

EFFECTIVENESS OF AN ONLINE HOMEWORK SYSTEM IN A
CAREER COLLEGE MATHEMATICS CLASS

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By
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CERTIFICATION OF APPROVAL

EFFECTIVENESS OF AN ONLINE HOMEWORK SYSTEM IN A CAREER
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DEDICATION

This is dedicated to Olivia and Gian. Don't ever give up on your goals.

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Thank you Dr. Dawn Poole for your support and guidance. It was with your infinite patience and instruction that I managed to write this paper. Also, thank you to my mom and my colleagues at San Joaquin Valley College for the helpful feedback when I needed it.

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ABSTRACT

This study investigated the impact the online homework system MyLabsPlus (MLP) had on student success in Introductory Algebra at a career college. Seventy-four students from five classrooms at the same campus participated in this study. The participants' beginning mathematics skills were assessed upon admission to the college. The results of the pre-assessment, grades and attendance were recorded for five Introductory Algebra classes. These classes were taught by four different instructors. Results demonstrated no statistical difference in final course grades between students using MLP homework and students using textbook homework even when controlling for beginning mathematics skills and attendance. Discussions of why MLP was not more effective and recommendations for further research are included.

CHAPTER I

INTRODUCTION

Thriving in modern society of the United States is becoming more challenging all of the time. Nowadays a college education is much more necessary to obtain a solid career (National Center for Public Policy and Higher Education, 1998). The result of this is that colleges are growing in numbers (Gonzalez, 2009). The number of high school students who enroll in college after graduation is growing. The percentage of 18 to 24 year-olds enrolled in a post-secondary institution rose from 35% in 2000 to 41% in 2010 (National Center for Education Statistics, 2012). During the recent recession, many adults who were displaced from the workforce returned to college to gain skills for a new job. However, it is estimated that more than 42 million Americans ages 18 to 64 who do not hold a postsecondary degree would need classes to improve their mathematics, reading and writing skills before pursuing a degree (National Conference of State Legislatures, 2013).

The options for how one earns a higher education are growing. There are not only the traditional two and four year institutions, but there are also career colleges. The goal of a career college is to help students discover and prepare for a career that suits their skills, values, interests, and personality. Many people aren't able to pursue a traditional college degree and prefer the fast, hands-on approach of a specific technical program. Additionally, career colleges are connected to local employers and offer job placement assistance (San Joaquin Valley College, 2013).

Whichever type of institution is chosen, students must be successful in proving they are knowledgeable in mathematics and English. Regrettably many students must enroll in remedial courses as a result of their performance on placement tests. The intention of remedial courses is to teach students the skills that they did not master in secondary school. Remedial courses are used to refresh and reteach the basics in a subject such as math or English. Unfortunately, completion of remedial courses does not earn college credit. This detour from college-level courses can be detrimental to one's success in college. According to the National Conference of State Legislatures (2013), less than 50% of remedial students complete their remedial courses. Additionally, remedial students are more likely to drop out of college. Less than 25% of students placed in remedial classes earn an associate degree or certificate within eight years. When looking at successful completion of bachelor's degrees, the outlook is similar. Only 27% of students initially enrolled in remedial mathematics earn a bachelor's degree (National Conference of State Legislatures, 2013).

Student success and achievement rates are below optimum levels in mathematics courses. According to the National Center for Public Policy and Higher Education (2010), nearly 60% of first-year college students discover that, despite being fully eligible to attend college, they are not academically ready for postsecondary studies. An overwhelming percentage of students are placed in remedial mathematics upon enrollment into a nonselective community college (California Community College Chancellor's Office, 2012). Remedial mathematics

is a road block for many students, with many ending their college experience without advancing from noncredit developmental classes. Remedial mathematics has become one of the largest barriers to student advancement (California Community College Chancellor's Office, 2012). Research conducted by the Academic Senate for Community Colleges (2010) has found that successful college completion in the US is falling and it is falling faster in California than in the rest of the country. Large numbers of students are placed in remediation, but never successfully transition to college level work. This is in part due to the fact that an effective remediation practice has not been adopted and implemented on a large scale.

Although many students are placed in remediation classes upon the start of their college career, there are new technologies available to assist students with learning mathematics. Enrolling in a traditional course is no longer the only option for fulfilling requirements. Many computer based programs are available to provide homework help and differentiated instruction. Students can click on a button and see a video of how to solve a type of problem or fill in the blanks as they are given step by step instructions. Some institutions now offer open entry/open exit classes for students needing remediation. These courses allow flexibility and provide self-paced instruction with guidance from instructors. There are also a variety of combinations of the previously mentioned options.

Statement of Problem

A post-secondary education is being sought out more and more. A number of students choose career colleges instead of traditional community colleges. There are a number of well-known and accredited career colleges: Heald, Kaplan and the University of Phoenix to name a few. There is also San Joaquin Valley College (SJVC), which encompasses 12 campuses across California and an online branch (San Joaquin Valley College, 2013).

SJVC is a career college that offers accelerated classes. SJVC has a very diverse student population and approximately 67% of the students are female. The majority of students are first generation college students and many are single parents (San Joaquin Valley College, 2010).

