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Strategies for Using Technology When Grading Problem-Based Classes

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Strategies for Using Technology when Grading Problem-Based Classes

Abstract

More and more work is being done today using technology. Email and digital drop boxes are useful tools for professors; however the challenge comes when one is teaching a quantitative class. The issue of using technology to manage work in a quantitative class is increasing as more engineering programs embrace distance education. In this paper we will review the advantages and disadvantages of several methods of collecting, grading, and returning homework assignments to students. The techniques considered include faxing, PDF grading using a Wacom Tablet, and various email approaches. Student survey results are also included in the paper.

Introduction

Many instructors consider grading as a necessary evil. Winger[4] discusses the importance of grading and how regardless of any lofty educational goals we may espouse that our grading practices truly reveal what we value. Graded homework is an opportunity to provide feedback to students as they are just learning material. It is an opportunity to correct misconceptions or a lack of understanding, often with less impact on a student's grade (see Scriffiny[3]).

For the instructor, however, grading homework can feel like drudgery. It is required to not only mark the work, but to record it and return it to students. Technology provides instructors with different methods of grading and returning homework. Some instructors have incorporated technology to be more "green" by eliminating the requirement to print homework on paper. Other instructors have adopted technology out of necessity to communicate with remote distance education students.

In this paper the authors will discuss the advantages and disadvantages of various technologies to grade and return feedback to students. Each of the authors has a different approach and has taught classes that have a combination of on-campus and remote off-campus students. We also present the results of a student survey discussing their preferences.

Survey

An anonymous online survey was sent to a group of students from one authors' classes. These students were towards the end of their MS degree class work and had taken classes from a variety of professors who used varying approaches to grading homework. The class instructor used course management software for the classes. We received 22 responses, 14 were distance students and 8 were on campus students. The gender of the respondents was 8 males, 16 females, and 2 who did not disclose. The rate of female students is higher than the typical make-up of our

student body. The students were asked about six methods of managing homework. These are listed in Table 1.

Hand Marked	The professor hand marks the papers and returns them in person or via fax
Email Comments	The professor emails comments to the student concerning the work, but the comments are not directly on the work
PDF	The professor marks the homework, converts it into a PDF and emails it to the student, a tablet device was used with this method
General Solution	The professor provides a grade and a general solution to the homework, but no specific feedback is given
Grade Only	The professor provides only a grade with no other feedback
Course Management	The professor uses a course management software package (such as Blackboard) to collect, grade, and return homework

Table 1 – Grading Methods Considered

There are advantages and disadvantages for each of these methods. Hand marked is the classical approach were paper copies are collected and specific feedback is marked on each paper. The papers copies are then returned to the students, often at the beginning of the class period. The email comments approach has the advantage of providing specific comments to the students in a timely and convenient fashion. However, the since comments are not made directly on the paper instructors often have to type detailed explanations such as "in problem 2 your objective function should be stated with minimize rather than maximize." In other methods the instructor would simply cross out "max" and write "min".

The PDF method combines the advantages of the traditional mark up method with the advantages of technology. The students receive an email with a marked up PDF copy attached. They get specific comments on their paper and the professor does not have to spend class time returning the work. The disadvantages of this method depend on the technology used. The most time intensive approach is when the professor marks a paper copy and then scans the work into a PDF. If the scanner is handfed a sheet at a time this becomes very time consuming. An automatic feeding scanner can speed up the process but still requires a paper copy of each homework assignment. If the homework is submitted electronically the students' work can be marked directly using a tablet device without the time and paper requirement of printing the work.

The general solution method is a time saving approach. The instructor creates a detailed solution for all of the students and the only individual feedback students receive is their grade. If for example, a student makes 7 out of 10 on a homework assignment he or she would have to compare their work with the solution to find their mistakes. The grade only method provides even less feedback to the students. They receive their grade but no specific feedback. It is a time saving approach and maybe appropriate for homework that is not challenging for the students.

