UNDERSTANDING STUDENTS ATTITUDES TOWARD MATHEMATICS ONLINE HOMEWORK

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ABSTRACT

Online homework systems that grade assignments and provide instant feedback have gained acceptance in the mathematics education field. This study employed a qualitative method, using interview protocol to collect data from 25 secondary school students. Coding the interview revealed four main categories related to students' attitudes toward online homework: feedback, confidence, convenience, and focus. This study provides evidence that secondary school students have a positive attitude toward the use of online homework for learning mathematics. This study is expected to be useful for mathematics educators to encourage them to implement online homework tools in their classrooms.

Keywords*: online homework, mathematics, attitude*

INTRODUCTION

The Internet is gradually becoming part and parcel of our lives. As part of this trend, numerous software packages have been developed, which allow students to complete homework assignments online. Online homework (OHW) has become a new trend, complementing traditional paper-and-pencil assignments in the teaching and learning of mathematics (Locklear, 2012).

Homework has been the preferred way for teachers to enhance students' learning. Homework allows students to take an active role in improving their knowledge and perception of the materials (Smolira, 2008). Most studies that focus specifically on quantitative homework have indicated that the course grades and overall performance are positively affected by doing homework (Ramdass & Zimmerman, 2011). Bembenutty (2011) found that if students receive shorter and more frequent homework, they are more likely to complete the assignments, which ultimately leads to increased achievement. Mitchell and Mitchell (2017) indicated OHW has a significant impact on the student's GPA. As a result, OHW has been a very important part of online classroom tools.

While many authors emphasise the positive impact of OHW systems at schools or higher educational institutions (e.g. Albelbisi & Yusop, 2018; Halcrow & Dunnigan, 2012), online assessment tools are not widely utilised in Malaysia (Ismail, Mokhtar, Nasir, & Rashid, 2014). Not much is known about how the Malaysian students perceive and react to OHW for mathematics or any other subject. Therefore, this study investigates the attitudes of students who use the online homework tool MyiMaths in a Malaysian secondary school.

Significance of the study

The purpose of the study is to investigate students' attitudes toward the use of online homework. Understanding students' attitudes toward mathematics OHW may enhance the performance of the students in learning mathematics, which increases the potential for students to succeed. This study is expected to be beneficial to stakeholders and mathematics educators who are planning to implement OHW tools in classrooms.

LITERATURE REVIEW

What is OHW?

The terms "web-based homework" or "online homework" refer to any system which has the ability to computerise homework problems in order to provide automatic grading and immediate feedback (Leong & Alexander, 2014). The online homework tool includes features for assessing mathematical skills, taking quizzes, viewing videos, and getting live tutorial help. Internet access is required to do the homework. However, it does not need to be done in a lab setting; students can do their online homework on their own computers. By using the OHW tools the students can achieve the lesson objectives by working out each exercise using the step-by-step option or viewing videos and reading the text. This is likely to build students' confidence and become an important part of their own mathematics learning.

Instructors use the OHW to create the questions, solutions, and feedback and to determine which type of problems to assign and the type of assistance to use (such as videos, working examples, and step-by-step hints). Instructors can also choose the due dates, the number of reattempts that a student gets on a single problem and a timer which helps the instructor see how long each student spends on each problem. OHW can be applied in universities, colleges and schools.

In the current study, the online homework (OHW) platform "MyiMaths" is used for examining students' attitude toward mathematics OHW. MyiMaths can be accessed online at http://www.myimaths.com.

The Benefit of OHW

The aim of using OHW tools is to enable students to complete and submit their homework assignments online and receive immediate feedback. OHW allows students to experience more success in mathematics when they can rework the problem until they get the correct answer. OHW increases students' mathematical understanding compared to traditional paper-based methods (Roschelle, Feng, Murphy, & Mason, 2016). Similarly, students are of the opinion that OHW increases their performance and that it is an effective method of study (Dillard-Eggers, Wooten, Childs, & Coker, 2008). There are many advantages of using OHW for both students and instructors:

(a) For students: Studies have indicated that students like many features of OHW such as: the possibility of multiple attempts, receiving immediate feedback, working at their own pace, and having access to the correct answers after submitting their work (Kelly et al., 2013; Sagarraa & Zapataa, 2008). Research has also shown that students have a highly positive perception of the pedagogical usefulness of online assessment (Roschelle et al., 2016).
(b) For instructors, OHW helps reduce faculty workload. The instructors prefer to use OHW systems because it saves time. OHW also provides teachers a unique opportunity to socially interact with students and keep track of their progress (Artino & Ioannou, 2008).