Many different two-year degrees are offered at SJVC, and all degrees require that students demonstrate knowledge in mathematics. Some students who are strong in mathematics may test out of these classes, but most are enrolled in a remedial algebra course. This course is broken up into two, five week classes.

Instructors have a choice between teaching these classes using traditional textbook homework or an online homework system called MyLabsPlus (MLP). Unlike traditional textbook assignments, MLP provides students with instant feedback on whether or not they answered the question correctly, allows students to attempt the same type of problem multiple times and also provides interactive examples to help students on problems with which they are struggling.

When using MLP, instructors can log onto the program and quickly see how students are progressing with the assignment and see which problems are missed. If a particular problem is frequently missed, the instructor can determine whether that topic needs to be given more instruction or if students simply need a little clarification. Since all classes are held in a computer lab, further explanation can occur before students are dismissed for the day.

At the end of each five week session, data are collected and analyzed to determine how successful a student was. Students' grades, attendance rates and retention get recorded. These meaningful data are available to provide instructors with the knowledge of what topics students have more trouble grasping, so that these areas can be addressed in the future.

The effectiveness of MLP has never been studied at SJVC. In studying the effects of this online mathematics program as compared to traditional textbook homework, it will be determined if there is an effect on a student's success in mathematics.

The purpose of this study is to analyze if method of homework assignment completion affects students' success in a mathematics class.

Significance of Study

The results of the study will help instructors and administrators know the extent to which MyLabsPlus (MLP) contributes to student achievement in Introductory Algebra. For the individual instructor, this study will assist in

determining whether or not he or she should implement MLP in his or her mathematics courses. In addition, this study will be useful to administrators whose goal is to improve student achievement in mathematics. Accordingly, administrators have the ability to encourage or reject the use of MLP by mathematics instructors.

Research Question

What is the effect of using MyLabsPlus (MLP) on student success in a remedial mathematics class?

Hypothesis 1A: Students enrolled in course sections using MLP have higher course grades than students in course sections using traditional homework methods.

Hypothesis 1B: Students enrolled in course sections using MLP have higher course grades than students in course sections using traditional homework methods after controlling for beginning mathematics skills.

Hypothesis 1C: Students enrolled in course sections using MLP have higher course grades than students in course sections using traditional homework methods after controlling for student attendance.

Hypothesis 1D: Among students missing two or fewer classes, those enrolled in course sections using MLP have higher course grades than students in course sections using traditional homework methods.

Hypothesis 1E: Among students missing two or fewer classes, those enrolled in course sections using MLP have higher course grades than students in course sections

using traditional homework methods after controlling for beginning mathematics skills.

Theoretical Framework

Developed by Chickering and Gamson (1991), *The Seven Principles for Good Practice in Undergraduate Education* gathers findings from research on postsecondary education and expresses those findings concisely in seven basic principles. These principles assert that good practice in postsecondary education “(1) encourages student-faculty contact, (2) encourages cooperation among students, (3) encourages active learning, (4) gives prompt feedback, (5) emphasizes time on task, (6) communicates high expectations, and (7) respects diverse talents and ways of learning” (p. 63). The Seven Principles are based on an underlying view of education as active, cooperative, and demanding (Gamson, 1991). The seven principles relate to this study because students have the opportunity to develop and broaden their knowledge about mathematics through MLP and its range of help options.

The *Email my Instructor* option built into MLP encourages contact between students and faculty outside of the classroom. This is an important factor in student motivation (Gamson, 1991). The ability to ask an instructor for help outside of class helps students solve tough questions and continue moving forward in their assignment.

MLP is equipped with an online discussion board to facilitate communication and cooperation among students. An online discussion board allows students to post

questions at any time and receive feedback from their peers or instructor (Lee, 2011). Learning is enriched and higher order thinking skills are often achieved when work is collaborative. Sharing ideas and responding to others' posts improves thinking and enhances understanding (Chickering & Gamson, 1991, p. 65).

MLP offers an array of activities that promote active learning and emphasize time on task. One of the most notable is *Help Me Solve This*. This option provides step-by-step assistance with solving the actual problem on which a student is working. People learn in a variety of different ways. Each person has a unique learning style (Chickering & Gamson, 1991, p. 68). If a concept wasn't fully understood in class, MLP offers an assortment of options for student knowledge building that are student-centered in nature. Through their own preferences, students can increase their understanding of mathematical topics (Dawson, 2013).

Feedback from instructors and peers will not only let a student know if he or she is on the right path, but also can alleviate student anxiety over mathematical topics (Anonymous, 2007). Receiving prompt feedback may also prevent a student from giving up and dropping a class. In addition to offering an outlet for peer and instructor feedback, MLP provides students feedback after each homework question stating whether or not that response was correct.

Communicating high expectations with students can encourage those students to perform better in class. The message board on MLP along with the discussion

board and email options, allows instructors to convey class expectations in an additional format outside of classroom.

Definitions

Course Learning Objective. A formal statement of what students are expected to learn in the course.

Mastery. When a student becomes adept at a particular Course Learning Objective.

MLP Homework. Describes the homework assignments developed through MyLabPlus, which accompanies the textbook *Intermediate Algebra*, Eleventh Edition, by Marvin L. Bittinger (2011). All assignments were developed by the instructor. Students retrieved and submitted assignments using the online system.