Examples might be if the students are assigned to write a brief opinion statement or to find an application of something covered in class.

The final method we titled course management. This is the method used by the instructor for the classes that were surveyed. While this could potentially have biased the students' feedback it eliminated the challenge of defining specifically for the students what the method entailed. The university uses a course management software package, Blackboard. In this system students can electronically submit work. This has an advantage over email in that the software tracks when an assignment was submitted reducing the arguments over "lost" homework assignments. The instructor also has all of the assignments located together in the system rather than scattered in the email inbox. The instructor replies directly to each student in the system and posts their grades in an electronic grade book that the students can review.

In the survey the students were asked their preference on a five point Likert scale to rate each of these methods. The numerical results are presented in Table 2. Open ended questions were also used to collect student comments on the various methods.

Preference	Hand Marked	Email Comments	PDF	General Solution	Grade Only	Course Management
Strongly dislike	3	1	0	1	12	0
Dislike	5	0	0	2	4	0
Neutral	10	6	5	8	5	2
Like	1	11	10	10	1	5
Strongly like	3	4	7	1	0	15

Table 2 – Student Preferences

Analysis

The survey results show the students' interest in getting feedback concerning mistakes they made on the homework. The option of only providing a grade on the assignment was disliked by the students (73% disliked or strongly disliked, 23% neutral, and 4% liked). Hand mark was less popular than the remaining. For local students the issue may be the time required to receive the feedback and the amount of time during class required to return the graded papers. A distance student commented, "Fax communications are not convenient for anyone." Another student expressed concerns about the lack of privacy related to fax machines. In many offices a wide variety of people share a common fax machine and papers sent via fax machine can be seen by numerous people. This is of particular concern if a student is struggling with the course material. The remaining methods (email comments, PDF, general solutions, and course management) had

a similar level of acceptance from the students. This led us to the conclusion that the method chosen should be a function of convience.

Other Considerations

In the traditional grading process, an instructor marks the set of homework assignments and then records the point values at one time in a grade book or spreadsheet. Many of the technology based methods require the instructor to open and close different screens on the computer. As the number of students in the class increases this can become more and more time consuming and the potential for errors can increase. One of the authors has solved this problem by using a very large monitor that can have the homework and virtual grade book open at the same time on the same screen. Another author has started using a two monitor setup. This allows her to read the electronic homework on one screen and then record it immediately on the spreadsheet on the second monitor. This approach saves time in transferring grades since the instructor is not repeatedly opening and closing computer screens.

Many campuses have adopted "green" initiatives to reduce use of paper. The methods discussed have varying levels of being "green". Faxing homework is the most paper intensive. A single problem can require three sheets of paper. The student does his or her work on paper, faxing it to the instructor generates a second page, and the returned fax is then a third sheet. If cover sheets are used this is further increased. There are also phone expenses associated with using the fax machine. The use of email, PDF (if it is all done online), and the course management software can significantly reduce the amount of paper used by the students and the faculty. Electronic work also has the benefit of easily saving work examples for ABET assessment and related activities.

A key consideration is always how or if a technology will impact learning. Bonham et al[1,2] did an extensive study comparing the performance of a group of undergraduate students in physics and math classes when homework was graded by hand in the traditional manner and done online with computer generated feedback. The students with the web based homework did slightly better than the paper based homework, however, the differences were not statistically significant.

One of the authors uses a tablet input device to allow hand written marks on homework without having to print the work on paper. Figure 1 shows an input device that was used to grade. The Wacom Tablet connects to any computer. The instructor uses an input pen and marks the work. The graded homework is then saved as a PDF and emailed to the student. Figure 1 shows the tablet and an example of comments that were made on an assignment using it.

