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Improved Pedagogy Enabled by Assessment Using Gradescope

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Abstract

As engineering educators, one of our most important, but often least liked, roles is that of grader: creating assignments to develop and measure proficiency on fundamental skills, providing effective feedback on those assignments, and assigning a fair and meaningful grade representing achievement. In our role as graders, we must often balance our desire to provide the most formative practice-feedback experience with the amount of time it takes to grade.

The web-based tool Gradescope supports grading quickly, equitably, and flexibly while providing detailed formative feedback to students. I have used this rubric-based digital grading tool on exams in two upper-level mechanical engineering courses over two successive cohorts and want to share key features that may appeal to both new and experienced engineering educators to support improved pedagogy. These include the ability to:

- grade student submissions online in any location,
- change the point value associated with a particular mistake once and apply to the entire population,
- quickly reference similar mistakes instead of rewriting the same comment,
- retain a digital record of the student work, and
- return feedback digitally outside of classroom time.

The online rubric-based grading tool can facilitate feedback that is prompt, equitable, explanatory and formative. Such tools can inform opportunities to re-teach and re-test in a learning outcomes-based environment. Finally, these tools may streamline the process of sampling for ABET outcomes assessment. Using this model, engineering educators can transform how effectively they grade and give feedback in their courses.

Introduction

As engineering educators, one of our most important, but often least liked, roles is that of grader: creating assignments to develop and measure proficiency on fundamental skills, providing effective feedback on those assignments, and assigning a fair and meaningful grade representing achievement. In our role as grader, we must often balance our desire to provide the most formative practice-feedback experience with the amount of time it takes to grade.

Characteristics of effective feedback include that the feedback on student work is prompt [1], trustworthy/equitable [2], explanatory [3], and aimed at identifying and resolving the gap between current and desired performance (ie, formative) [4-7].

However, meeting many of these aspects of effective feedback takes a great deal of instructors' time. A 2014 study on faculty workload at Boise State University found that faculty across all ranks typically work a total of 60 hours a week, and that 11% of that time, or approximately 6 hours a week on average, was spent on grading [8]. For many faculty that are new instructors, that teach large courses, or that teach at undergraduate-focused institutions without graduate student TAs, the number of hours spent grading may be higher.

Papers presented at past ASEE conferences have provided tips and tricks to streamline the grading process for new engineering educators [9]. In addition, innovations such as an online rubric-based grading tool (Gradescope) can help engineering educators transform how effectively they grade and give feedback in their courses while managing their time-on-task.

Course Context

A rubric-based online grading tool was used to grade midterms and final exams in two mid- to upper-level mechanical engineering courses at an undergraduate-focused, private, regional liberal arts college with an ABET-accredited general engineering program.

The courses were Thermodynamics and Strength of Materials. Each course has an enrollment of approximately 20-30 students. Students' mastery of engineering concepts, problem formulation, and problem solving was developed and assessed with weekly homework assignments graded on completion, along with an individual in-class weekly quiz, and unit exams. This structure represented a layered practice-feedback-assess structure (Figure 1).

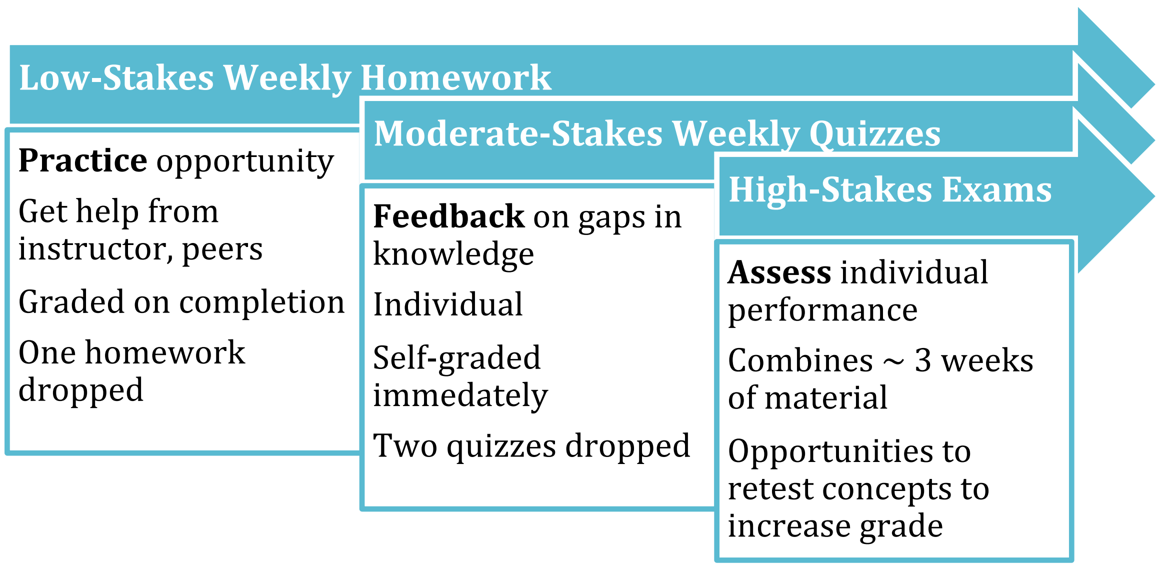

Figure 1. Practice-feedback-assessment structure.

Exams comprised 3-4 problems with multiple parts. All problems required students to show their work and obtain a numerical answer. Some parts of problems asked students to reflect on their answers in a few sentences or predict consequences of changing parameters. Multiple choice, fill-in-the-blank, and true-false were not testing constructs used heavily in these courses.

Undergraduate graders were utilized in checking the completion-based homework assignments and as teaching assistants in the Strength of Materials laboratory. The instructor graded all exams.