Remediation. Describes a student's need to improve basic skills.

Textbook Homework. Describes the instructor selected and evaluated homework assignments selected from the textbook *Intermediate Algebra*, Eleventh Edition, by Marvin L. Bittinger (2011).

Summary

The purpose of this study was to determine the effect of MyLabsPlus (MLP) on student success in an on-campus, community college, remedial mathematics course. Chapter II contains a literature review in which research related to computer versus textbook based learning and analysis of classes with online components is discussed.

CHAPTER II

REVIEW OF LITERATURE

The review of literature focuses on computer based versus textbook based learning and analysis of classes with online components.

Computer Based vs. Textbook Based Learning

A recent development affecting the mathematics classroom is the practice of using an online homework system. Whereas traditional homework assignments are given from textbook problems and students must read the text for examples and help outside of school, online homework systems provide interactive elements to assist students in learning and the completion of their assignments while off-campus (Dawson, 2013).

The study by Brewer and Becker (2010) was designed to compare the effectiveness of the use of online math homework in a college algebra class to the use of textbook homework. This analysis took place over the course of a semester and involved 145 community college students in nine different class sections. Eighty-five students were enrolled in a math class that used textbook homework and 60 students were enrolled in a class that used online math homework. Each class section shared a common syllabus, schedule and homework list. Students of all class sections completed a common final exam, and results were compared based on homework type. Overall, there was no statistical difference ($F(1, 137) = 1.216, p = .272$) between type of homework, online ($M = 65.4, SD = 19.98$) or textbook ($M = 60.12, SD = 21.76$) and results on the final exam. However, researchers noticed that

there was almost a significant difference ($F(1, 137) = 3.069, p = .082$) between the two groups and their final exam scores when controlling for incoming skill level and felt this slight difference deserved further exploration. A secondary analysis based on incoming math skill level was performed. The same group of students had been categorized into either high or low skill levels based on the results of a pretest at the beginning of the semester. Analysis of the low skill level students showed that those who completed online homework ($M = 61.25$ and $SD = 19.48$) demonstrated significantly higher mathematical achievement than those who used textbook homework ($M = 51.28, SD = 19.06, t = -2.174, p = .033$).

Silverman (2010), conducted a study to determine what impact, if any, a redesigned basic-skills math program, Math My Way (MMW), had on students' progression to a college-level math course compared to a traditional basic-skills math course. The 202 participants in this study were community college students at Foothill College in the San Jose area. Students were divided into two groups. Students in the control group were taught using traditional lecture style instruction. Class met for 5 hours per week throughout the course of a 12-week quarter. Instructors set the pace of the class and established times to assess students. Students were assigned a letter grade at the end of the quarter. There were 35 students to one instructor and courses were offered at varying times. The treatment group used the MMW program which divided the curriculum into 10 sequential modules. Students worked within a module until they proved through assessment that the material had

been mastered. MMW required students to attend class for 10 hours per week, from 10 a.m. to noon every weekday, and did not assign students a grade at the end of the quarter if that student required more time for mastery learning. The MMW program had five instructors working collaboratively, utilized peer tutors in the classrooms and followed a highly structured format for both classroom work and attendance. There were 150 students to five instructors.

An independent samples t -test was used to evaluate the difference in course grades of the two groups at the end of the math class. Data showed students in the MMW program, $M = 2.26$ and $SD = 1.25$, performed better than the students in the traditional lecture-style basic-skills math course, $M = 1.81$ and $SD = 1.43$. The data revealed that the MMW program had a positive effect on grades in math courses ($t = 2.34, p = .02$).

In the study conducted by Lenz (2010) at Marymount University, it was found that online homework offered advantages over textbook homework. Over the course of five semesters, a total of 191 Finite Mathematics students were voluntarily enrolled into a class utilizing online homework, a class utilizing textbook homework, or a class that used a combination of the two. The same instructor taught all sections. The main advantage afforded by online homework classes was the instant feedback and immediate help at any time on any homework problem. The results of this study indicate that students assigned online homework ultimately worked through more problems than those assigned textbook homework or a combination of the two and

had higher assignment completion scores (88%, 80% and 79% respectively).

However, when the homework scores were removed and grades were computed solely on exam scores, there was no reported significant difference in mean GPA in mathematics classes among the online homework classes (2.17, based on a 4.0 scale) and the textbook homework classes (2.39). There was a difference in GPA among the combination classes (1.78) and the textbook homework classes (2.39). Calculations of grades based on exam scores alone showed that the students in the textbook homework classes earned higher scores than students in the other two groups.

