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Abstract

Enhancing students' conceptual understanding and increasing student motivation to effectively participate in classroom discussions are important for instructors of mathematics. Web-based homework management systems provide alternatives to the traditional pen-and-paper based approaches. In addition, these tools facilitate the creation of a student-centered environment which allows instructors to assign work based on students' needs while using a variety of multimedia materials that can include animation, video, and/or audio in order to enhance student learning and facilitate student-instructor communications. These systems provide flexible instructional tools that not only offer students immediate feedback, but also track student performance. The goal of using these programs is to enhance student understanding and learning of different mathematical concepts. The purpose of this paper is to present students' perceptions of the advantages and disadvantages of using two web-based homework management systems; MyMathLab and WebAssign. In addition, it sheds light on students' habits of using these systems and their perception of the optimal number of attempts that should be allowed to complete the homework assignments.

Introduction

The importance of homework and the relationship between homework and academic performance have already been the focus of several studies (Cooper, Robinson & Patall, 2006; Eren & Henderson, 2008; Keith & Cool, 1992; Peters, Kethley & Bullington, 2002; Warton, 2001). Web-based homework systems can provide an alternative to the traditional paper-based homework (Dufresne, Mestre, Hart, & Rath, 2002). Many studies have been conducted using web-based homework in chemistry, mathematics, physics and statistics courses (Bliwise, 2005; Bonham, Beichner, & Deardorff, 2001; Cole & Todd, 2003; Dufresne, Mestre, Hart, & Rath, 2002; Freasier, Collins, & Newitt, 2003; Hauk, & Segalla, 2005; Lenz, 2010; Lin, 2009; Pascarella, 2004; Penn, Nedeff, & Gozdzik, 2000; Pennington, 2013; Toback, Mershin, & Nazimova, 2005; York, Hodge & Richardson, 2008; Zerr, 2007). Some studies focused on students' perceptions of their learning using web-based homework systems (Demirci, 2007; Hauk & Segalla, 2005; Picciano, 2002). Other studies compared between the use of web- based homework systems and the use of paper-and-pencil homework (Dufresne, Mestre, Hart, & Rath, 2002; Thoennessen & Harrison, 1996).

Two of these web-based systems are WebAssign & MyMathLab. WebAssign was developed by Dr. John Risley in 1997 to enhance student learning and support instructors in their classroom. WebAssign is a flexible web-based instructional system that allows students more practice as well as easy access to their performance assessment. Using WebAssign, students can work on their assignments multiple times until they get the correct answer. Student performance can be assessed regularly. MyMathLab is an online textbook resource that is used to generate online homework assignments. MyMathLab offers instant feedback, step-by-step examples, videos, tutorials. MyMathLab creates a personalized adaptive study plan based on the collected data targeting each student's individual strengths and weaknesses. The goal of the adaptive plan is to improve student conceptual understanding of the mathematical concepts.

Tang and Titus (2002) conducted a study that surveyed students who used WebAssign in their physics and calculus courses on a weekly basis. They found that using WebAssign increased student-instructor as well as student-student interactions, increased student time and effort doing homework outside the classroom and allowed instructors to create learning activities based on student feedback. Gok (2011) compared the effects of web-based homework vs paper-and-pencil homework on the achievement of 287 students using conceptual tests, exams, and homework assignments. The participants were enrolled in two sections of an introductory calculus-based semester courses at a public university in the middle region of the US. Students in the experimental section used a web-based homework system, while students in the other section completed

homework in a traditional fashion using paper and pencil. Gok found that there was no significant difference between the exam scores for the two sections. However, he found that students in the experimental section performed better on their homework.

Pennington (2013) conducted a study that investigated the use of ALEKS as a web-based homework system on student achievement in a college algebra course. To access the online quiz, students were required to achieve a 75% correct completion level for the online homework assignments. Pennington collected the data using a pretest, posttest, pre-survey and post-survey. The pre-test was used to measure students' prior knowledge of the material before taking the course. The pre-survey was used to gather demographic information including gender. The post-survey was used to gain information on students' work ethic, their feelings about the use of ALEKS. The researcher found that using ALEKS did not raise final exam grades but that it improved students' online quiz grades.