Rubric-Based Online Grading Tool

A rubric-based online grading tool (Gradescope) was used in both course offerings to grade and give feedback on exams. The grading tool is based on four fundamental principles of effective and efficient feedback: that it is prompt, equitable, flexible, and formative (Figure 2).

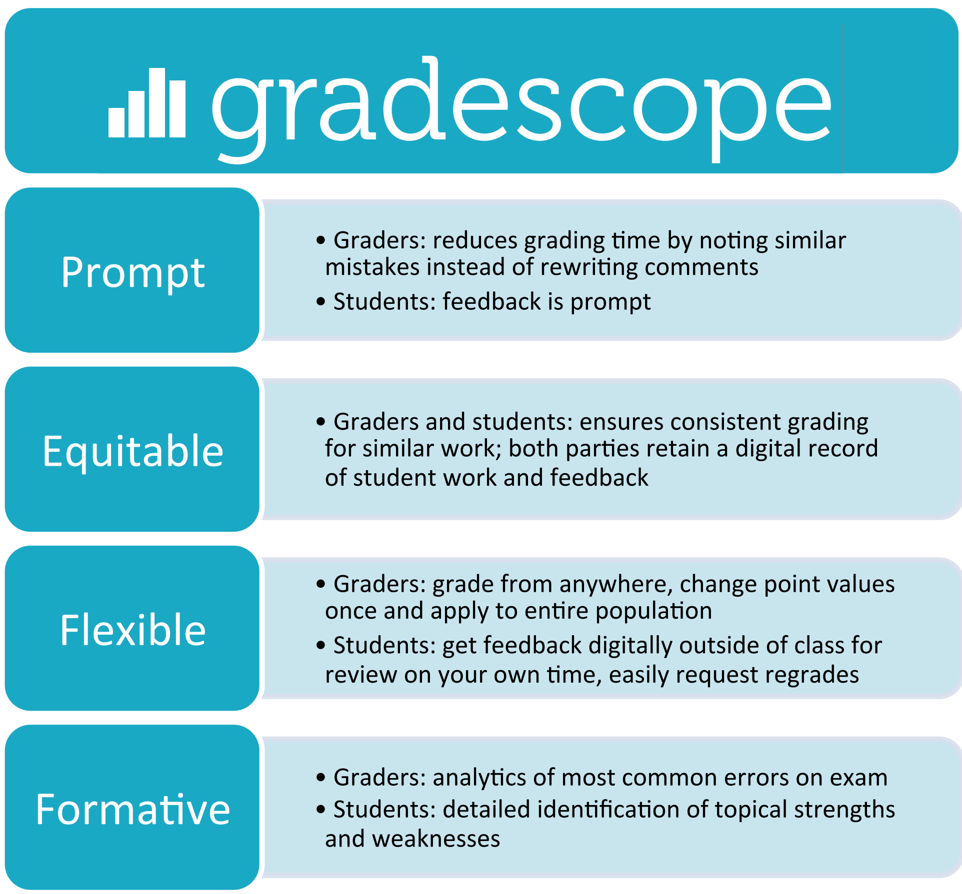

Figure 2. Gradescope is based on four principals of effective feedback - that it is prompt, equitable, flexible, and formative for both graders and students.

Two PhD candidates in computer science at the University of California at Berkeley created Gradescope while serving as Graduate Student Instructors in artificial intelligence courses. They recognized the need for a more efficient way to grade exams in STEM courses. Since that time, Gradescope has received start-up funding and is currently in use in STEM courses at Berkeley, Stanford, and Purdue as well as by instructors in over 300 additional institutions (https://gradescope.com/).

This rubric-based online grading tool has four steps in the grader's workflow (Figure 3). Before entering this workflow, the instructor creates a course and uploads a CSV file with student names and email addresses. The students are invited to join Gradescope and must log in to view their feedback, which ensures the system is FERPA compliant.

Figure 3. Steps in grading workflow (https://gradescope.com/).

A detailed explanation of the logistics of the workflow with examples is shown in the Appendix.

Reflection on Improved Pedagogy

Prompt

The rubric-based online grading tool enabled me to promptly return feedback to the students. Prompt feedback is one of the Seven Principles of Good Practice in Undergraduate Education [1], and is widely suggested as a highly effective pedagogical practice for a number of reasons. Students still remember the exam, their studying process, and the questions they couldn't quite figure out. The syllabus has not moved far into new material before giving feedback and bolstering prior material. When students know their strengths, weaknesses, and approximate grade, it creates a secure rather than anxious learning environment. And finally, as an instructor you show students respect by prioritizing exam grading the same way you ask them to prioritize exam studying. For these reasons, I have almost without fail returned exams the subsequent class period. Gradescope supported me tremendously in meeting that pedagogical commitment.

The grading tool reduced the time to grade exams substantially. While I didn't record my time-on-task from previous years, I know that 1) I spent less time grading, and 2) grading was much more enjoyable. Roughly, I spent less than 2.5 hours from start to finish grading a set of exams. This time consisted of:

- **Scanning exams:** less than 15 minutes for a set of 30, 4-page exams. I divide exams into piles of 5 students, cut off the stapled corner, and send one set through the copier/scanner while preparing the next set and/or stapling back the previous set. I learned to not scan all the exams as one file, as it was sometimes too large to email and troublesome and time-consuming if a jam occurred. Cleanly cutting off the stapled corner greatly helped avoid jams.