Community colleges are rapidly increasing their enrollment in online and developmental courses (Ashby, Sadera & McNary, 2011). The purpose of the study conducted by Ashby, Sadera and McNary (2011) was to compare student success in a developmental math course offered in three different learning environments: online, face-to-face and blended, which was a combination of online and face-to-face. Students self-selected into classes. Standardized unit tests were administered to all of the classes and Standardized Intermediate Algebra Competency Exams (IACE) scores along with grades were collected from 167 participants. There were 63 online students, 46 blended students and 58 face-to-face students. Initial analyses revealed that there were no significant differences in student performance among learning environments. The percentage of students earning a passing grade was as follows: Face-to-face 59%, blended 48%, and online 65%, $\chi^2 (2, N = 167) = 3.26$ with $p = .20$. However, class attrition was then taken into consideration and analyses were re-

computed. These new computations omitted students who did not complete the class. New results of the percentage of students earning a passing grade were: Face-to-face 63%, blended 69%, and online 85%, $\chi^2(2, N = 134) = 6.69$ with $p = .04$. These data revealed that there was a significant difference among learning environments with regard to earning passing grades. Students in the online class had the highest success rates, while students enrolled in face-to-face and blended courses were not as successful.

The purpose of the study conducted by Dawson (2013) was to determine what impact an online homework system had in a face-to-face college mathematics course. Four sections of Intermediate Algebra consisting of 118 students were analyzed. The treatment group consisted of 52 students and utilized an online homework system, MathXL. The control group consisted of 66 students and utilized textbook homework. All sections were taught by the same instructor and met for the same amount of time each week, were assigned similar homework questions and took similar exams. The format and pacing of the classes was the same, with the first few minutes of class time spent answering student questions and the remainder of the class time reserved for lecture.

Differences in academic achievement on the final exam were compared among students of both groups. Students in the classes utilizing online homework had a mean of 12.27 (SD = 3.12) while students in classes utilizing textbook homework had a mean of 12.53 (SD = 3.47). The resulting value of $t(116) = -.42$

with $p = .67$ suggested that there was no significant difference in academic achievement based on the form in which homework was completed. However, while investigating student perceptions of MathXL, it was found that students enjoyed using the program and felt it was beneficial.

Analysis of Classes with Online Components

Online education is growing rapidly in postsecondary institutions (Morris & Finnegan, 2009). Students are typically free to self-select into online courses and courses with online elements. It is essential that these classes are well structured so that the students receive as much attention and assistance as needed (Waycaster, 2011).

Lee's (2011) study was designed to investigate and analyze factors that contribute to students' success in online math courses at community colleges. One hundred and thirty-five students were enrolled in one of three online math courses. These students were asked to complete a Self-Assessment Questionnaire which was based on principles of successful college teaching previously studied by Chickering and Gamson. Multiple regression analysis was used to identify if student success was associated with the approaches addressed by the seven principles of Chickering and Gamson, if student success was associated with help of tutoring services and if student success was associated with their degree of technology competence. Results found that student success was associated with the following: communication and interaction between students and instructors ($\beta = -.285, p = .015$ and $\beta = -.241, p =$

.035 respectively), participation in instructor driven discussion boards ($\beta = .270, p = .010$), thoroughly reading assignments and instructions ($\beta = -.240, p = .040$), ability to handle online homework ($\beta = .353, p = .013$), and getting online or in-person tutoring when needed ($\beta = -.522, p < .001$). Two of the variables that were found to be least significant were watching instructor provided videos ($\beta = .070, p = .550$) and the ability for a student's personal computer to run the necessary software ($\beta = -.084, p = .508$).

The case study performed by Kendricks (2011) examined one College Algebra class during the fall semester of 2008. The 12 students were all freshman science, technology, engineering or mathematics (STEM) majors and part of the Just Undergraduate Mentoring Program (JUMP). The newly designed course was blended as it had both face-to-face and online components. Students completed homework assignments online; took paper based, in class assessments; were assigned projects; had regular notebook checks and were held accountable for their attendance. There were also a number of opportunities for active learning inside and outside of the classroom. Students earning a D or lower on any of the biweekly assessments were required to meet with a tutor for 2 to 4 hours until the next assessment. Over the course of the semester, 63% of the class members completed mandatory tutoring hours. This required tutoring resulted in a 67% increase in students' grades on the subsequent biweekly assessments. Additionally, the integration of support components such as positive feedback and professional development sessions for

students resulted in an end of the semester pass rate of 75%. That was an increase of 15% over the average pass rate of the previous years.

According to Hatziapostolou and Paraskakis (2010), giving students formative feedback on their work allows those students to ascertain their strengths and weaknesses and guides them about the necessary actions needed to be successful in class. In this study, the Online FEedback System (OFES), a web-based tool that supports the delivery of formative feedback, was examined. The OFES tool was used by 80 students while completing an individual project which included a number of the learning outcomes of a Data Structures and Algorithms course. Statistics recorded by the OFES system showed that 100% of the students accessed OFES and viewed their online feedback forms and information about their class performance. The statistics also showed that a number of students visited the site before final exams: 35% during the first year of the study and 32% during the second year of the study. These pre-final visits might have assisted students in final exam preparedness. Additionally, a positive student perception of the OFES system was expressed by students during a discussion forum. According to students, OFES is an efficient, prompt and helpful communication tool and increased their understanding of concepts.

