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Online Homework Assignments: Instructor's Perspective and Students' Responses

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Online homework assignments: instructor's perspective and students' responses

Introduction

With the continuous development of technologies, creating online homework assignments becomes possible. For large classes, online homework assignments can address problems, comparing to paper assignments, such as delay in feedback given to students. From the instructor's point of view, online homework assignments have a potential to provide students with instant feedback and multiple practice opportunities. However, how do students feel about online homework assignments? Are there any issues? I (the course instructor) have conducted a survey after implementing online homework assignments in a large engineering class for one semester. This paper discusses students' responses to online homework assignments, and the underlying practical and pedagogical aspects of online homework assignments. I hope this study would promote further discussions among educators and technology specialists on how to maximize the potential benefits of online homework in university educational settings.

Literature review

It is commonly believed that learning takes place during doing. Homework assignments, as a means of practice, remain an important instructional tool for decades in K-12 and college education.[1-3] Through setting up homework assignments at a proper level of difficulty, instructors communicate expectations with students and guide students' outside class learning; whereas by completing homework assignments, students review course material, practise problem solving techniques and develop analytical and critical thinking skills. Grading homework assignments also provides instructors an opportunity to assess students' learning outcomes and to identify challenging topics for the class.

In the past, paper homework assignments were collected and graded manually by instructors or their teaching assistants (TA). Due to an increased number of students in class and limited teaching resources in many universities, grading paper homework assignments becomes time-consuming, resulting in delays in feedback. This problem of paper homework assignments is common in large classes.[4-8] On one hand, instructors face challenges to mark a large number of assignments in a relatively short period of time; on the other hand, timely feedback plays an important role in student learning; it allows students to recognize and correct misconceptions early during learning. Without timely feedback, misconceptions could stay within students along the way, making future learning more difficult.

The problem of delayed feedback in paper homework assignments might be solved with online technologies. Various online systems have been developed for teaching and learning in the past couple of decades. Some systems enable an entire course to be hosted online such as Moodle;[9] while other online systems are designed mainly for homework submission and grading, such as WeBWork[8,10] and Hpcs[11]. Publishers also create e-textbooks and corresponding online learning platforms, which allow automated submission and grading of homework assignments.

However, can online homework provide students desirable learning outcomes? Various answers were found in the literature. For example, Zerr[6] reported a positive impact of an online homework system in Blackboard on student engagement. WeBWork[8] has been used for calculus and algebra classes in several studies; some studies[10] showed improved performance on final exams, while others[12] found no difference in performance between students using WeBWork and students doing homework on paper. Parlocsay and Stevens[4] compared textbook-based homework assignments with three automatic web-based homework delivery systems for undergraduate business statistics courses; they found that the delivery methods made little difference on student performance measured by GPA. Bonham's study[13] on introductory physics also indicated no significant difference on exam performance between groups completing homework online and on paper. However, Dufresne's study[14] on a large physics class suggested that replacing paper with online homework assignments improved the exam scores.

Despite the mixed results in the literature, many studies appreciate the common benefits of online homework assignments, such as ease of use, flexibility, multiple attempts on problems and immediate feedback. These features may have an impact on student motivation[15]. A study[7] on students' attitude and mathematics achievement conducted for a community college showed that low to moderate performing students responded more positively towards doing online homework compared to high performing students. This finding is similar to that in Wooten and Egger's study[16] for students in accounting classes. The lower performing students preferred the online homework, possibly because the online homework provided them multiple opportunities to correct mistakes. This possibility of achieving a gradual success may increase the confidence of those students in learning.

Methods

In this study, weekly online homework assignments were given to students in a sophomore engineering fluid mechanics class. This class has 175 students. The major problem of paper homework assignments in such a large class is the delay in feedback, and the resulting disconnection between students and me (the course instructor). For example, it usually takes 2-3 weeks for students to receive graded paper homework. For students, it is difficult to monitor their progress in learning without feedback; at the same time, it is also difficult for me to adjust my teaching strategies timely without realizing students' problems.