- **Setting up the assignment, exam outline, and matching names:** less than 10 minutes for a 3-4 problem, multi-part exam. The ability to drag and upload pdf files, split pdfs into submissions automatically, and have names automatically assigned made this process quick. I learned to ensure my blank exam pdf and the student submissions had the same number of pages (one instance took extra time due to a blank last page that was not present on my exam pdf). I also learned to scan separately any students who used additional pages as those are not easily automatically divided into submissions.
- **Grading:** about 60-90 minutes for a 3-4 question, multi-part, 4-page exam for 20-25 students. This depended on how well students did on the exam, how many errors were made, and how complex the cascade effect from those errors. The ability to change point values associated with a rubric item for the entire population in about 10 seconds reduced my time, and more importantly the effort of trying to hold in my memory similar performance/errors across the cohort of students and the psychological annoyance at digging through a pile of papers to find submissions with the same or similar mistakes.
- **Reviewing, entering grades:** About 15-20 minutes to review the exam statistics, go back and change any point values after seeing the entirety of exam performance, and enter the grades manually into my LMS. Submissions may be downloaded as a batch pdf, but also student performance can be downloaded as an .xls or .csv file.
- **Returning exams:** About 10 minutes. Gradescope provides a template email sent to the entire class with the exam statistics and an opportunity to personalize a message. I also wrote the final grades on the paper exams, and hand them back the next class period for students to review and use to rework problems for some points back.

The time and mental energy saved on grading translated into time and energy I could put into other aspects of effective pedagogy, and made it much easier to meet my aggressive deadline of returning exams by the next class period or within a few days.

Equitable

As instructors we hold ourselves to the highest standards of fairness and equality in evaluating students; however, grading a stack of paper exams makes that challenging. If grading takes a long time, sometimes over multiple days, it is hard to ensure consistency in point deductions for mistakes. Some instructors notice they are harsher in evaluating the first few exams or less accurate in rushing through the last few exams. If the student's name is on every page, it can be hard to separate your expectation of that student from their work. It is difficult to hold in memory all previous errors and constantly compare the severity of previous errors with each new submission. Ensuring fairness and equality has saved me a great deal of angst over grading, and is a major factor in enabling me to grade more quickly, confidently, and enjoyably.

I have found that Gradescope's workflow eliminates many of these challenges. The software is set up to zoom in on the students' work so the name is not seen, and with a simple keypress or click, you go to the same zoomed region for the next submission (Figure A5). This encourages the effective practice of grading one problem for the entire population before moving onto the next. Most importantly, the rubric structure ensures consistency in awarding the same value to the same errors. With each question's rubric items laid out next to one another at all times, it is easy to compare performance and adjust point values fairly (Figure A5).

Flexible

The flexibility to grade anywhere on any computer is certainly a matter of convenience for me as an instructor, and has facilitated prompt feedback for students. For some faculty, paper exams may provide a convenience that needing a laptop and internet connection do not. For me, this is not the case. Furthermore, the flexibility to easily change point values associated with rubric items improves fairness and equality in evaluating student work. But the biggest pedagogical improvement is allowing me the flexibility to return feedback to students outside of class.

Returning paper exams can take a great deal of time in class. FERPA restrictions prohibit the historical practice of students picking up exams from a box or folder outside the instructors office. Instructors may post the final grade on a learning management system, but students do not see explanatory feedback alongside the numerical grade. Most importantly, returning exams in the public space of a classroom creates an anxious environment in which students receive that feedback.

By returning the feedback (and exam grades) digitally outside of class time, students are able to review and process their exam result in privacy at their own pace. This has substantially reduced the anxiety and emotion in class when exams are returned. Instead, I have found that students are more receptive to a discussion about the exam during class when they aren't in the midst of reacting and emotionally processing the returned grade. Additionally, students are in a better mindset to hear and absorb a teaching session to clear up the most common misunderstandings after they have been able to process the feedback individually first.

I acknowledge that there is some emotional risk in students receiving the exam grade potentially alone. However, I'm not sure that a disastrous emotional response is ameliorated inside the classroom. This is a topic that deserves further discussion in another forum, as mental health issues on college campuses increase while resiliency amongst many of our student populations continues to decrease.

Formative

As an engineering educator, I philosophically believe that feedback on my course assignments is primarily to develop students' talent (formative), rather than assess performance to select the best students (summative). My course structures are inspired by a learning outcomes-based approach. I strive to communicate that assessment on quizzes and exams is a way to identify strengths, weaknesses, and gaps in knowledge so that all students in my class can achieve mastery of the learning outcomes for use in future endeavors. However, handing back a graded exam with the primary feedback as a percentage measure of summary performance is anathema to the formative learning outcomes-based approach.

Other tips and tricks are often utilized to help students focus on the formative feedback rather than the overall grade, such as handing back a filled in rubric or a marked up copy of the assessment (exam, lab report) while posting the percentage grade separately in the course management system. Exam wrappers are another strategy to encourage students to reflect on the feedback rather than looking at the grade and putting the assessment away [10].

Gradescope similarly aids in focusing students on the formative aspect of the feedback. The feedback presentation emphasizes the rubric items rather than the grade, and shows all rubric items for full transparency (Figure A8). I have encouraged students to use this feedback to study for the *next* exam by reviewing all the errors that were made on the problems so they can better avoid them in the future. The rubric-focused feedback also allows students to see themes in their errors, such as consistently struggling with units.

Within the rubric-based grading framework, I can easily identify the learning outcomes for a particular topic, and therefore target assignments and student study efforts more efficiently. Instead of providing the right answer, I identify the error and allow students to attempt a similar problem again for credit. This approach underscores the idea that assessment on exams is formative and intended to help students identify and correct weaknesses and gaps in knowledge.

Furthermore, the summary report automatically generated in Gradescope (Figures A6 and A7) provides the instructor immediate formative feedback on how well the class as a whole understood concepts or mastered skills. This feedback can be acted upon to revisit a topic, change the instructional approach for certain material, or devote more time in future course offerings to a particularly challenging concept.