The study by Morris and Finnegan (2009) combined the findings from four studies conducted in the University System of Georgia. Five hundred students enrolled in online lower division courses and their instructors were studied and observed. The online courses were designed by faculty and instructional design

experts and met standards established by the University System of Georgia. Through the combined results of the four studies, best practices in online teaching were developed and recorded. The first of those results determined that faculty members new to teaching online courses would benefit from a mentor, that mentor being an experienced and substantiated online instructor. This partnership would provide the new online instructor with necessary support in handling the technological, managerial, social and pedagogical aspects of being an online instructor. The results also established that students need active instructor involvement from the onset of the course. Identifying weaker students through pre-assessment and identifying reserved students may help instructors provide early assistance to those who need it. Instructors of online classes should also be proficient at providing differentiated instruction. Additionally, instructors should monitor student activity using the tools available through their course management system. Instructors should ask who is online, when are they online, what are they doing and how often? The answers to these questions can serve as early indicators for students who will persist and succeed and those who may withdraw from an online course.

The purpose of the study by Brill and Galloway (2007) was to examine college-level instructors' use of and attitudes towards teaching technologies. The qualitative design relied on survey and interview data collection methods. The research site was a large, public university in the United States. Of 180 surveys distributed, 53 (29.4%) were completed and returned. Of the 53 surveys returned, six

of those subjects were interviewed. Findings revealed the positive influence of technology on teaching and learning. It was concluded that technology facilitates clear and elaborate presentation of information to students, enables the showing of numerous and complex examples, enhances student engagement, encourages interaction and provides structure and support.

Generally it was concluded that colleges should provide extended hours for both in-person and online tutoring, technology workshops and support ought to be available to students and instructors, and methods must be developed to foster active learning and interaction between students and instructors.

Summary

The studies discussed in the computer based versus textbook based learning section confirmed that students using an online homework system are at least as successful as students using traditional textbook homework. Also, students appreciate the benefits of an online homework system. The analysis of classes with online components section provided information on what is needed for a student to thrive in an environment that uses online elements.

In Chapter III, the research design is presented. Details of the sample, procedure, instruments and analysis are provided.

CHAPTER III

METHODS

The objective of this study was to learn the extent to which MyLabsPlus (MLP) contributes to student achievement in Introductory Algebra. Three classes used MLP and two used traditional textbook homework. Results of class grades were compared.

Sample

The participants of this study were students at one of the 13 campuses of San Joaquin Valley College (SJVC). There were 3,407 total students enrolled at SJVC. SJVC had a very diverse student population and approximately 67% of the students were female (SJVC, 2010). The majority of students were first generation college students and many were single parents (San Joaquin Valley College, 2013).

All students enrolled in an Associate Degree program were required to take a five week module of beginning algebra. This course was called Math 121 and was held Monday through Thursday for two hours and ten minutes. The class size for all SJVC courses had a capacity limit of 24 students.

During the September 2013 and November 2013 modules there were five Math 121 classes. The control group was taught by instructors who did not use MLP as a part of class, but instead assigned homework from the textbook. The other classes were taught by instructors who used MLP for homework on a daily basis. This study included all students enrolled in Math 121 at the start of the September

2013 and November 2013 modules. Any students who dis-enrolled were not included in analysis.

Procedure

At SJVC, instructors had a choice between using traditional textbook homework or an online homework system called MyLabsPlus. Students of the instructors whom assigned a homework set in the textbook were able to check their answers to select problems in the appendix of their textbook. Additionally, those completing homework sets directly from the textbook were only able to receive help while on campus. Students of the instructors whom used MLP were offered interactive examples through MLP as additional help for problems with which they struggled. MLP also provided students with instant feedback on whether or not they answered the question correctly and allowed students to attempt the same problem multiple times until they arrived at the correct answer.

The homework set for each section was assigned after the lecture and discussion of the topic. The homework assignments did not differ between type of class. The question bank that MLP used drew from the questions in the practice set at the end of each section of each chapter of the textbook. The homework assignments were to be completed prior to the next class meeting. All students were given the opportunity to begin the homework assignment in class.

Instruments

All SJVC students took a mathematics assessment test upon enrollment into the school. The assessment was administered through MLP. MLP used the results of this assessment to build a study plan based on questions answered incorrectly for each individual student. SJVC students were required to complete this study plan within two modules of the start of their selected program. The study plan was designed to help the students be more successful in Math 121 and to re-introduce topics in basic mathematics for students enrolled in both Associate degree and Certificate programs. The results of this assessment were used to normalize student achievement data.

The campuses of SJVC all used a course management system called Desire to Learn. Instructors used Desire to Learn to record the grades of student coursework. Summative assessments were also composed, administered and scored using this system. During the course of Math 121, there were two multiple-choice, summative assessments, the Midterm and the Final. Each assessment was worth 20% of the total grade for a total of 40%. Students in all classes were given two hours to complete each of these assessments. Each test was comprised of roughly 37 questions chosen from a common test bank. Students could earn scores from zero to 100%.

The results of student grades and attendance were recorded for five Math 121 classes. These classes were taught by four different instructors. The curriculum instructors were required to cover in Math 121 courses was the same at all SJVC campuses. There was also a common syllabus. Classes were taught in similar

formats. All classes began with answering student questions, which was followed by a warm-up or short quiz that was comprised of questions from previous lessons. Next the instructor lectured on a topic. Students were asked to participate in the lesson by working out practice problems on paper and also on the white board at the head of the classroom. After the lesson, students then had the opportunity to begin homework in class.