To overcome this drawback and truly engage students in learning through homework, I started to explore the option of online homework. Many publishers provide online teaching and learning environment, which may consist of e-textbook, question bank, grade book, and analytical and reporting tools. From the instructor's point of view, these features have a great potential to provide students personalized learning experience because:

(1) Students have multiple practice opportunities. The instant feedback of the online system allows students to appreciate their achievement, and to correct their mistakes in a timely manner. Figure 1 illustrates an online homework question in this study. The buttons "Check my work", "Hint", "Solution" and "Guided solution" allow students to check their work and perform self-directed studies. The instant feedback may enhance the role of homework as a learning tool.

(2) Analytical and reporting tools provide instructors statistics on overall class performance and individual progress. Figure 2 shows sample statistics generated by the analytical tools of online homework in this study. These data can help instructors identify student challenges, monitor student workload, and evaluate their own teaching styles.
(3) The online homework saves time for both students and instructors, as the process for assigning, collecting, grading and distributing homework is automatic.

For these potential benefits, I switched from paper to online homework by using the textbook publisher's online learning environment. All the assignment questions were chosen from the publisher's question bank, and were of multiple-choice, fill-in-the-blank, or numerical answer types. Students were given three chances to do each homework assignment; and all homework assignments were set to release different questions for different attempts.

To understand students' viewpoints, I conducted an anonymous survey at the end of the semester. The survey focuses on (1) students' perceptions on online homework assignments at the beginning and end of the semester; (2) the value of the help buttons in student learning; and (3) students' opinions on the online versus paper homework assignments.

One limitation of the study is that the student perceptions data of online homework assignments prior to the course were not collected. Whether their perceptions were biased by their experiences over the course of the semester is thus unknown.

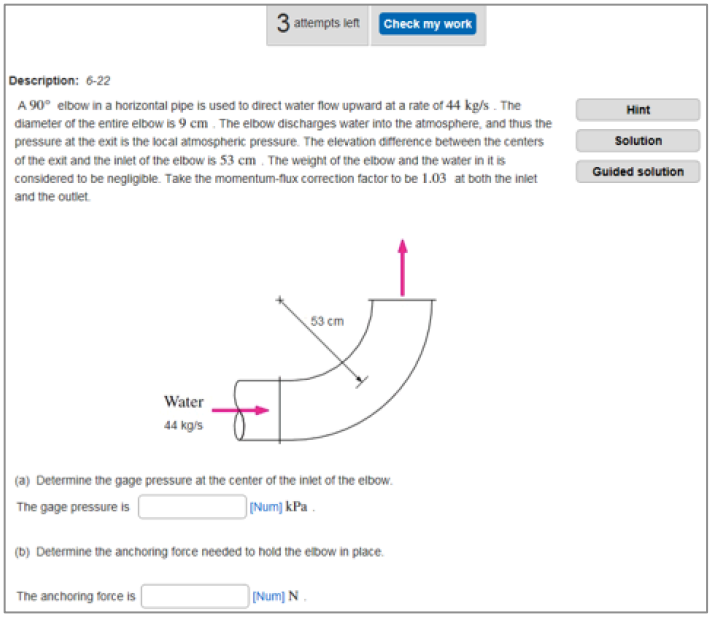
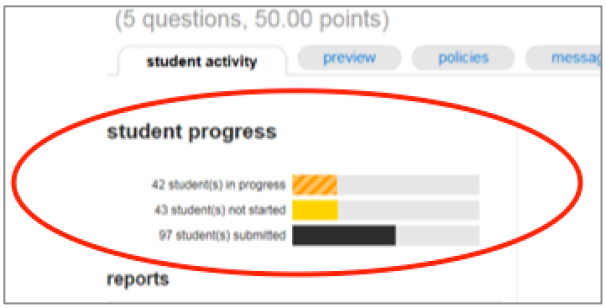
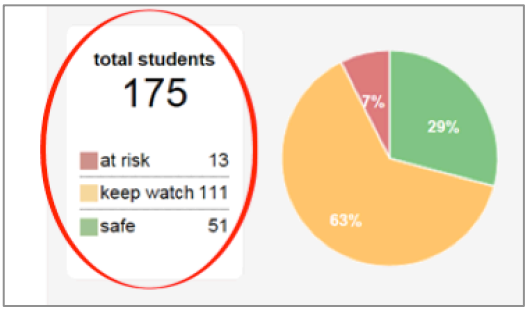


