

## **Exploration of a Nontraditional Assessment Method Using a Participatory Approach**

**Dr. Tamara Floyd Smith, Tuskegee University**

Dr. Tamara Floyd Smith is a Professor of Chemical Engineering at Tuskegee University. She has been a faculty member at Tuskegee University for 18 years. She currently teaches Fluid Mechanics and Heat Transfer. Those courses integrate well with her scientific research portfolio. She is also actively engaged in engineering education research.

## **Exploration of a Non-Traditional Assessment Method Using a Participatory Approach**

In response to the COVID-19 pandemic, institutions of higher education quickly pivoted to remote learning in Spring 2020. While, pre-pandemic, many face-to-face classes were structured as flipped classrooms or other formats that allowed some remote learning, student assessments like exams were typically administered in person. The pivot to fully remote learning motivated the exploration of alternative assessment methods that measure student learning outcomes, encourage student creativity, eliminate the need for proctoring and don't require face-to-face administration. This paper describes a non-traditional approach to assessment in which students were expected to write an exam along with the solutions in place of a traditional exam. This novel assessment approach addresses the needs previously listed.

The method was first explored in Fluid Mechanics, a sophomore level course in the chemical engineering curriculum. It was offered in the Spring 2020 semester. The instructor provided the students a practice exam and detailed rubric. In earlier exam administrations, the practice exam and solutions gave the students the freedom to assess their own readiness for the actual exam. In the non-traditional exam, the practice exam served as a model exam, along with the rubric, to assist students in preparing a high quality submission. In the referenced course, two of three regular exams were administered in a more traditional format before the pivot to remote learning. Thus, the previous two exams provide a baseline to compare student performance. Students completed pre and post surveys inquiring about student perceptions of both the appropriateness of the exam and the value of the rubric and practice exam as preparation tools. Key outcomes were the expression of student creativity, evidence to suggest an elevation of course equity and the identification of gaps in student understanding that would not have been apparent using a more typical assessment method.

The method was also explored in Fall 2020 in Heat Transfer, a junior level course in the chemical engineering curriculum. It was the follow-on course from Fluid Mechanics. Therefore, the cohort was similar. Because the full course was during the pandemic, a comparison couldn't be made to a traditional exam format to use as evidence to confirm an elevation of course equity. However, creative expression and the identification of gaps were realized. Students were not as enthusiastic about the approach in Fall 2020 and attributed this attitude to the ongoing pandemic. This lethargy is supported by the higher education literature describing mounting mental health pressures due to the duration of the pandemic.

Going forward, the author will not implement the assessment method again during the pandemic. However, there are plans for use as a better alternative to the occasional take home exam.

### **Goal of the Study**

The goal of this study is to review the outcomes from other educators' use of students writing their own exams as an assessment method. Second, the study aims to implement this method of assessment and make a determination about its efficacy and outcomes for sophomore and junior level engineering lecture courses. Lastly, the goal is to make improvements based on the initial implementation of the method and make recommendations for continued use of the method.

## Motivation for the Study

In response to the COVID-19 pandemic, institutions of higher education quickly pivoted to remote learning in Spring 2020. While, pre-pandemic, many face-to-face classes were structured as flipped classrooms or other formats that allowed some remote learning, student assessments like exams were typically administered in person. The pivot to fully remote learning motivated the exploration of alternative assessment methods that measure student learning outcomes, encourage student creativity, eliminate the need for proctoring and don't require face-to-face administration.

## Course Context for the Study

The method was first explored in Fluid Mechanics, a sophomore level course in the chemical engineering curriculum. It was offered in the Spring 2020 semester. The course is offered once per year in the Spring. The textbook is *Fluid Mechanics for Chemical Engineers* by Noel De Nevers. The material covered in the course does not follow the order of the textbook. The exam coverage is as follows:

- Exam 1: material balances, pumps and compressors
- Exam 2: fluid friction in steady one-dimensional flow
- Exam 3: Bernoulli's equation, fluid statics and fluid properties
- Final Exam: comprehensive including submerged objects, conservation of momentum and microfluidics.

