepts. (General Education Overview Documents, 2007).

Because of Marion Technical College's ongoing commitment to assessment, data have been collected in all five skill set areas since 2005. Data were collected from the entire population of students enrolled in MH101 beginning winter quarter 2005 and ending fall quarter 2007; sampling did not occur. Therefore, the data are reflective of the parameters of the population. Independent t-tests will be used to determine whether the means of two data groups are statistically different. In 2004 and 2005, MH101 did not utilize a *MyMathLab* component. Beginning in 2006, all MH101 courses began using *MyMathLab*. This study will analyze the data from the 2004 and 2005 academic years as reflective of student performance in classes not using *MyMathLab*. Data from 2006 and 2007 will be used for student performance in those skill areas using *MyMathLab*.

Review of Related Literature

Technology is becoming increasingly available to today's students and is greatly affecting the delivery of education. Entire degrees can now be earned online, and most colleges provide students with computer labs. As technology grows, our dependence on it is deepening, but we cannot help but wonder whether all of these changes are positively affecting education.

From the invention of the abacus, students have sought tools to help them solve mathematical equations. Calculators and computers are now utilized in many mathematics classrooms. Even the National Council of Teachers of Mathematics supports the use of technology in the classroom. "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning (National Council of Teachers of Mathematics, 2000).

Introduced in 2001, *MyMathLab* "is an innovative series of text-specific online courses that accompany Pearson Addison-Wesley and Pearson Prentice Hall textbooks in mathematics and statistics" (Pearson Education, Inc., 2006, para. 1). The *MyMathLab* web site boasts that more than 3 million students have been helped with *MyMathLab*. Statistics from approximately 20 colleges are posted, all of which reflect *MyMathLab*'s positive impact (Pearson Education, Inc., 2006). Although *MyMathLab* has a seemingly positive influence, copies of the studies themselves are not available in any of the information posted by Pearson. Attempts to access this information have been unsuccessful.

Many studies have been conducted on the success of technology in the classroom. These studies are varied and include qualitative, quantitative, and a combination of data. The qualitative research often focuses on attitudes toward the use of technology, and most of the quantitative research has focused on elementary school children's results on standardized tests. Very few studies appear to have been conducted involving high school and college students (Klein, 2005).

As James Kulik discusses, computer tutorials are frequently used in the classroom. On the surface, these computer tutorials – or computer assisted instruction – work in the same way as a tutor, but critics believe that computer assisted instruction can be detrimental to student learning because it encourages mechanical learning which decreases student motivation (Kulik, 2003).

In 1991, Kulik published a summary of 37 studies which compared student performance at the college level. These studies were cross-disciplinary and included a wide variety of computer assisted tutorials or computer assisted simulations. In 26 of the studies, students using computer assisted technology performed better than those who did not use the technology; however, the effect was too small to be considered significant. The results from the other 11 groups reflect higher scores from students not using computer assisted technology (Kulik, 2003).

The effects of computer assisted instruction on adult learners in an algebra class were assessed by Oxford, Proctor, and Slate in 1998. Complete classes were studied with some classes assigned to the control group with the remaining classes assigned to the experimental group. The experimental group received computer assisted instruction through the PLATO system. The control group students were taught using traditional methods, and both groups were tested using the same pretest and posttest. A comparison of test scores suggests that the students enrolled in the class with computer assisted instruction had statistically greater improvement (Oxford, Proctor, & Slate, 1998).

A 2005 study by Hagerty and Smith explored the effectiveness of using online learning in a college-level math class. The study compared four classes using online learning with four classes taught using traditional methods. Students using online learning worked at their own speed. The online portion of this course used computerized exercises to replace more traditional assignments, even though the students still attended class and were taught face-to-face by an instructor. The results of the study suggest that students using online learning performed better than those students in the traditional classroom. However, one experimental group using online learning did not outperform the traditional class, and the authors attribute this to the demographics of that class which consisted of non-traditional students who were employed on a full-time basis and had families. The older students found it difficult to find the time to complete the computer assignments, so that section of students was not required to use the online training until later in the year. As a result, students were permitted to use text-based curriculum, and some selected this option. The study also found that students using online learning retained the information longer (Hagerty & Smith, 2005).

A 2007 study at Fayetteville State University compared success rates of students enrolled in two sections of MATH 123 (College Algebra). The study hypothesized that students completing homework using *MyMathLab* would score better on exams. Seventy-two students participated in the study in which 34 students completed homework using *MyMathLab* and 38 students completed homework assignments using more traditional types of assignments. Students completing homework using *MyMathLab* scored an average of 73.7% on exams, while students completing other types of assignments scored an average of 67.4%. The difference in the averages was not statistically significant, however, so it cannot be concluded that students' achievement in the course was better having used *MyMathLab* (Kodippili & Senaratne, 2008).