Figure 1: Sample homework assignment question



(a)



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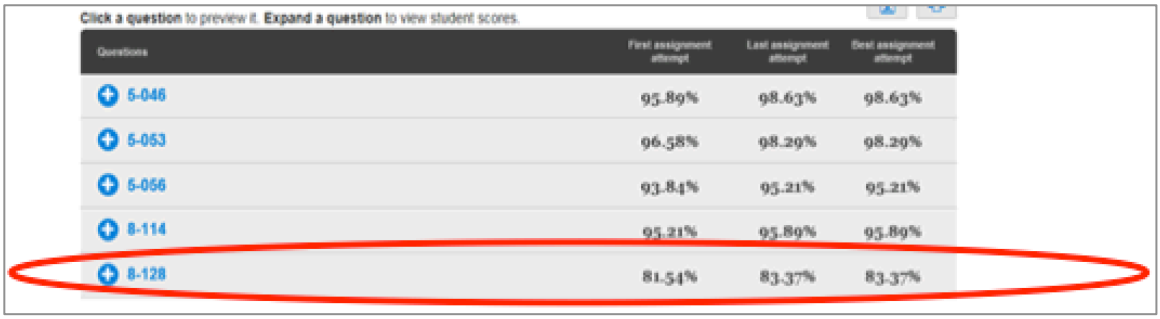

(c)

Figure 2: Statistics of a sample homework assignment generated by the online analytical tools. 2(a) gives statistics of student progress in an assignment; 2(b) separates students in different performance groups; and 2(c) provides class average for each question and each attempt.

Results

A total of 33 students responded to the survey. The response rate is about 19%. Figure 3 shows the disciplines of the survey participants. The majority of them are from mechanical and civil programs; in both programs, fluid mechanics (the course in this study) is a core course. 77% of the survey participants purchased e-textbooks with access code and 23% purchased printed textbooks with access code. Students must purchase the access code in order to do the online homework assignments.

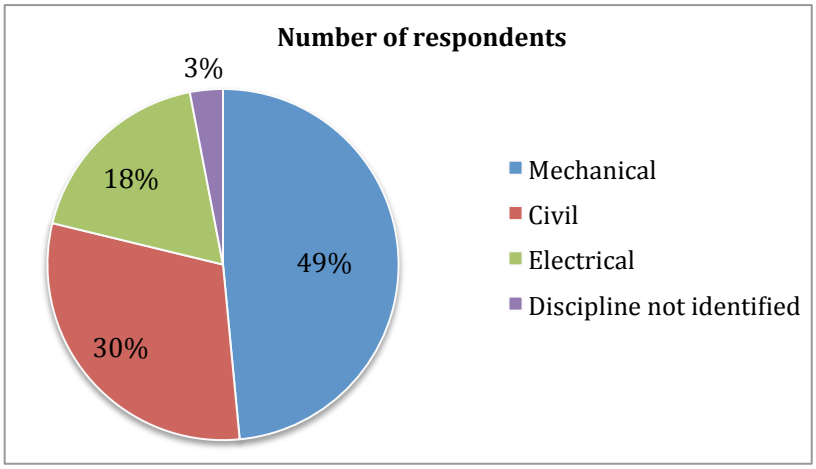

Figure 3: Disciplines of the survey participants

Figure 4 compares the student perceptions on the online homework assignments at the beginning and end of the semester. At the beginning of the semester, over 90% of the class were not in favour of the idea of switching from paper to online homework assignments. Only a limited number of students indicated an interest in online homework. The major concern from students was the cost of the e-textbook and the associated access code. Another concern was the limited access to the e-textbook (1 year in this case), as some students wanted to use the same book for future studies and projects. A number of students also mentioned their previous bad experience with online homework in other courses. At the end of the semester, students showed an increased interest in online homework. About 57% of the student participants indicated not in favour of the online homework, compared to 90% at the beginning of the semester. Some students (18%) showed a change from "0" (don't like at all) to "4" (mostly like) or "5" (strongly like) on the Likert scale.