The instructor provided the students a practice exam and detailed rubric. In earlier exam administrations, the practice exam and solutions gave the students the freedom to assess their own readiness for the actual exam. In the non-traditional exam, the practice exam served as a model exam, along with the rubric, to assist students in preparing a high quality submission. In the referenced course, two of three regular exams were administered in a more traditional format before the pivot to remote learning. Thus, the previous two exams provided a baseline to compare student performance.

The method was explored again in Heat Transfer, a junior level course in the chemical engineering curriculum. It was offered in the Fall 2020 semester. The course is offered once per year in the Fall. The currently adopted textbook is *Heat Transfer* by J.P. Holman. The material covered in the course does not follow the order of the textbook. The exam coverage is as follows:

- Exam 1: Introduction to conduction, convection and radiation
- Exam 2: Steady-state one-dimensional conduction
- Exam 3: Heat exchangers
- Exam 4: Free convection, forced convection and phase change heat transfer
- Final Exam: comprehensive including unsteady state heat transfer, radiation and two-dimensional heat transfer

For this semester, all exams were administered remotely. Also, the students from the first implementation were the same cohort in the second implementation.

### **Prior Work Closely Related to the Study**

The relevant literature for the study is fairly expansive, but this paper will highlight six key sources. During the COVID-19 pandemic, online proctoring surged [1]. With that surge, debates about student privacy and proctoring methods began. Proponents of online proctoring cite the desire to maintain academic integrity and discourage and eliminate, to the extent possible, academic dishonesty in the online environment. The desire to protect student privacy while engaging in meaningful assessment is the key motivation for this study.

Key to identifying appropriate alternative methods for assessment is to clearly understand what factors are most important. Felder [2] in “Designing Tests to Maximize Learning” indicated that an appropriate exam, among other things, has the following key characteristics:

- (1) Tests on what is taught
- (2) Takes the guesswork out of expectations
- (3) Minimizes speed as a factor in performance.

The method employed in this study requires students to write and answer an assessment on what is covered in the course. It also takes the guesswork out of expectations by providing both a practice exam and a detailed rubric for evaluation. The practice exam and solutions model an appropriate exam for the students. Finally, with the method described, students can work at their own pace. Thus, speed is not a factor in performance. Felder [2] suggests that an instructor should be able to solve an exam in one-third the time given to students. Thus for a 1 hour exam, the instructor should be able to solve the exam in approximately 20 minutes for it to be considered a reasonable length for the student who is a learner and would need more time to consider the problem statement and write the solution.

While the present study does have some novel elements, it doesn't represent the first study in which students were tasked with writing their own exam questions. A group was highlighted in the Chronicle of Higher Education [3] for students writing their own exam problems. The group also published a more detailed journal article [4] that described their approach and how it was effective in participatory learning in food science education. Briefly, Teplitski *et al.* investigated student-generated pre-exam questions as a student-centered and inquiry-driven approach to learning. Specifically, they wanted to determine the effectiveness of student-generated questions banks on student learning. Teplitski *et al.* conducted a review of the literature on student-generated exam content and concluded that to achieve the outcome of measurable learning gains, students must create questions at the higher levels of Bloom's taxonomy and receive timely feedback. In the study by Teplitski *et al.*, students were given specific instructions and examples about exam problems that could be accepted for credit. They were given a 15 minute presentation about Bloom's Taxonomy and told that less than 20% of their questions must be from the lower two domains. In their study, students who earned between 60% and 80% on an earlier exam had the greatest average percentage improvement in their grade, 12.37%. Thus, Teplitski *et al.* seem to characterize this approach as one that benefits the weaker students. The

authors also note that in semesters without the intervention, subsequent exam scores were lower rather than higher.