Lin (2009) conducted a study to investigate the comparative efficiency of Web-based instruction and traditional teaching methods on preservice teachers' fraction knowledge. Forty- two preservice teachers who were enrolled in two classes (21 students each) participated in this study. The experimental class used Web-based Instruction, the other class was given traditional instruction. The researcher collected the data using pre- and posttest. The test consisted of 32 items that aimed at assessing students' knowledge of fractions. The other class that was assigned as a control group (n = 21) was given traditional instruction. The analysis of results showed that there was a statistically significant difference between the experimental and the control groups' posttest mean scores in favor of the experimental group.

York, Hodge & Richardson (2008) conducted a study that examined students' perceptions of the effects of the use of web-based homework on their learning and motivation. Participants in study were 376 students who were enrolled in a college algebra class at the university level. Participants completed the majority of their homework online. The researchers evaluated students' perceptions of the web-based homework through a survey containing both Likert-scale items and open-ended questions. The researchers found that few students appreciated the immediate feedback, but that most of them felt more accountable for completing the assigned work.

In a study that focused on the number of attempts that a student should be allowed to solve numerical free-response problems, Kortemeyer (2015) argued that the "number should be large enough to allow learners mastery of concepts and avoid copying, on the other hand, granting too many allowed tries encourages counter-productive behavior". The researcher investigated data from an introductory calculus-based physics course that allowed different numbers of attempts in different semesters. He found that the probability for students to complete a problem successfully decreases with the number of allowed attempts, which might be, as he indicated, due to increased carelessness or guessing. Based on his findings he predicted an optimum number of five allowed tries.

The focus of this paper is on students' perceptions of the advantages and disadvantages of using MyMathLab and WebAssign in learning mathematics in addition to their perceptions of the optimum number of attempts needed to complete homework assignments. In addition, the study investigated students' habits of completing homework and the number of hours needed to complete the homework.

Research Questions

The aim of this study was to answer the following questions:

1. How many hours per week do students spend doing web-based homework?
2. Where do students complete their web-based homework?
3. What is the optimal number of attempts that students should be allowed to complete each homework assignment?
4. What are students' perceptions of the advantages and disadvantages of using MyMathLab and WebAssign in learning mathematics?

Method

The participants in this study were university students who were enrolled in two different mathematics courses. One course used MyMathLab while the other class used WebAssign as web-based homework tools. To provide

an answer to the research questions, data were collected using a survey asking students to provide answers to the following questions:

1. How many hours per week did you spend doing your web-based homework?
2. Where do you complete your web-based homework? (campus, home, both, ….)
3. How many attempts should be allowed for each question before assignment submission?
4. What are the advantages of using a web-based homework system?
5. What are the disadvantages of using a web-based homework system?

Findings

In this section we discuss the findings to provide a response to the research questions regarding the students' perceptions of the advantages and disadvantages of using MyMathLab and WebAssign in learning mathematics as well as their use of these web-based homework systems. Participants' responses were summarized and tabulated as follows: Table 1 provides the number of hours students spent working on these systems per week, Table 2 provides the location of where students completed their assignments, Table 3 provides students perceptions of the ideal number of attempts per question, Table 4 provides students' perceptions of advantages using MyMathLab and Webassign, and Table 5 provides students' perceptions of disadvantages of using MyMathLab and WebAssign. To answer the first question regarding the number of hours that student spend working on their homework using either Webassign or MyMathLab, the collected data were tabulated into four categories as seen in Table 1. As indicated in the table, the majority of students spend 3-6 hours per week working on their web-based homework (MyMathLab: 78%; WebAssign: 69%).