On the other hand, the barrier of using OHW tool is that most of these tools present questions in the form of multiple-choice questions where the student may guess the answers when they solve the questions. Requiring an algebraic answer necessitates the student to work through the entire problem.

Research on OHW

Albelbisi and Yusop (2018) examined the influence of performance expectancy and effort expectancy factors on students' attitudes toward the use of mathematics online homework. They administered a 15 item, five-point Likert scale instrument to 345 secondary school students (Albelbisi & Yusop, 2018). Findings revealed that there were significant relationships between performance expectancy and effort expectancy and student attitudes toward the use of an online mathematics homework tool (Albelbisi & Yusop, 2018). Meanwhile, Mitchell and Mitchell (2017) conducted a study to investigate the role of OHW in improving students' performance in a microeconomics course. Although the authors did not find a statistically significant impact of OHW on exam scores, with the students' GPA being a significant predictor linking OHW and exam scores. The study concluded that students who get high grades in other courses should be expected to benefit from using OHW in microeconomics courses (Mitchell & Mitchell, 2017). The expected benefits is also supported by Self (2015) who highlighted the effect of using OHW on students' outcomes. The author found that although OHW did not improve student performance, voluntary involvement, as indicated by student access to additional materials available in the OHW tool, did (Self, 2015). In another study, Barnsley (2014) examined the relationship between OHW and academic achievement, persistence, and attitude involving six instructors and 423 students. From the survey, the researcher concluded that instructors who choose online homework can continue to offer it, knowing that students enjoy quick and detailed feedback and have access to online support videos and explanations, which may not be available in traditional paper homework (Barnsley, 2014).

Leong and Alexander (2014) studied how students' attitudes toward using OHW are connected to their mathematics learning and achievement in developmental mathematics courses in a two-year community college class (n=78). They found that low achievers have a more positive attitude toward OHW compared to high achievers (Leong & Alexander, 2014). They concluded that the OHW tools which provide immediate feedback play an important role in student learning and attitudes toward mathematics (Leong & Alexander, 2014). Meanwhile, Halcrow and Dunnigan (2012) who also studied the use of online homework in a college calculus class (n=232). Their qualitative analysis revealed that students felt more motivated to do the graded online homework (Halcrow & Dunnigan, 2012). Students found that OHW motivated them to succeed by re-attempting the questions using online homework (Halcrow & Dunnigan, 2012).

RESEARCH METHOD

In this study of students' attitudes toward the use of online homework, a qualitative method utilising an interview protocol was adopted. Interviews "can produce in-depth data not possible with a questionnaire" (Gay, Mills, & Airasian, 2006, p. 173).

The sample of this study is 25 students from one of the secondary schools in Kuala Lumpur who have experience in using the mathematics OHW tool. All the participants and their parents were given an Informed Consent form to be signed if they agreed to participate in the interviews.

Purposeful sampling (n=25) was used to select participants for the interviews. "The logic and power of purposeful sampling lies in selecting information rich cases for study in depth from small sample size (Patton, 1990, p. 171). Specifically, intensity sampling was used, which is defined by Patton as selecting "information-rich cases that manifest the phenomenon of interest intensely (but not extremely)" (Patton, 1990, p. 171).

Prior to conducting the interviews, participants were given a copy of the questions and they were given a few moments to gather their thoughts about each question that would be asked during the interview. The students were asked about the roles of online homework tools in learning mathematics and whether OHW helped them to understand the mathematics problems. The students were also asked about the aspects that they enjoyed about using the mathematics OHW. The interview questions reflected the students' experience in using the mathematics OHW tool.

The data from the Interview Protocol were transcribed by the researcher and then read through in its entirety. Then, thematic analysis was performed, meaning that "the patterns, themes and categories of analysis come from the data" (Patton, 1990, p. 390).

FINDINGS

Interviews were conducted to evaluate students' attitudes towards the use of mathematics OHW and to understand the aspects of OHW that they enjoy the most while doing their mathematics online homework. The results from the interviews revealed that students' attitudes towards the use of online homework were positive. It was found that students enjoyed doing their homework online and they were more motivated to do homework using MyiMaths.

Each of the interviews was digitally audio recorded; the digital recordings were loaded onto the researcher's laptop. Pseudonyms were given to the students when quoting them in the analysis. All 25 of the students interviewed enjoyed doing homework on MyiMaths and preferred it over doing homework in a textbook. Coding of the interview data revealed four main categories. Table 1 shows a breakdown of how many students commented on each of the coded categories.