ABET assessment

In addition to grading individual assignments to give formative feedback to students and to calculate an appropriate end-of-semester grade, engineering educators must often simultaneously use assessment of student work to evaluate larger programmatic outcomes for ABET. There are many approaches to ABET outcomes assessment, but many involve reviewing questions on exams, or entire exams, to select exercises targeting relevant outcomes (such as applying mathematical principals, or forming an engineering problem, or evaluating broader impacts from an engineering solution). A meta-analysis must then be performed to look at the student work and determine how many students performed at an acceptable or strong level on the assessment of that particular outcome. For many instructors, this is one of the ongoing ‘housekeeping’ chores at the end of the semester, while some make an effort to evaluate many past courses as part of an ABET self-study.

I have discovered great potential to streamline the ABET process using Gradescope’s ‘tagging’ feature. I was able to create ‘tags’ in Gradescope that corresponded to the ABET outcomes targeted in my course (Figure A9). I could then associate tags with each relevant question with a few simple clicks. Summary performance on each of these tags could then be automatically generated for each exam. Gradescope is also currently developing a feature to generate a file that samples low, medium, and high performance on each exam for ABET reporting. These aspects have the potential to make the ABET outcomes assessment process an automatically generated part of grading student work, rather than a separate additional process.

Student Feedback and Challenges

The first semesters that I used Gradescope, I included a specific question on my end-of-semester teaching evaluations. The feedback I got was highly positive that students liked Gradescope. In subsequent semesters I have gotten more instances of students saying they prefer markings on paper exams. I believe this disconnect occurred because I stopped communicating with students about *why* I was using Gradescope and what it allowed me to do (return exams more promptly, ensure complete fairness, allow students to continue to learn from the exam by reworking problems without the 'right answer' written out to the side). I've had those conversations and respect that some students (and faculty) will always tend to prefer marking up paper exams. However, when I have conversations with students about those issues, they have generally walk away positive, and especially say they like getting the feedback promptly, knowing that it is fair, and processing their performance in private rather than being anxious about returning exams in class.

I also have come to the conclusion that some assignments are more appropriate for Gradescope than others. If I had fewer than about 15 students, I likely would not see an advantage in Gradescope's workflow. I do not use Gradescope for my weekly quizzes (in fact, students self-grade in class as we go over the quiz immediately and then I simply check over and record the grades). For me personally, Gradescope has made exam grading a much easier process, mostly due to the ability to grade remotely with only a laptop, the ability to grade relatively quickly and return feedback promptly, the ability to ensure fairness and easily change point values for the entire population, and the ability to streamline my ABET assess process for the course.

Conclusions

Engineering educators must balance time-on-task spent grading versus implementing best practices for effective feedback. Innovative approaches such as using an online rubric-based grading tool can facilitate feedback that is prompt, equitable, explanatory and formative. Such tools can inform opportunities to re-teach and re-test in a learning outcomes-based environment. Finally, these tools may streamline the process of sampling for ABET outcomes assessment.

Disclosures

As the primary author of this paper, I would like to disclose that I have received no funding from Gradescope or other sources. I approached the Gradescope team with the idea for this paper because I was so impressed with their online rubric-based grading tool and wanted to share it with other engineering educators, particularly those at small institutions that may not hear about it otherwise. Gradescope subsequently agreed to collaborating on this paper.

The co-author is the CEO and co-founder of Gradescope. We hope that our collaboration models an effective academic-industry partnership. Gradescope is currently operating under a profit-generating model to ensure sustained improvement and maintenance of the tool. At the time of publication, the inaugural five faculty at each institution to register and use the tool receive a lifetime basic version of the software for free. Outside of that, the basic version described in this paper is currently $1 per student per course, following a two-term free trial for all new users. An upgraded complete version that includes AI grading assistance and support for grading programming assignments is priced at $3 per student per course. There are also team-teaching and institutional plans available.

References

[1] A. W. Chickering and Z. F. Gamson, "Seven principles for good practice in undergraduate education," *AAHE bulletin,* vol. 3, p. 7, 1987.

[2] A. N. Kluger and A. DeNisi, "Feedback interventions: Toward the understanding of a double-edged sword," *Current directions in psychological science,* vol. 7, pp. 67-72, 1998.

[3] R. Moreno, "Decreasing cognitive load for novice students: Effects of explanatory versus corrective feedback in discovery-based multimedia," *Instructional science,* vol. 32, pp. 99-113, 2004.

[4] E. A. Locke and G. P. Latham, "Work motivation and satisfaction: Light at the end of the tunnel," *Psychological science,* vol. 1, pp. 240-246, 1990.

[5] S. H. Song and J. M. Keller, "Effectiveness of motivationally adaptive computer-assisted instruction on the dynamic aspects of motivation," *Educational technology research and development,* vol. 49, pp. 5-22, 2001.

[6] S. J. Ashford, R. Blatt, and D. V. Walle, "Reflections on the looking glass: A review of research on feedback-seeking behavior in organizations," *Journal of Management,* vol. 29, pp. 773-799, 2003.

[7] V. Shute, "Assessments for learning: Great idea, but do they work," in *annual meeting of the American Educational Research Association, San Francisco, CA*, 2006.

[8] J. P. Ziker, A. Wintermote, D. Nolin, K. Demps, M. Genuchi, and K. Meinhardt, "Time distribution of faculty workload at Boise State University," 2014.

[9] E. Larson and A. Miguel, "Efficient and Effective Grading of Student Work," in *American Society for Engineering Education*, Chicago, Illinois, 2006.

[10] R. N. Soicher and R. A. Gurung, "Do exam wrappers increase metacognition and performance? A single course intervention," *Psychology Learning & Teaching,* vol. 16, pp. 64-73, 2017.

Appendix – Detailed Example of Gradescope Workflow

Figure A1. Steps in grading workflow (https://gradescope.com/).

0. Create an assignment and exam outline

The first step is to create an assignment by uploading a PDF of your blank exam and giving it an assignment title (Figure A2). There is an option to allow students to upload work; I have only uploaded the student's work myself.