SJVC was the first post-secondary institution at which each of the four instructors taught. One of those four instructors had previous experience teaching at the elementary level. Time spent as an SJVC instructor varied greatly. One of the instructors had taught at SJVC for 10 years, two for 3 years and one for 3 months. Two of the instructors held Bachelor degrees in Mathematics and two of the instructors had Bachelor degrees in Business with at least 12 units in college level mathematics. One of the instructors had a Master's degree; however, it was not in a field related to mathematics.

Data Analysis

The Math 121 data were analyzed using the Statistical Package for the Social Sciences (SPSS), v. 22. Levene's Tests of Equality of Variances were run to check for equal variances between groups. Several one-way analyses of variance (ANOVA) and one-way analyses of covariance (ANCOVA) were used to analyze the data.

Summary

The sample, procedure, instrumentation, and analyses used in this study were presented. The results of student grades, attendance and beginning math skills were recorded for five Math 121 classes. Although most classes were taught by different instructors, classes were taught in similar formats. All data were entered into SPSS for analyses. Chapter IV reports the results of the study.

CHAPTER IV

RESULTS

The purpose of this study was to determine the effect of MyLabsPlus (MLP) on student success in an on-campus, community college, remedial mathematics course. Data on grades, attendance and beginning mathematics skills were collected from students in five Math 121 classes.

Findings

Research Question

What is the effect of using MLP on student success in a remedial mathematics class?

Hypothesis 1A: Students enrolled in course sections using MLP have higher course grades than students in course sections using traditional homework methods.

Table 1 shows what effect the use of MLP homework ($M = 79.39$, $SD = 18.369$) versus textbook homework ($M = 73.22$, $SD = 22.457$) had on final course grades.

Table 1
Effect of using MLP Homework vs. using Textbook Homework on Final Course Grades

	<i>n</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>p</i>
Treatment	42	79.36	18.369	1.672	.200
Control	32	73.22	22.457		

Levene's Test for Equality of Variances was not significant, $F(1, 72) = 1.513$, $p = .223$, therefore equal variances were assumed. A one-way analysis of variance (ANOVA) was run. Overall there was no statistical difference ($F(1, 72) = 1.672$, $p = .200$) on the final course grades between students completing homework using MLP and students completing homework assigned from the textbook.

Hypothesis 1B: Students enrolled in course sections using MLP have higher course grades than students in course sections using traditional homework methods after controlling for beginning mathematics skills.

Table 2
Effect of MLP on Final Course Grades After Controlling for Beginning Mathematics Skills

	<i>n</i>	<i>M_{adj}</i>	<i>SD</i>	<i>F</i>	<i>p</i>
Treatment	42	79.729	18.369	2.923	.092
Control	32	72.730	22.457		

Levene's Test for Equality of Variances was not significant, $F(1, 72) = 0.040$, $p = .841$, therefore equal variances were assumed. A one-way analysis of covariance (ANCOVA) was run. Overall there was no statistical difference ($F(1, 72) = 2.923$, $p = .092$) on the final course grades between students completing homework using MLP homework and students completing homework assigned from the textbook when controlling for incoming mathematics skills.

Hypothesis 1C: Students enrolled in course sections using MLP have higher course grades than students in course sections using traditional homework methods after controlling for student attendance.

Table 3
Effect of MLP on Final Course Grades After Controlling for Attendance

	<i>n</i>	<i>M_{adj}</i>	<i>SD</i>	<i>F</i>	<i>p</i>
Treatment	42	76.391	18.369	0.042	.839
Control	32	77.112	22.457		

Levene's Test for Equality of Variances was not significant, $F(1, 72) = 1.957$, $p = .166$, therefore equal variances were assumed. A one-way analysis of covariance (ANCOVA) was run. Overall there was no statistical difference ($F(1, 72) = 0.042$, $p = .839$) on the final course grades between students completing homework using MLP and students completing homework assigned from the textbook when controlling for student attendance.

Hypothesis 1D: Among students missing two or fewer classes, those enrolled in course sections using MLP have higher course grades than students in course sections using traditional homework methods.

In Table 4, students who had missed more than two class meetings were removed from the data and analyses were run on this subset of MLP homework students ($M = 84.57$, $SD = 11.155$) and textbook homework students ($M = 80.33$, $SD = 14.461$).

Table 4
Effect of Missing 2 or Fewer Class Meetings on Final Course Grades

	<i>n</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>p</i>
Treatment	35	84.57	11.155	1.513	.224
Control	21	80.33	14.461		

Levene's Test for Equality of Variances was not significant, $F(1, 54) = 1.942$, $p = .169$, therefore equal variances were assumed. A one-way analysis of variance

(ANOVA) was run. Overall there was no statistical difference ($F(1, 54) = 1.513, p = .224$) on the final course grades among students who missed two or fewer class meetings.

Hypothesis 1E: Among students missing two or fewer classes, those enrolled in course sections using MLP have higher course grades than students in course sections using traditional homework methods after controlling for beginning mathematics skills.