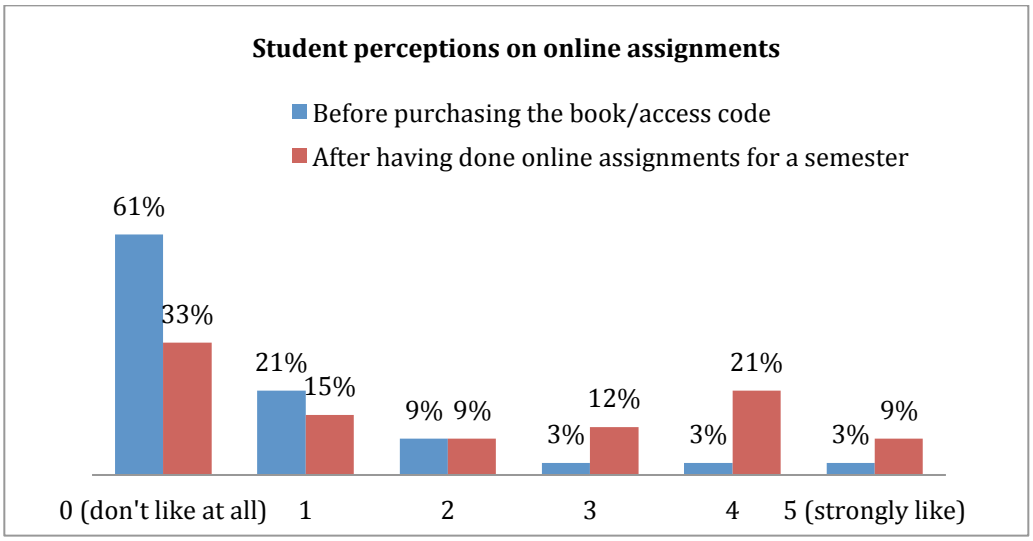

Figure 4: Comparison of student perceptions on the online homework assignments at the beginning and end of the semester

The online homework in this study allows students to click "Check my work", "Hint", "Solution" and "Guided solution" when they need help. The survey collected information on how often students used these help buttons and how useful they were during learning. Figures 5 and 6 show the data. The majority of the students (79%) used the help buttons regularly when working on their homework assignments. Close to one-third of the students used the buttons for every assignment. Although a small number of students found these buttons of little use, 76% of students found the buttons extremely or significantly helpful. Such feature of immediate feedback explains students' increased interest in online homework assignments. Despite the advantage of instant feedback, 61% of students still preferred paper to online homework assignments at the end of the semester, and this preference was seen in all three disciplines (see figure 7).