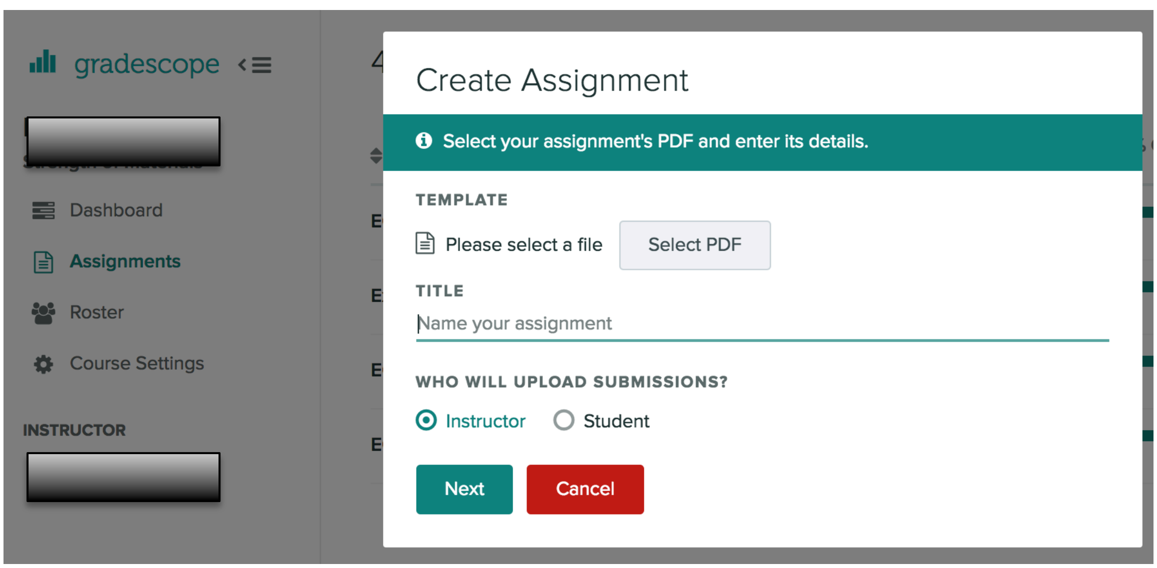

Figure A2. Creating an assignment by uploading a pdf of the exam.

The next step is defining regions for entries such as the student name, question 1.1, etc. This is easily done by clicking and dragging to define the region, then typing a description and point value into the outline (Figure A3).

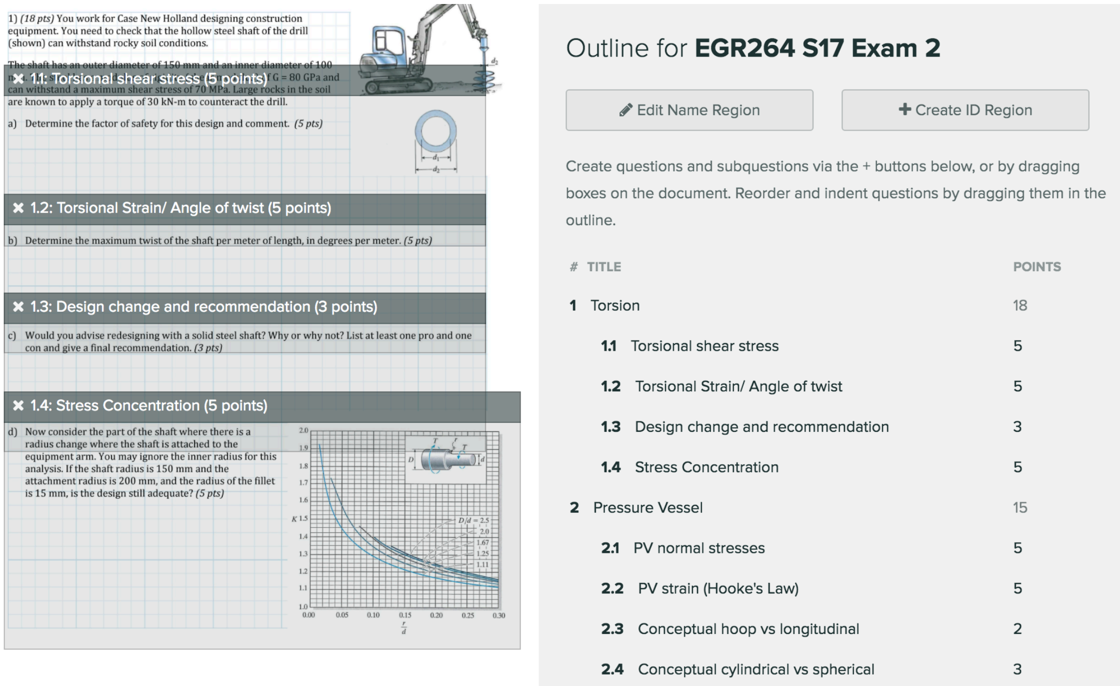

Figure A3. Creating the exam outline by clicking and dragging over a region to define a specific part of the question and typing a corresponding description and point value into the outline.

1. *Scan and upload work*

While it is perhaps the most intimidating barrier to using this tool, scanning in the student work took much less time and effort than anticipated (less than 10-15 minutes for a 30-student set of a 4-page exam). As in most engineering courses, the exams were given on paper during a class session. Once the exams were collected, tips and tricks from Gradescope were followed including:

- Grouping exams in sets of 5 (approximately 20 pages), and scanning in several separate files with a known number of pages.
- Cutting off the stapled corner of the papers instead of using a staple remover.
- Stapling or clipping the exams again immediately after a successful scan.
- Save the scans as PDFs. The file name doesn't matter –accept the copier-generated default.