Table 1. Percentages for Working Hours

Hours spent per week	MyMathLab	WebAssign
Less than 3 hours	10%	17%
3-6 hours	78%	69%
7-10 hours	10%	12%
More than 10 hours	2%	2%

To answer the second question regarding the location where students worked on their homework, the collected data were tabulated into three categories as seen in Table 2. The majority of students either worked at home or both home and campus. Students could choose to work on these assignments anywhere they liked since they could access the homework easily anywhere and anytime. This means that accessing either one of the web-based systems was not an issue for students.

Table 2. Percentages for Place of Access

Place of Access	MyMathLab	WebAssign
Home	43%	35.4%
Campus	14%	8.3%
Both	43%	56.3%

To answer the third question about the optimal number of attempts for each question, the majority of students as seen in Table 3 indicated that they would like to have unlimited number of attempts. It seems that, students like to be on the safe side and they prefer to keep trying until they get the correct answer.

Table 3. Percentages for Optimum Number of Attempts

Total number of attempts	MyMathLab	WebAssign
1-5	29%	10.4%
6-10	2%	31.3%
11- 30	0%	10.4%
Unlimited	69%	47.9%

To answer the fourth question about students' perceptions about the advantages and disadvantages of using MyMathLab and WebAssign in the mathematics classroom, students' responses were tabulated based on similarities and the percentages of students' responses were calculated as seen in Table 4 and Table 5. The main advantages of using MyMathLab and WebAssign according to students were: immediate feedback (22.4%, 27.1%), multiple attempts (14.3%, 18.8%) and ease of access (18.4%, 16.7%). Some students (about 8%)

indicated saving trees as one advantage of using web-based homework systems. Other advantages mentioned include online tutoring and the availability of multiple resources including videos.

Table 4. Percentages of Students' Perceptions of Advantages

MyMathLab		WebAssign	
multiple attempts, practice over and over again	14.3%	You get several tries, multiple attempts	18.8%
immediate feedback	22.4%	immediate feedback, quick feedback and self-learning	27.1%
you can do it anytime, anywhere, easy access	18.4%	being able to do it anymore on a mobile device	16.7%
online tutoring, help is immediate	8.2%	online tutoring to help students when they don't understand something	4.2%
no paper, less paper used	8.2%	less paper to deal with/kill less tress	8.3%
the online resources are great, multiple resources such as videos	10.2%	more resources that are easy to access	16.7%

The major disadvantages, as listed by students, of using MyMathLab and WebAssign were: having technical difficulties and no internet access (34.7%, 33.3%), less interaction with instructor (8.2%, 2.1%) and forgetting to complete the assignment (4.1%, 2.1%). Other disadvantages that students mentioned include matching the system format by entering the exact answer and being less friendly in case of asking a question in the tutoring center.

Table 5. Percentages of Students' Perceptions of Disadvantages

MyMathLab		WebAssign	
technical difficulties, issues with the internet	34.7%	technical difficulties, technology failure-Wi-Fi/network is down	33.3%
system glitch, you enter the correct answer but the system doesn't accept it	8.2%	sometimes your answer is a little off and not approved by the system	2.1%
instructor isn't available, no teacher help, less interaction with professor	8.2%	less interaction with the professor	2.1%
less friendly than using a paper submission	2%	if you do not understand something it is really hard to bring your laptop around places to seek help rather than a piece of paper	2.1%
you have to remember to get it done, easy to forget to do your homework	4.1%	you forget about it	2.1%

Conclusion

Enhancing students' conceptual understanding and encouraging them to be involved in the classroom discussions are important for instructors of mathematics. The use of technology was an essential part of the teaching and learning in mathematics courses. Web-based homework management systems is a possible alternative to the traditional pen-and-paper based approach. Homework systems provide a flexible instructional tool that offers students immediate feedback which helps students learn and understand mathematical concepts. In addition, these systems track student performance, and facilitate a student-centered environment where students are able to rework the questions multiple times thus enhancing the learning process. The systems also provide the instructors with the ability to create multimedia enhanced questions that can include video, animation, or audio and facilitate student-instructor communications. Using web-based systems enhanced student learning and understanding of the different mathematical concepts.

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