An even earlier study focused on biochemistry students [5]. In their study, students were assigned to write their own multiple choice questions using the software, PeerWise, a web-based system that supports students in the creation and sharing of assessment questions. The study found a direct correlation between performance on the PeerWise assignment and overall course performance.

Lastly, Munakato & Vaidya [6] describe a project that was developed for an introductory physics courses. The goal of the project was to encourage creativity in science. The framework was a design with a theme of sustainability. The authors opined that creativity is often connected to the arts. However, connecting ideas and recognizing similarities and differences are also considered creative endeavors. One definition of creativity is “the use of the imagination or original ideas.” Another definition of creativity is “a phenomenon whereby something new and valuable is formed.” Finally, on the initial rubric, creativity was defined as the “demonstration of transcending ideas, rules, and patterns to create meaningful new ideas, forms, methods and interpretations [7]. Imaginative.” Thus, when students engage in developing original content such as writing exam problems, they are demonstrating creative expression.

### Novelty of the Assessment Method and Bloom’s Taxonomy

Bloom’s Taxonomy is a valuable framework for considering pedagogical tools. Figure 1 shows the six levels of Bloom’s Taxonomy, (1) remember, (2) understand, (3) apply, (4) analyze, (5) evaluate and (6) create. It also provides a description at each level.

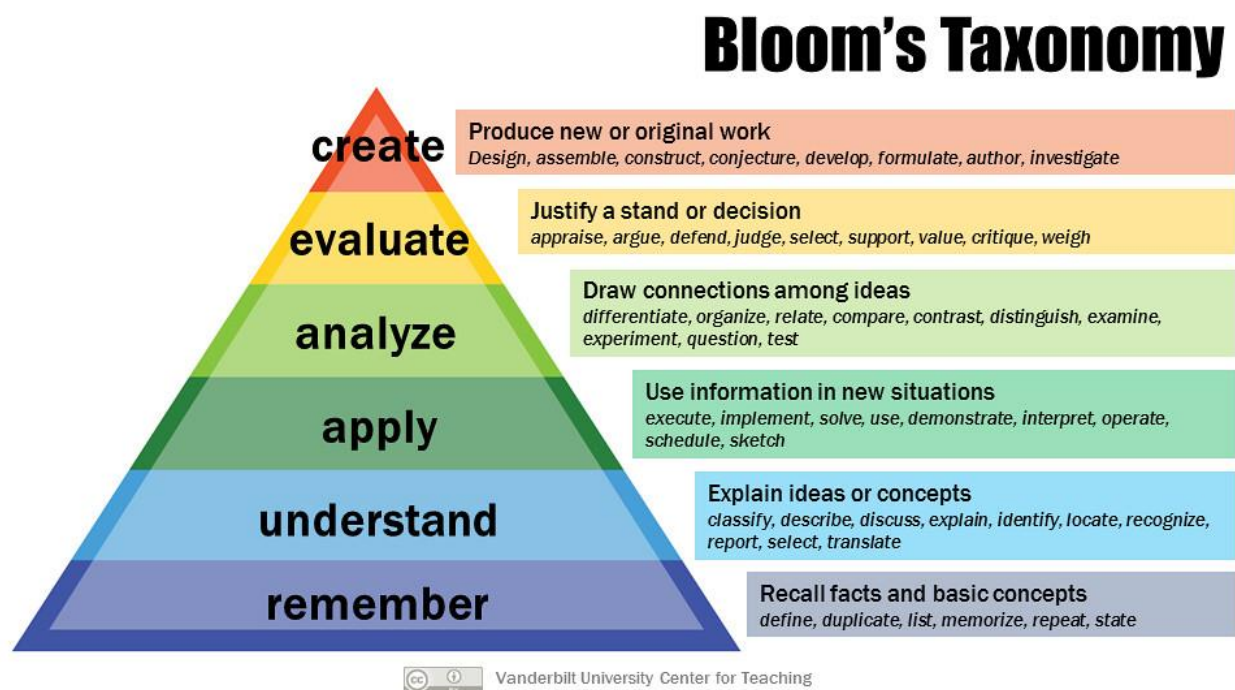


Figure 1: Bloom’s Taxonomy (CC License from Vanderbilt University Center for Teaching)