To upload the student work simply drag and drop the scanned PDF files into the web interface (Figure A4). The software is smart enough to separate out individual submissions based on the blank exam copy already uploaded. Additionally, the process of matching student name to their submission is automatically and extremely quick using the previously defined 'name region.' The process of assigning names manually (if needed) takes as little as 5-10 seconds per submission.

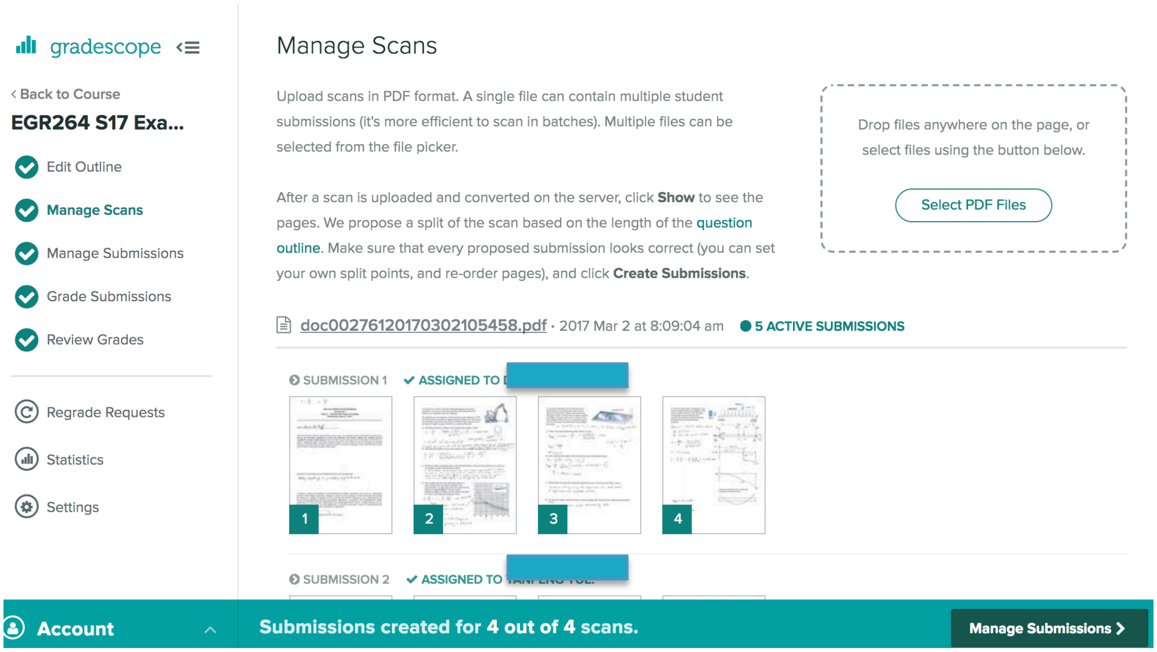

Figure A4. Uploading and managing the scanned student work. Scans are automatically broken into individual submissions and names are matched automatically.

2. *Grade online*

A big advantage of using this web-based tool is the ability to grade online from any computer in any location. For instructors that means the ability to grade at home or while traveling with only a laptop and an internet connection. Previously, grading remotely was difficult for me due to the space required to spread exam copies out on a table, along with the difficulty of traveling with large amounts of paper. This may not be the case for all faculty. However, with this system both the instructor and the student retain a digital copy of the students' work, alleviating the fear of losing or damaging paper copies particularly if they leave the instructor's office.

Additionally, the grading workflow facilitates good pedagogical practices including grading anonymously and grading all of one question before moving onto the next.

The software 'zooms in' to the instructor-defined region for a part of a question. At that point, the instructor creates a rubric item that describes the student work. For example, rubric items might include:

- Correct
- Units issue
- Didn't consider location of the worst stress for design.

As each error is encountered in student work, that rubric item is added to the list. Each rubric item is given a point value (either positive scoring or negative scoring is enabled). More than one rubric item may be selected; errors are summative up to an instructor-defined ceiling or floor. Instructors may either click on rubric items (Figure A5) or use hotkeys for increased speed.

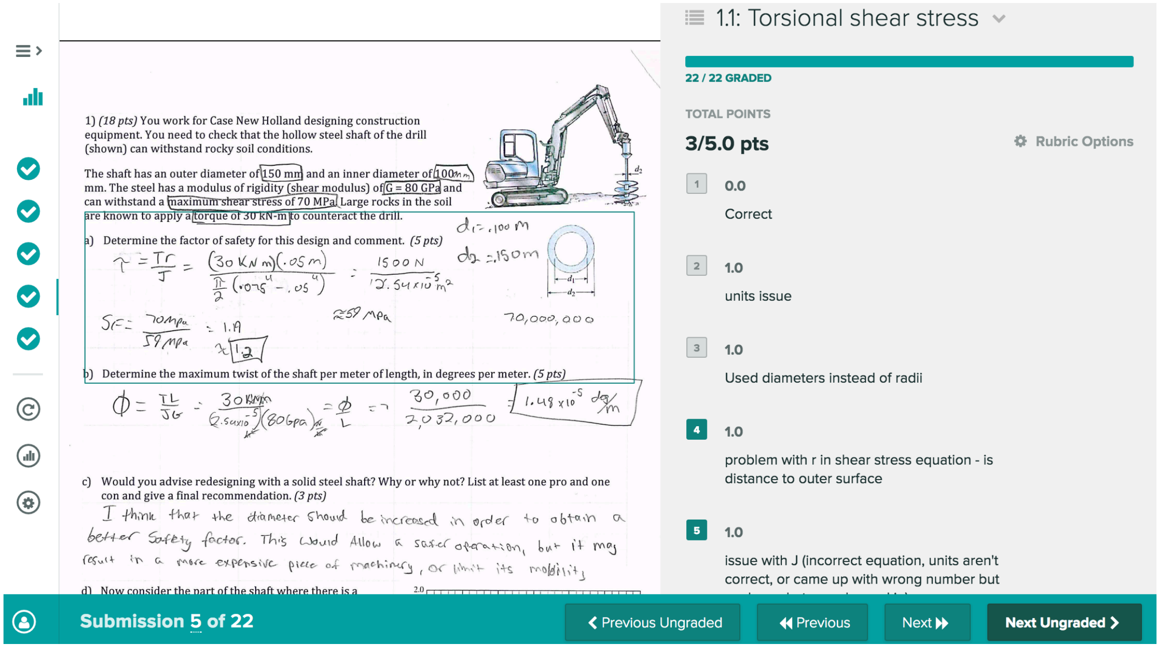

Figure A5. Grading involves adding rubric items as they are encountered in student work, which can be selected quickly each time they are encountered.