In 2005, a semester-long study on the effects of *MyMathLab* was conducted at Texas Tech University. Fifty-nine students participated in the study of a College Algebra class. Thirty of the students were enrolled in the traditional course, and twenty-nine students completed the course using a *MyMathLab* component. The final exam scores for the two classes were compared and the results suggest that there was no significant difference between the two class averages. Therefore, there was no indication that students performed better after completing exercises from *MyMathLab* (Klein, 2005).

Statement of the Hypothesis

The use of technology in the mathematics classroom is growing. Although some research exists on the effects of using *MyMathLab*, very little scholarly research has been published. This study hypothesized that students using *MyMathLab* in Mathematics I (MH 101) at Marion Technical College would demonstrate higher achievement in skill set areas than students completing the course prior to the introduction of *MyMathLab*.

Method

Participants

The participants for this study were taken from the total population of students enrolled at Marion Technical College in Mathematics I from Fall Quarter 2005 to Winter Quarter 2007. The student population at MTC is 93% Caucasian and 7% minority, 64% female, and 36% male (Marion Technical College Self Study, 2007). Mathematics I is not a required course for all students, and no direct demographic information exists for the population of students enrolled in each section of the course.

Instrument

The final exam for Mathematics I was used as the measuring instrument. This test was designed to measure student performance in the course. This instructor-designed examination consists of five parts. The first part of the test consists of eight basic mathematics questions which require students to solve problems using basic mathematical operations. In this part of the exam, students solve problems and give answers in the form of integers or fractions. All fractions must be reduced to lowest terms. The second portion of the exam requires students to use a calculator. It consists of eight questions in which students solve problems with the assistance of a scientific calculator. Part three of the examination requires students to solve algebraic equations and consists of 14 questions. Each question asks students to provide an answer to an open-ended question. The fourth part of the exam involves graphing and interpreting tables and charts. There are eight open-ended questions in this section. The final section of the exam asks students to demonstrate knowledge of basic statistical operations. There are also eight open-ended questions in this section. During the study period, the questions on the exam were not changed and all students took the same test. Furthermore, the same instructors consistently taught the course. This applied research project provides an analysis of specific skill sets within the Math 101 classroom at Marion Technical College and statistical data regarding student performance in five specific areas. Those skill areas are reflected in the five sections of the final exam and include:

1. Solve problems using basic mathematical operations.
2. Use a calculator or computer to perform mathematical calculations.
3. Solve algebraic equations.
4. Create and interpret tables, graphs, and charts.
5. Demonstrate knowledge of basic statistical concepts.

Experimental Design

Data were collected beginning winter quarter 2005 and ending fall quarter 2007. All students completing the final exam for MH101 were included in the study. Five quarters of data (winter quarter 2005 through spring quarter 2006) reflect student scores prior to the implementation of *MyMathLab*. A total of 222 subjects' scores pre-*MyMathLab* were assessed. Scores beginning in fall quarter 2006 and going through fall quarter 2007 reflect students' scores after the implementation of *MyMathLab*. Only 90 subjects' scores were assessed after the implementation of *MyMathLab*.

Results

Because of the large disparity in group sizes, Welch's t-test for samples having unequal variances was used to analyze the MH101 final exam data. Table 1 is a summary of the analysis results. Mean scores for students using *MyMathLab* were higher in every skill area. The Bonferroni adjustment of an overall experimental alpha of 0.05 for five t-tests resulted in a pre-test alpha of 0.01. If the p-value of a particular t-test was greater than 0.01, the test was considered non-significant.

Table 1
Means, Standard Deviations, p-value, and t-test Results for the Five Skill Areas

Skill Area		n	Mean	St.Dev.	df	p-value	t
Solve problems using basic mathematical operations.	Pre-*MyMathLab*	222	86	1.41	217	.0028	9.1273
	Post-*MyMathLab*	90	95.5	.58			
Use a calculator or computer to perform math calculations.	Pre-*MyMathLab*	222	78.8	4.09	259	.0146	5.0920
	Post-*MyMathLab*	90	90	.82			
Solve algebraic Equations.	Pre-*MyMathLab*	222	77.4	1.52	99	.0076	6.4254
	Post-*MyMathLab*	90	85.75	1.89			
Create and interpret tables, graphs, and charts.	Pre-*MyMathLab*	222	73.6	1.34	121	.0006	15.6667
	Post-*MyMathLab*	90	85.5	2.08			
Demonstrate knowledge of basic statistical concepts.	Pre-*MyMathLab*	222	66.2	9.88	227	.0116	5.5340
	Post-*MyMathLab*	90	94	.82			

The mean scores of students using *MyMathLab* to solve problems using basic mathematical operations increased to 95.5% from 86%. A p-value of .0028 suggests that the improvement in student scores was related to the use of *MyMathLab.*

When tested on using a calculator or computer to perform math calculations, students' mean scores increased to 90% from 78.8%. A p-value of .0146 for this skill set was not significant when compared to the Bonferroni-adjusted alpha of 0.01.