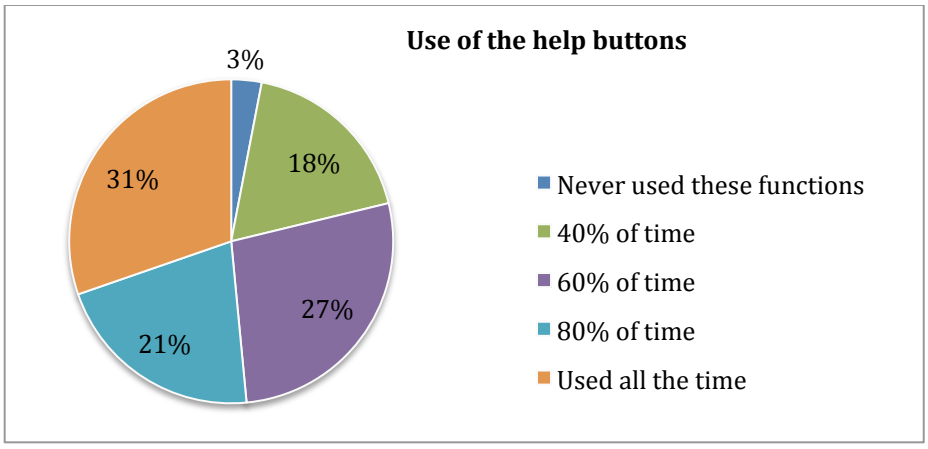

Figure 5: Student response on how often they used the help buttons

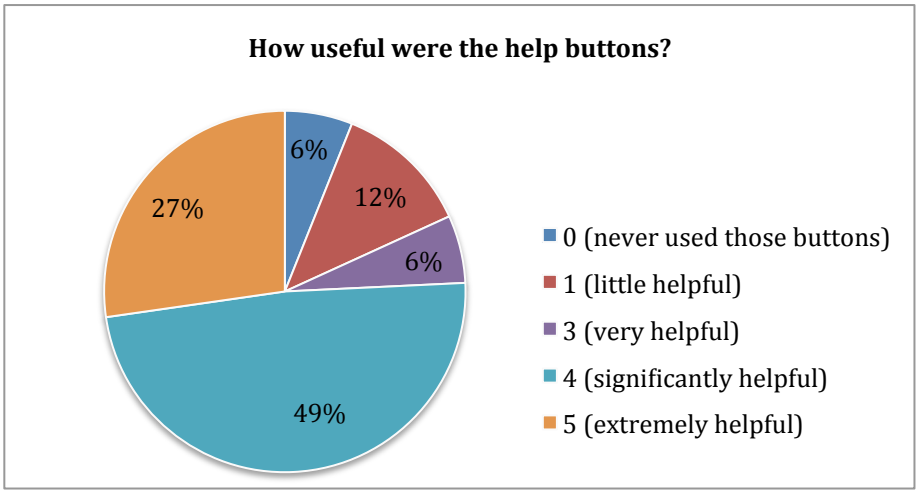

Figure 6: Student response on how useful the help buttons were

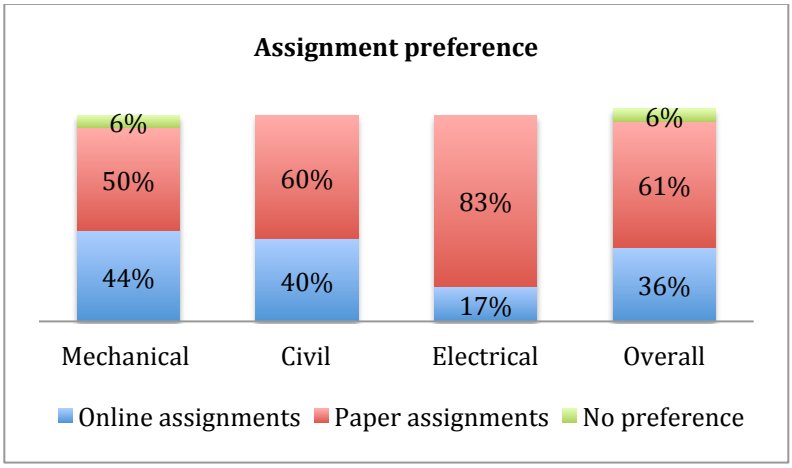

Figure 7: Students' preference on assignments

The survey asks students to comment on their most and least favourable aspects of the online homework in comparison to paper homework. Students' comments are further analyzed and summarized to gain insights into the issues that prevent the online homework from being widely accepted by students in this study, see Table 1. Although students appreciated the advantageous features of the online homework such as automatic grading and feedback, link to online resources and ease of use, they didn't like the cost associated with the online homework and the frustrations that they experienced during the process of dealing with content errors and system glitches. Some students wanted TA to grade assignments on paper because TA was able to check errors on the final answers, as well as make comments on the exact wrong steps. In addition, TA's grading rubric could give them an idea on how exams would be graded.