Prior work in the area of engaging students in participatory learning through the writing of exam questions included questions at the lower levels of Bloom's Taxonomy. In the present study, all questions were at the "apply" or higher level. Also, earlier studies focused on multiple choice and other short answer questions whereas the present study uses word problems. This problem type is driven by the practice exam that students are provided. Also, in the present study, the questions and the solutions were the full assessment, whereas in prior work, the questions that students developed were typically reviewed and added to a test bank for study material or for subsequent assessment. Lastly, this study provided a detailed rubric to aid the students in reflecting, analyzing and ultimately improving the submission.

## **Methods**

The study was reviewed and approved by the Tuskegee University Institutional Review Board (IRB). The first cohort included 12 students, the total course enrollment. The students in the second cohort were identical to first cohort with the exception that one student in cohort 1 chose to leave the major and, therefore, didn't enroll in the second course.

## **Initial Implementation**

As stated earlier, the initial implementation of the method was in a Fluid Mechanics, a course offered in Spring 2020. The assessment method was employed as the third of three regular exams. The first two exams were administered in a more traditional format. The students were provided a practice exam with solutions. This was the case with earlier exam administrations. In prior exam administrations, the resources allowed students to assess their own readiness for the exam. In the present study, the practice exam served as a model exam for students to guide them as they developed their own exams.

### *Rubric 1.0*

The students were also provided a rubric, shown in Figure 2. The students were evaluated based on seven criteria indicated in the rubric. The rubric also included five evaluation levels. It is worth noting that the lowest grade that a student could earn with a submission was 60%. The purpose of this approach was to attempt to alleviate student anxiety around the approach so that they could deliver their best performance on the assessment. All students submitted a complete submission.

Of the seven criteria, the technical accuracy of the solutions was given 4X weight. The second criterion – legibility and assumptions – was important because it would not be possible to evaluate a solution that wasn't legible. Assuming that the solution was legible, stating assumptions was very important because certain theories are only applicable under particular conditions. A student would need to demonstrate knowledge of the assumptions in order to apply the theory and receive full credit.

The student was also expected to write an exam of an appropriate length. This constraint further tested the students' creativity and problem solving ability. It ensured that the student took the assessment seriously by writing an exam that was long enough. Meeting this requirement guided the student toward success in appropriate content. The student was also tested to ensure that the

exam was not too long. It is more straightforward to cover the content for the exam by writing one problem per concept which would yield an assessment that was too long. The constraint of writing a shorter exam encourages the student to be creative, yet fair, by combining concepts and also identifying the most critical concepts to be covered.