The third skill set, solving algebraic equations, reflects an increase in mean scores of students to 85.75% from 74.4%. The p-value of 0.0076 also suggests a positive relationship to *MyMathLab.*

The mean scores of students using *MyMathLab* to create and interpret tables, graphs, and charts increased to 85.5% from 73.6%. A p-value of .0006 is considered statistically significant and suggests that there is a positive relationship in this area between student performance and *MyMathLab.*

Students tested on their ability to demonstrate knowledge of basic statistical concepts showed an increased mean score of 94% from 66.2%. Although this was a large difference, the t-test was not significant at the Bonferroni-adjusted alpha of 0.01.

Limitations of Study

The most significant limitation to the internal validity of this study was the lack of any specific demographic information. As a result, there is no way of knowing if one population is affected differently than another population when using

MyMathLab. It is also impossible to determine whether the pre-*MyMathLab* group and the post *MyMathLab* group were demographically similar.

Another limitation of the study was that the number of student hours devoted to studying with or without *MyMathLab* was not tracked. The data could be skewed because students in one group devoted more time to studying.

A third limitation is that instructor familiarity with the program was not monitored. As instructors became more familiar with *MyMathLab*, their teaching styles may have been affected. In turn, this could affect the results. Many of the instructors involved in the study taught the course before and after the addition of *MyMathLab.*

A fourth limitation is that instructors were not identified. Instructor ability and style could certainly affect student performance.

Finally, the size of the groups studied was quite different. There were 222 subjects included in the group that did not use *MyMathLab* but only 90 subjects using *MyMathLab* were studied. Although five quarters of data were available pre-*MyMathLab* as compared with four quarters of data post-*MyMathLab*, far fewer students appear to be taking the exam after the implementation of *MyMathLab*. This creates many new research questions regarding students' attitudes toward the product. It also suggests the possibility that fewer students are successfully completing the course. Further research needs to be conducted to study the reasons that students are not completing the course.

External validity of this research is also in question. Marion Technical College is a small, rural, two-year institution in Ohio. It is questionable whether subjects in this research will reflect other populations, especially since no demographic data were collected. Furthermore, student and instructor attitudes were not measured as part of this study and may have affected performance. Therefore, the results of this study should not be generalized to larger populations.

Conclusions

The original hypothesis of this study was supported: Marion Technical College students using *MyMathLab* in Mathematics I (MH 101) demonstrated higher achievement in skill set areas than students completing the course prior to the introduction of *MyMathLab.* Because the increase in test scores was significantly different in three of the five sections of the final exam and in the predicted direction in the other two sections, the use of *MyMathLab* was positively related to student performance in all five skill set areas. However, due to the limitations of this study, unknown factors may have contributed to the improvement. Future research needs to be conducted to solidify these findings. Future studies that identify demographic groups and resolve questions of validity need to be done to replicate the results of this study.

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Appendix A

Summary of Raw Data

Solve problems using basic mathematical operations.

	Average	Sample Size
Winter 2005	88	44
Spring 2005	86	48
Fall 2005	86	57
Winter 2006	84	25
Spring 2006	86	48
Fall 2006	95	26
Winter 2007	96	21
Spring 2007	95	21
Fall 2007	96	22

Use a calculator or computer to perform mathematical calculations.

	Average	Sample Size
Winter 2005	84	44
Spring 2005	78	48
Fall 2005	81	57
Winter 2006	73	25
Spring 2006	78	48
Fall 2006	91	26
Winter 2007	89	21
Spring 2007	90	21
Fall 2007	90	22

Solve algebraic equations.

	Average	Sample Size
Winter 2005	79	44
Spring 2005	78	48
Fall 2005	77	57
Winter 2006	75	25
Spring 2006	78	48
Fall 2006	87	26

Winter 2007	83	21
Spring 2007	87	21
Fall 2007	86	22

Create and interpret tables, graphs, and charts.

	Average	Sample Size
Winter 2005	75	44
Spring 2005	73	48
Fall 2005	75	57
Winter 2006	72	25
Spring 2006	73	48
Fall 2006	88	26
Winter 2007	83	21
Spring 2007	86	21
Fall 2007	85	22

Demonstrate knowledge of basic statistical concepts.

	Average	Sample Size
Winter 2005	65	44
Spring 2005	75	48
Fall 2005	68	57
Winter 2006	50	25
Spring 2006	73	48
Fall 2006	95	26
Winter 2007	94	21
Spring 2007	93	21
Fall 2007	94	22