Table 1: Students' comments on the online and paper homework assignments

	Online homework assignments	**Paper homework assignments**
Liked	• Quick feedback; help buttons provide instant assistance and direct access to worked out solutions • Automatic link to online resources for self-guided learning • Multiple chances to attempt questions • Easy to submit assignments • Instant grades; no discrepancies in grading; easy to track grades • No paper; save trees	• No additional cost for doing assignments • TA grades assignments more accurately, and can add comments on wrong procedures/answers. • Students practise solving problems in the same format as they will do in exams

Didn't like	• Very expensive
	• No check on solution process; no tolerance on small errors; only final answers count
	• Content errors; inconsistent wording and notations in questions
	• Technical problems
	  • Not always compatible with different operating systems
	  • Glitches in system
	• Require internet; cannot do assignment when internet is down
	• Frustrations and time wasted when things went wrong
	• Possibility of cheating
		• Delayed feedback
		• Hard to track assignments and grades

Students' wish list for online assignments is summarized as follows:

1. Reduce the cost: make it free or of minimal charge
2. Improve the technology
    - Fix glitches so that students will not waste time and can focus more on learning
    - Add 'auto save" feature so that students will not loss their work
    - Make the system more reliable and compatible so that students can do assignments on different devices

3. Integrate written work into online assignments so that the thought process can be checked
4. Make online assignments optional for practice and keep paper assignments for grading

The final exam grades are used to measure the impact of the online homework on student overall learning. Two consecutive years, 2013-14 Term 2 (online homework assignments) and 2014-15 Term 2 (paper homework assignments) are chosen for the comparison because (1) both exams are cumulative and cover the same concepts; (2) both are three-hour exams and have nine questions in total. The 2013-14 Term 2 exam consists of five short-answer conceptual questions and four long-answer analytical questions requiring step-by-step calculations, whereas the 2014-15 Term 2 exam consists of four short-answer conceptual questions and five long-answer analytical questions; (3) the two class sizes are comparable with 175 students in the 2013-14 Term 2 and 181 students in the 2014-15 Term 2. Figure 8 shows student letter grades in these two exams. Although the student overall performances in the two exams are similar, the 2013-14 Term 2 sees a larger percentage of students achieving B+ and above than the 2014-15 Term 2. The percentage of students in grades D and F is also lower in the 2013-14 Term 2. As a result, the 2013-14 Term 2 class achieved a higher exam mean (77%) than the 2014-15 Term 2 class (74%). The online homework assignments in the 2013-14 Term 2 might contribute to the shift to higher letter grades in the final exam, as these online assignments tend to promote self-directed learning and timely reflection. One limitation of the comparison is that the two exams are not exactly the same. It is difficult to filter out other factors, which might influence the exam performance such as the variations in exam questions and the diversity of students. Despite this limitation, it is positive to conclude that the online homework assignments can engage students in learning in a better way than or at least in a similar way as the paper homework assignments.