One of the most convenient and timesaving features is the ability to change the point value associated with a rubric item and apply it to the entire population. Any exam with that particular rubric item tagged is automatically updated with the new point value. **The ability to update point values and apply automatically to the entire population was transformational for me in terms of grading efficiency and consistency.**

3. *View statistics*

During and after grading, I was able to view analytics about the class's performance to inform the need to revisit concepts or reallocate time in the syllabus in future course offerings. For example, in this particular Strength of Materials exam it was clear that students were challenged by making the leap to using 3-D Hooke's Law (versus 1-D) to calculate diameter change in a pressure vessel (question 2.2), and were struggling more with shear and moment diagrams and beam stresses (question 3) than with torsion (question 1) and pressure vessels (question 2) (Figure A6).

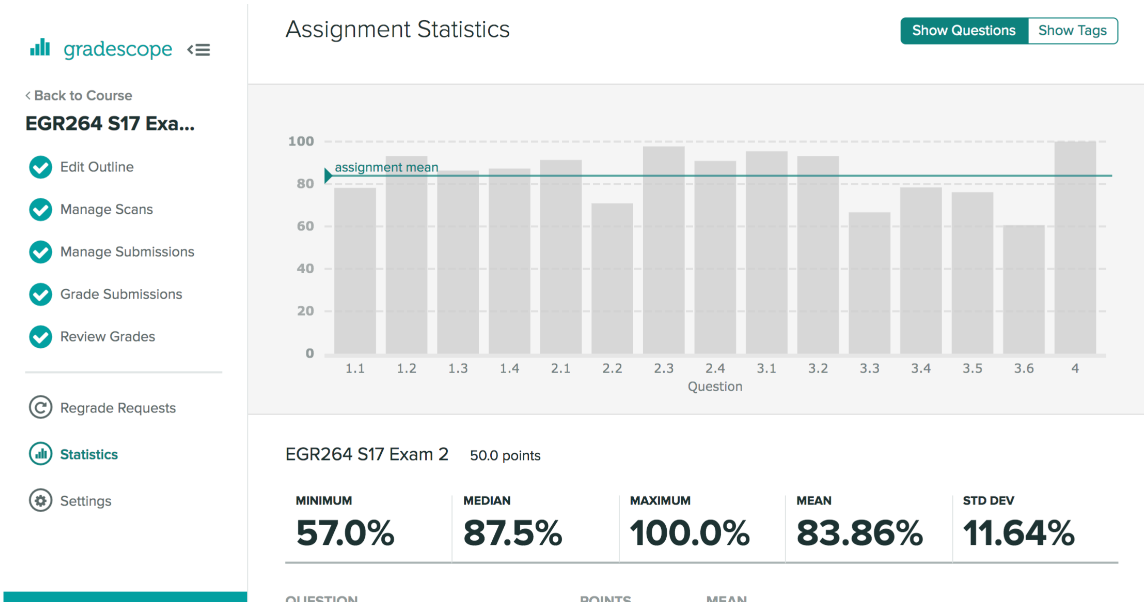

Figure A6. Assignment statistics provide a summary of which items or questions students struggled with, so instructors may revisit those concepts.

More detailed analytics allow the instructor to determine which errors were most common for a specific task asked of students. For example, in calculating a safety factor for a hollow shaft subjected to a given torque, the most common mistake was finding the shear torsional stress using the inside radius and overlooking the fact that for design, the highest torsional stress occurs on the outer surface (Figure A7).

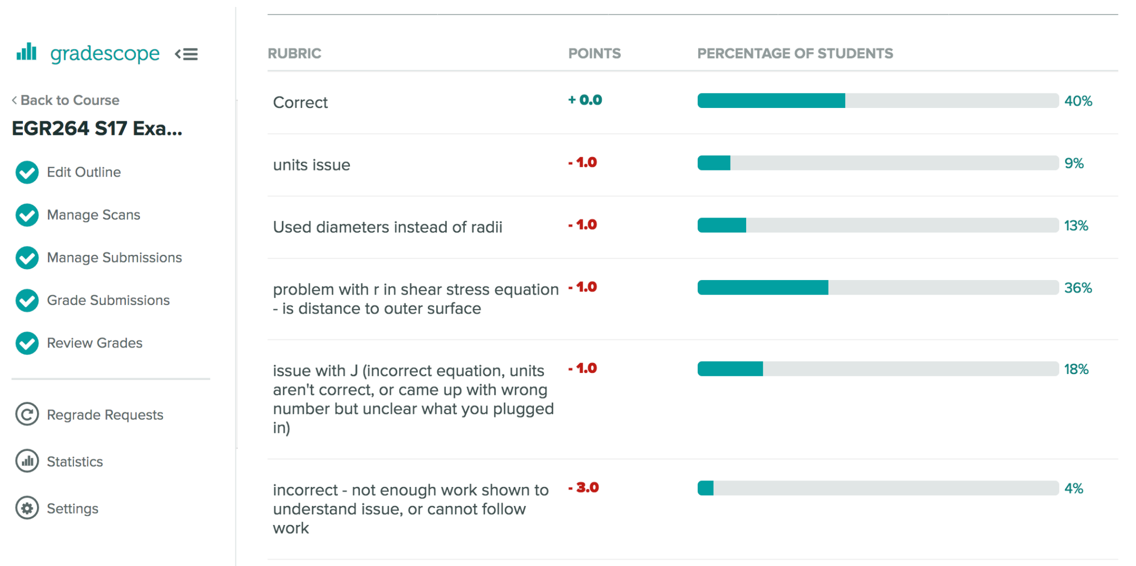

Figure A7. Analytics for a particular question make it easy to see which mistakes were most common.