	Unsatisfactory (6)	Needs Improvement (7)	Satisfactory (8)	Very Good (9)	Exemplary (10)
<b>Technical accuracy of solutions (4X weight)</b>	more than 3 major technical errors identified (24)	at least one major technical error identified (28)	more than 2 minor technical errors but no major technical errors (32)	only 1-2 minor technical errors identified (36)	no technical errors identified (40)
<b>Solution is legible and assumptions clearly stated</b>	4 or more assumptions are not clearly stated OR the solutions are not legible	3 assumptions are not clearly stated	2 assumptions are not clearly stated	1 assumption is not clearly stated	all solution assumptions clearly stated
<b>Appropriate length for a 55 minute exam<sup>1</sup></b>	length appears to be more than 40 minutes too long or too short	length appears to be approximately 30 minutes too long or too short	length appears to be approximately 20 minutes too long or too short	length appears to be approximately 10 minutes too long or too short	based on time to write solutions and other factors, length appears appropriate
<b>Appropriate content</b>	four or more questions or sub-questions are not appropriate for the material covered	three questions or sub-questions are not appropriate for the material covered	two questions or sub-questions are not appropriate for the material covered	one question or sub-question is not appropriate for the material covered	all of the questions are appropriate for the material covered
<b>Creativity<sup>2</sup></b>	unsatisfactory	sub-par	satisfactory	very good	exemplary
<b>Professionalism (Solutions are not expected to be typed. This refers to the exam only.)</b>	The exam is not typed.	Exam is typed but superscripts, subscripts, Greek symbols, etc. are not used <b>and</b> it has multiple typographical errors.	Exam is typed but superscripts, subscripts, Greek symbols, etc. are not used <b>or</b> it has multiple typographical errors.	Exam is typed well.	Exam is typed well and uses high quality images.
<b>Authenticity</b>	In at least one question or sub-question, the exam was identical to another problem.	The exam appears to be almost identical to the sample exam provided to the class, problems in the textbook or other obvious sources with superficial adjustments like changing the numbers.	The exam appears to be very similar to the sample exam provided to the class, problems in the textbook or other obvious sources.	The exam appears to be somewhat similar to the sample exam provided to the class, problems in the textbook or other obvious sources.	The exams appears to be the authentic work of the student.

<sup>1</sup> on solution page, report time required for student to write the solutions after the questions were identified

<sup>2</sup> creativity - demonstration of transcending traditional ideas, rules, and patterns to create meaningful new ideas, forms, methods and

Figure 2: Write-Your-Own Exam Rubric 1.0

Students were required to develop appropriate content. One could imagine a scenario where a student develops an exam that is an appropriate length but it doesn't cover the appropriate content. As an example, the content could cover Bernoulli's equation, but the student problems could be focused on Stoke's Law or concepts from an entirely different course in the curriculum. This criterion on the rubric, therefore, focused the student's attention on the theory identified as covered on the exam.

Professionalism was a criterion on the rubric. Specifically, were the exams typed? If so, were symbols, subscripts and superscripts, readily available in Microsoft Word, used? This was important because some students use “^” instead of superscripting and write “delta P” instead of “ $\Delta P$ .” This criterion reinforced the importance of professionalism to students. It was also reflected in the practice exam. Making the item a criterion on the rubric forced students to reflect and potentially revise their submission.

Authenticity, as a criterion, addresses issues of academic integrity. Students were provided a practice exam, and they did have access to their textbook to see examples of problem formulations. However, the expectation was that students would be inspired by the information yet still develop something that was their own. If the problems were too similar to the practice exam, textbook problems or other materials readily available on the World Wide Web, the students would not earn the highest score for this criterion indicated on the rubric.

Outcomes

Figure 3 shows the rubric scores by criterion for the first implementation of the method. The bars represent the average score and the error bars represent two standard deviations. Both the maximum possible and average scores are shown. Overall, student performance was very good. However, although some students wrote appropriate problems, they were unable to solve them correctly. Thus, the performance in technical accuracy varied. Second, the average authenticity score was 9.00/10.00 with a low score of 7/10. Many students scored 10, but some students wrote exams that were too similar to the practice exam, textbook problems or materials available on the World Wide Web. Students were given direct feedback and sources when their authenticity score was not 10.