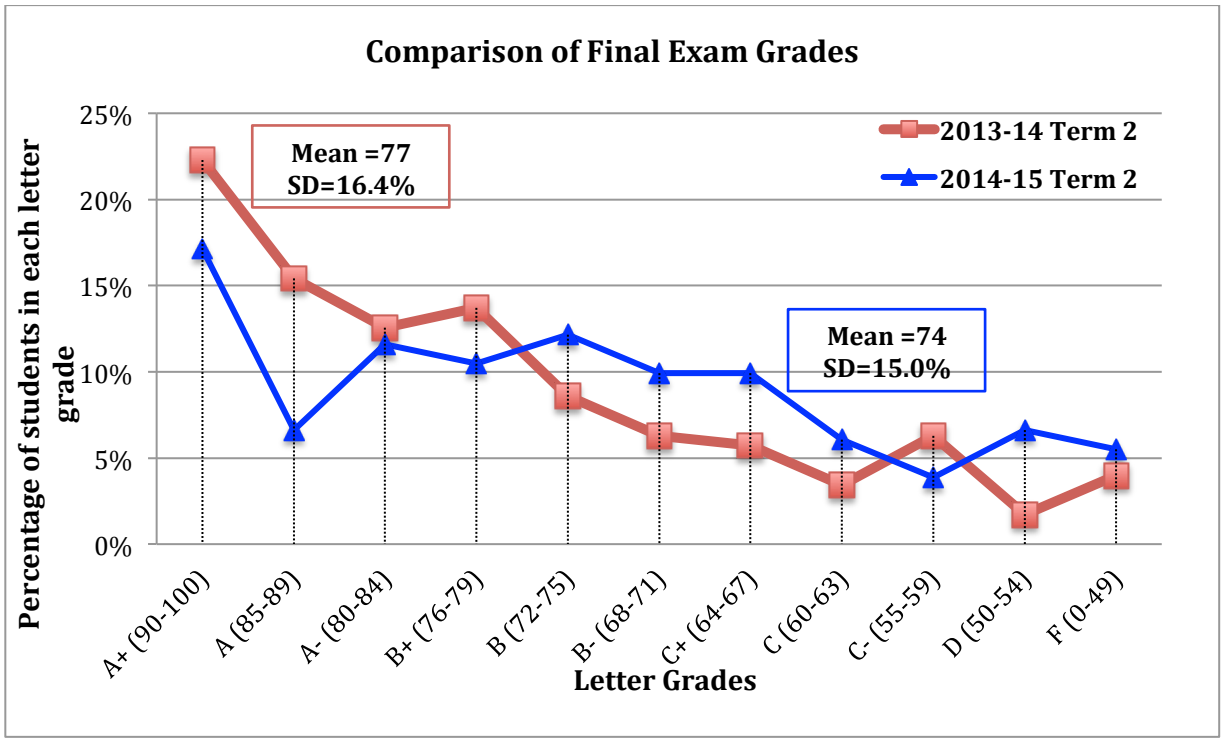

Figure 8: Comparison of the final exam grades in two semesters: 2013-14 Term 2 (online homework assignments) and 2014-15 Term 2 (paper homework assignments).

Discussion and conclusion

This paper discusses the instructor's perspective and student responses to online homework assignments in a sophomore engineering class. The impact of the online homework on student learning is measured with the final exam scores. It is found that the online homework can help engage students in self-directed learning outside class, which contributes to an improved student performance in the final exam.

Despite this, online homework was not widely accepted by students. Cost is one of the major deciding factors. Although students generally appreciate the benefits of online homework assignments, such as the accessibility, convenience, flexibility, and instant feedback, these benefits cannot justify the high cost associated with the online homework assignments. Future effort should be made to design affordable online homework systems.

Technical flaws are the second major factor that prevents students from choosing online homework assignments. Technical flaws not only cause anxiety in students, but also increase the amount of time that students must allocate for completing the online assignments. Such frustrations distract students from focusing on specific learning objectives. Many students, for this reason, prefer paper assignments to online assignments. Student frustrations due to technical flaws are also found in other studies[7] in the literature.

In addition to addressing students' social-economical constraints and technical flaws in online homework, instructors must also think about this question: what feedback from online homework assignments can help foster student learning? Research shows "goal-directed practice coupled with targeted feedback are critical to learning."[17] In other words, an effective feedback must retain two features: good timing and valuable content. Online homework can provide timely feedback especially for large classes and distance learners. However, many online homework assignments (e.g., in this study and in other studies in the literature[7]) fail to retain the feature of effective content. Only final answers were checked, and there was no mechanism to check students' thought process in problem solving. The current right/wrong type of feedback is not sufficient for complex engineering problems. How to improve the quality of feedback in online assignments is a challenging topic and worth further studies.

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