Table 5
Effect of Missing 2 or Fewer Class Meetings and Controlling for Beginning Mathematics Skills on Final Course Grades

	<i>n</i>	<i>M_{adj}</i>	<i>SD</i>	<i>F</i>	<i>p</i>
Treatment	35	84.225	11.155	1.673	.201
Control	21	80.912	14.461		

Levene's Test for Equality of Variances was not significant, $F(1, 54) = 0.260, p = .612$, therefore equal variances were assumed. A one-way analysis of covariance (ANCOVA) was run. Overall there was no statistical difference ($F(1, 54) = 1.673, p = .201$) on the final course grades among students who missed two or fewer class meetings while controlling for incoming mathematics skills.

Summary

The Math 121 data analyzed in this chapter were used to investigate the effect of using MLP on student success in a remedial mathematics class. Results of the research question demonstrated no statistical significance in final course grades between students using MLP homework and students using textbook homework even when controlling for beginning mathematics skills and attendance.

CHAPTER V

DISCUSSION AND RECOMMENDATIONS

The results of the study will help college instructors and administrators know the extent to which MyLabsPlus (MLP) contributes to student achievement in Introductory Algebra. For the individual instructor, this study will assist in determining whether or not they should implement MLP in their mathematics courses. In addition, this study will be useful to administrators whose goal is to improve student achievement in mathematics. Accordingly, administrators have the ability to encourage or reject the use of MLP by mathematics instructors

Summary of Results

The Math 121 data analyzed in the previous chapter demonstrated no statistically significant differences in final course grades between students using MLP homework and students using textbook homework.

Research hypotheses (H1A, H1B, H1C) examining whether students enrolled in course sections using MLP have higher course grades than students in course sections using traditional homework methods were tested, using an alpha level of .05. Levene's Tests for Equality of Variances were not significant; therefore, equal variances were assumed. One-way analysis of variance (ANOVA) and one-way analyses of covariance (ANCOVA) were run. There was no statistical difference ($F(1, 72) = 1.672, p = .200$) on the final course grades between students completing homework using MLP and students completing homework assigned from the textbook. In addition, there was no statistical difference when controlling for

incoming math skills, $F(1, 72) = 2.923, p = .092$ or student attendance, $F(1, 72) = 0.042, p = .839$.

In addition, research hypotheses (H1D and H1E) examined whether those enrolled in course sections using MLP have higher course grades than students in course sections using traditional homework methods, examining only students missing two or fewer classes. Levene's Tests for Equality of Variances were not significant; therefore, equal variances were assumed. A one-way analysis of variance (ANOVA) and a one-way analysis of covariance (ANCOVA) were run. There was no statistical difference ($F(1, 54) = 1.513, p = .224$) on the final course grades among students who missed two or fewer class meetings based on whether they used MLP. In addition, there was no statistical difference when controlling for incoming math skills, $F(1, 54) = 1.673, p = .201$.

Discussion

Results indicated there were no statistically significant differences in final course grades between students using MLP homework and students using textbook homework. This result may stem from a variety of reasons.

MLP provides students feedback after each homework question, stating whether or not that response was correct. It also offers an array of support for successful homework completion, one of which is *Help Me Solve This*. This option provides step-by-step assistance on solving the actual problem a student is working on. Students at SJVC are allowed and encouraged to begin their homework assignments in class. In-class feedback and aid from instructors and peers will not

only let a student know if he or she is on the right path, but also can alleviate anxiety (Anonymous, 2007). Oftentimes students are able to complete the homework assignment before the end of class. Additionally, at all SJVC campuses there are Student Centers, where students can go to receive help on homework and tutoring on any subject. Students learn in a variety of different ways and each has a unique learning style (Chickering & Gamson, 1991, p. 68). However, traditional, in-person classroom and campus-based support services may negate the impact of online support offered through MLP.

In the study by Lenz (2010) it was found that the main advantage afforded by online homework resources was the instant feedback and immediate help at any time on any homework problem. The results of Lenz's study indicated that students assigned online homework ultimately worked through more problems than those assigned textbook homework. However, when the homework scores were removed and grades were computed solely on exam scores, there was no reported significant difference in final course grade between students in classes utilizing online homework and students in classes utilizing textbook homework (Lenz, 2010). Students using online homework may not write out their solutions to homework problems and keep those solutions to study from later. Instead, they may work out the assigned problems on scratch paper which is later discarded. In the textbook classes students are required to write out their responses to homework questions and in turn students have these documents to study from. This difference may result in students enrolled in classes using online homework resources having less to study with than

those enrolled in the textbook classes. Perhaps requiring students who complete online homework to submit a hand written version of the homework or portion of the homework would help prevent this problem. If students only put minimal effort into homework and studying and do not make use of everything available to be successful in class, the extra support of MLP may not be effective in helping students achieve higher scores on assessments.

The mean of the final grades for the MLP classes was consistently a few points higher than the mean final grades for the textbook classes, but not enough so to be statistically significant. This may be due to the sample size. A sample size that is too small may distort the results of a study and the means may be artificially increased or decreased. A small sample size also creates difficulty with confidently generalizing the results to a broader population. The larger the sample size, the more the results truly reflect the population. Additionally larger sample sizes are more likely to find significant differences. Perhaps if the study had had a larger sample size, there may have been a statistically significant difference between the MLP homework classes and traditional homework classes.