The course management software was perceived very positively by the students. Blackboard (see www.blackboard.com) is used at our university. There is a great deal of variability between the software packages and the approach that different instructors use. The software can be used as a collection and distribution method or homework can be given online with the software grading and recording directly.
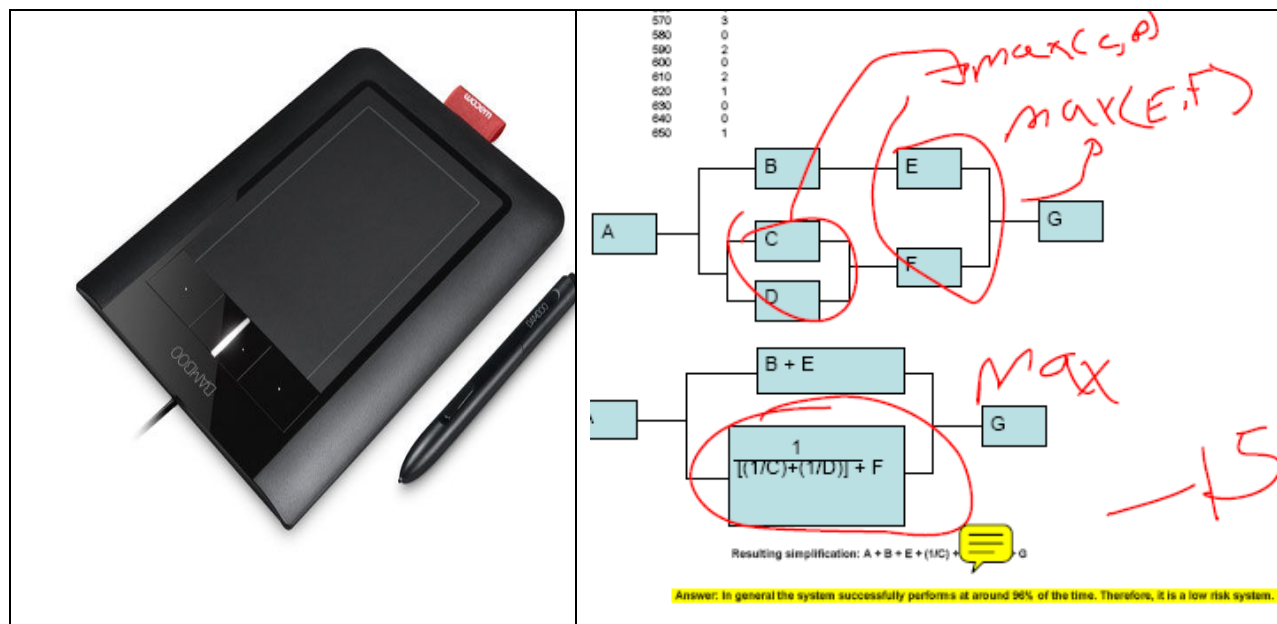
Figure 1 – Wacom Tablet and Sample of Graded Work

Conclusion

One student's comment on the survey summarizes the student perspective, "Any feedback is appreciated. Any way you deliver it, just let me see what I did wrong and what the solution should be." So, as faculty we can feel comfortable in selecting the method of grading and distributing homework that is most effective or convenient for us. Given the wide variety of tools, both software and hardware, most of us can likely improve the method we are using and reduce the amount of time required in the grading process.

References

[1] Bonham, Scott, R.J. Beichner, and D.L. Deardorff, (2001), "Online Homework: Does it Make a Difference?", *The Physics Teacher,* 39(5), pp. 293-296.

[2] Bonham, S.W., D.L. Deardorff D.L., and R.J. Beichner, (2003), "Comparison of student performance using web and paper-based homework in college-level physics." *Journal of Research in Science Teaching,* 40, 1050-1071.

[3] Scriffiny, Patricia, (2008), "Seven Reasons for Standards-Based Grading", *Educational Leadership*, 66(2), pp 70-74.

[4] Winger, Tony, (2009), "Grading What Matters", *Educational Leadership,* 66(11), pp. 73-75.