4. Return graded work

Instead of taking time in class to pass back exams - creating a stressful environment - students receive an email, login and view their feedback. **The feedback presentation emphasizes the rubric items rather than the grade,** and shows all rubric items for full transparency (Figure A8).

Figure A8 – Feedback presented to the students. The feedback emphasizes the rubric items rather than the numerical grade, and allows students to see the larger context of all errors committed on the exam. For example, this particular student is having consistent issues with units.

Gradescope can also handle regrade requests through the web interface, but I have not utilized that feature. My preference is that students have a conversation with me during office hours. However, this could be useful in larger courses.

5. Tagging feature

For purposes of ABET outcomes assessment or a learning outcomes-based approach, instructors can apply self-generated 'tags' to particular questions, and then view class performance on those tags (Figure A9).

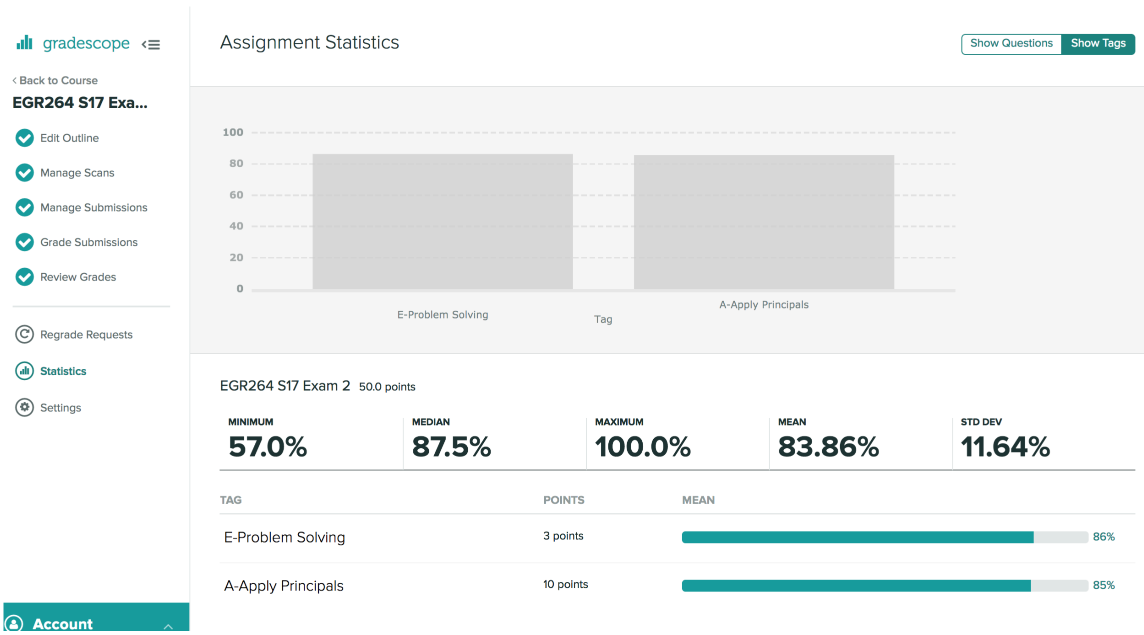

Figure A9. Applying user-generated 'tags' to particular problems can provide an automatically-generated summary of the class performance on a particular assessment for evaluation of ABET outcomes.

[1] A. W. Chickering and Z. F. Gamson, "Seven principles for good practice in undergraduate education," *AAHE bulletin,* vol. 3, p. 7, 1987.

[2] A. N. Kluger and A. DeNisi, "Feedback interventions: Toward the understanding of a double-edged sword," *Current directions in psychological science,* vol. 7, pp. 67-72, 1998.

[3] R. Moreno, "Decreasing cognitive load for novice students: Effects of explanatory versus corrective feedback in discovery-based multimedia," *Instructional science,* vol. 32, pp. 99-113, 2004.

[4] E. A. Locke and G. P. Latham, "Work motivation and satisfaction: Light at the end of the tunnel," *Psychological science,* vol. 1, pp. 240-246, 1990.

[5] S. H. Song and J. M. Keller, "Effectiveness of motivationally adaptive computer-assisted instruction on the dynamic aspects of motivation," *Educational technology research and development,* vol. 49, pp. 5-22, 2001.

[6] S. J. Ashford, R. Blatt, and D. V. Walle, "Reflections on the looking glass: A review of research on feedback-seeking behavior in organizations," *Journal of Management,* vol. 29, pp. 773-799, 2003.

[7] V. Shute, "Assessments for learning: Great idea, but do they work," in *annual meeting of the American Educational Research Association, San Francisco, CA*, 2006.

[8] J. P. Ziker, A. Wintermote, D. Nolin, K. Demps, M. Genuchi, and K. Meinhardt, "Time distribution of faculty workload at Boise State University," 2014.

[9] E. Larson and A. Miguel, "Efficient and Effective Grading of Student Work," in *American Society for Engineering Education*, Chicago, Illinois, 2006.

[10] R. N. Soicher and R. A. Gurung, "Do exam wrappers increase metacognition and performance? A single course intervention," *Psychology Learning & Teaching,* vol. 16, pp. 64-73, 2017.