At SJVC, grades represent more than simply knowledge of content. Being a career college, courses are designed to emulate being “at work” and are designed to encourage students to attend every day. An absent student will receive no credit for formative assessments that occurred or were due the day of the absence. The final grades for Math 121 are composed of the following: 20% Midterm, 20% Final, 25% Quizzes, 35% Homework and Projects. Due to the weights of the Quiz and

Homework and Project categories, if a student is absent enough times, the grade will be affected, regardless of how well they learn the material. Some of the final grades used in this study may have been affected in this manner. To avoid this, data from midterms and final exams alone could be collected. This information would be more representative of how well students acquired the material.

Students in some of the classes that utilized MLP may not have been aware of all of the support it offers or how to use MLP to the fullest extent. To create uniformity between classes that use MLP and allow students to maximize the benefits offered by MLP, instructors should work together to form a list of “best practices” with regard to the use of MLP. These best practices could include an in-class, instructor guided tutorial of the features of MLP. Instructors could also demonstrate common answer entry errors and help students avoid having answers rejected by the MLP system. Best practices could also include a teaching model that addresses how to best incorporate MLP into the classroom. These practices may lead to a statistically significant difference between students in the MLP homework classes and those in traditional homework classes.

The environment of a career college is unique and substantially different than that of a public post-secondary institution. The duration of classes is much shorter and there is a highly structured, specific standard of classroom practices. Instructors are very accessible outside of class. There are also student support services offered beyond academic assistance such as gas cards and bus passes provided to those who have a temporary transportation problem. Students of SJVC are focused on

completing school quickly and beginning work in their field of study. These factors influence a student's success in class, and perhaps are more influential on success than the method by which homework is assigned.

Unlike public colleges where students are free to pick and choose when and with whom they take a class, students at SJVC are on a set schedule and have no choice at what point in their program they take a class or what instructor they have. This is largely due to accelerated programs and campus sizes being small. Results indicated there were no significant differences between course type and final grades among students. Presently SJVC has very rigid scheduling, but may consider options in the future that would give students the choice of enrolling in sections of Math 121 based on which homework method aligns with their personal preferences.

The studies discussed in Chapter II find that students using an online homework system are at least as successful as students using traditional textbook homework. In this study the results showed no significant difference between the two types of homework with regard to final grades. At SJVC, the online assistance provided by MLP may simply be no better than classroom instruction and support services.

Recommendations

When controlling for incoming mathematics skills, the results of the ANCOVA ($F(1, 72) = 2.923, p = .092$) were nearly significant. This may warrant further investigation. It may be useful to rerun analyses after dividing the students' incoming mathematics skill level into two groups, low and high.

Summative assessments at SJVC contain common assessment questions that are designed to test how well a student has mastered the course learning objectives (CLOs). There were common assessment questions given to all students on midterms and finals. For each CLO, there were about six multiple choice questions and instructors were expected to pick at least three and add those to their assessments. Mastery is recorded as having been met if the student answered all of the questions of a particular CLO correctly. Due to software issues, these data were not recorded properly at the time this study took place. Analyzing the results of student mastery of CLOs may yield a significant difference between students that use MLP and those who do not.

A similar study may be performed in which fewer instructors teach the classes. Having fewer instructors teach will result in more consistency between courses.

Another study may be conducted where type of student is a factor. Student course load, age, number of children, hours worked per week, primary language and level of technical ability could be collected. These data could be analyzed along with course grades to determine the students for whom online homework is more for effective.

Yet another suggestion is to conduct a study in which data on exam performance is collected and examined. Analyzing the results of exam scores may yield a significant difference between students who use MLP and those who do not.

A final suggestion would be to carry out an in-depth study of how students actually use the online system (Dawson, 2013). Students or the program itself could report on usage items such as when and where they attempt assignments, time required to complete assignments, which help options they depend on, whether they attempt problems before seeking help, how often they have to re-attempt problems and whether the MLP system was primarily accessed at home or on campus (Dawson, 2013). This information could help instructors understand the manner in which students use the MLP system and accordingly might help instructors better serve student needs.

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APPENDIX

APPENDIX A

IRB RESEARCH APPROVAL FORM



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December 9, 2013

Lisa Diaz
 872 Rolling Oak Court
 Modesto, CA 95351

Re: Protocol #1314-068

Dear Lisa,

Congratulations. Your research has been designated Exempt and can be conducted as detailed in your research protocol "*Effectiveness of MyLabsPlus as an online homework system.*"

If you have any questions regarding this designation, please contact Campus Compliance at (209) 667-3784.

Please Note:

Human subjects research liability protection from the university only covers IRB-approved research by faculty, students, and employees of CSU Stanislaus. If your employment or student status changes during the year or if you make changes to your methods, subject selection, or instrumentation, please discontinue your research and notify the IRB to obtain the appropriate clearances.

If any research subject experiences a serious adverse or unexpected event during or following participation, please notify Campus Compliance immediately.

Best regards,

A handwritten signature in blue ink that reads 'Jarrett Kotrozo'.

Jarrett Kotrozo, Ph.D., Chair



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