Table 1: Interview Coding Results

Categories	Confidence	Focus	Feedback	Convenience
% (out of 25 students)	14	9	17	13

The four categories revealed from the data analysis are as follows:

(a) Confidence: Students enjoyed that they could receive a full mark even if they missed a problem because they could go back and try a similar problem. This gave them confidence.
(b) Focus: This category represented any time the students mentioned that OHW helped them to focus on completing the homework.
(c) Feedback: This category was marked whenever a student said that they enjoyed being able to know immediately if their answer was right or wrong.
(d) Convenience: The last category refers to students' statements that they liked how easy it was to use features of OHW.

Of the 25 students who participated in the interviews, 14 were female and 11 were males. It was the aim of the study to have a bigger sample size to represent in the interviews, but only 25 students came forward to be interviewed. The main reason for this was that the interviews took place towards the end of the school year and students were busy after school, and it was logistically difficult for some of the students to be interviewed as many of them had other obligations.

DISCUSSION

The four categories derived from analysing the interviews are discussed in the following sections.

Feedback

The students reported that they liked the immediate feedback that was given when doing homework and assessments online. Student #11 explained that "I would rather to do my homework using MyiMaths because it is telling you that your answers are right or wrong. You can try it again until you get it right." Similarly, student #7 pointed out that MyiMaths made them feel better about learning mathematics "because it is helping me to learn a lot of how to do mathematical problems, it also helps me to re-do the wrong answer and fix it." Student #2 also noted that they had done well in mathematics because of MyiMaths, saying "When we use MyiMaths we are able to see what like we are doing wrong and what is right, so, we are able to change the answer and like to find out what is wrong and learn from it." Student #16 noted that "MyiMaths helps and provide the opportunities to try and fix incorrect answers."

These students highly preferred the software's ability to provide immediate feedback for their answer and determine whether it was right or wrong. The feedback given encouraged students to continue working on a particular mathematical problem until they could get the right answer. This finding is supported by previous OHW studies which indicated that students have positive attitudes toward the OHW tool because of the immediate feedback that helps to improve student learning (Leong & Alexander, 2014). Roschelle et al. (2016) also highlighted that introduction of OHW is a promising way to improve the feedback process and effectiveness of homework.

Confidence

The students reported that they liked OHW because they become more confident when OHW features help them to get a perfect score. Student #3 stated that "I was going to say that using OHW gives you confidence. You can try new problems as many times as you want until you get a full mark. If you keep getting it wrong, you can view an example of the problem." Also, student #13 stated, "you did not have to worry about your grade, you can get 100% easily if (you) want."

These students felt that OHW improved their confidence because they were able to attempt any homework problem as many times as necessary in order to get a correct answer. They can examine similar problems using different figures until they get a perfect mark. Peng's (2009) study supported this finding which showed that online homework could have positive effects on students, whereby most of the students felt that the experience was beneficial.

Convenience

Numerous students commented upon the convenience of OHW, which has easy-to-use features such as seeing examples that are tied directly to what they are learning. Student #1 shared the following: "I prefer using MyiMaths to do my homework; it is more organised and helped me to be more involved. I would do and complete more homework". Student #3 said, "It is convenient; using MyiMaths is easy to me." Moreover, student #12 spoke about this feature: "It makes you feel better because you can see an example of how to do the problem."

Students are more motivated to accept and use online tools if they perceive that these tools are easy to use and make it easy to learn a subject (Albelbisi, 2019). This result supports Albelbisi and Yusop's (2018) study, which revealed that students prefer using OHW tools if they believe that OHW is easy to use.

Focus

Students also mentioned reasons related to their attitude toward doing their mathematics homework online. Student #20 stated that "I'm really focused on doing homework using MyiMaths. I spent more time doing more math problems on MyiMaths than I would have in the book." The students preferred to do mathematics homework online because they could focus on completing the assignment. Students were able to focus and receive help in situations where they would normally get stuck. This result is consistent with Morgan's (2013) study, which indicates that students prefer to use OHW tools when they believe that using them requires less effort.

CONCLUSION

Online homework plays an important role in improving students' attitudes toward mathematics learning, possibly because of the immediate feedback that advances student learning (Albelbisi & Yusop, 2018). Students with negative attitudes toward mathematics in high school took fewer mathematics courses in college. In this regard, it is necessary to encourage students to develop positive attitudes toward mathematics at the secondary education level. Thus, using online technologies such as OHW contribute to improve students' attitudes toward mathematics and encourage them to work harder on mathematics learning. From the interviews, this study indicated that the overall attitude toward OHW was positive; the students enjoyed doing their mathematics homework online. OHW features have promoted the students to complete more homework and consequently, succeed in mathematics learning. The finding of this study should be useful for mathematics instructors to encourage them to adopt online homework tools as an instructional and assessment tool. It is suggested that future studies expand the scope of such research into cross-country and cultural comparison to better understand students' attitudes toward the use of OHW in mathematics learning.

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