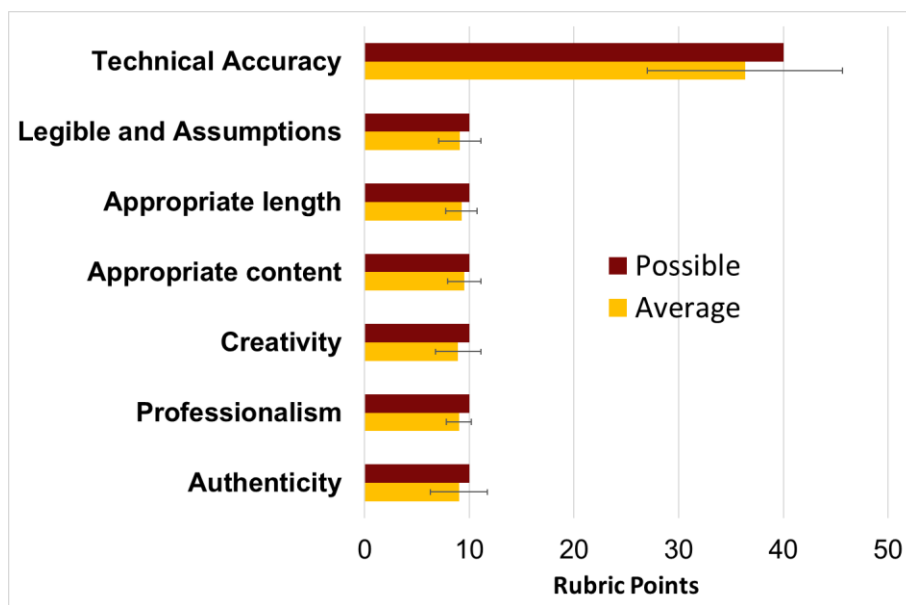


Figure 3: Spring 2020 Rubric Results (error bars represent 2σ)

Figure 4 shows a bar chart of the average performance in the course. It provides the overall final grade in the course, and average scores on both tradition exams as well as the write your own exam. The error bars on the reported average represent the range of actual scores.

Figure 4 shows significant variation in student performance in the traditional exam administrations. However, one outcome of the write-your-own-exam may have been *equity*. The weakest students performed well on the write-your-own-exam whereas many of the students who performed well on traditional exams struggled. It may point to some students' natural ability to read, comprehend and solve problems that are presented. However, those same



students may not be as strong in creative expression. Providing assessment variability gives students who are stronger in creative expression an opportunity to be assessed in a manner that is in-line with their natural strengths. It is worth noting that no student scored near the minimum score of 60. Thus, the floor of the rubric did not seem to influence this outcome.

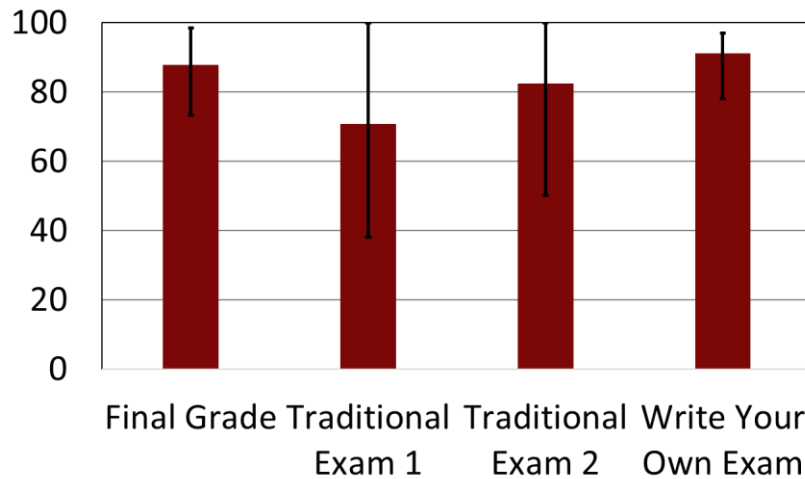


Figure 4: Comparison of Overall Student Performance to Exam Format (error bars represent the range of student scores)

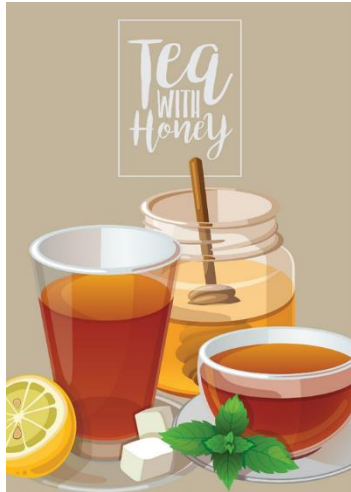


Figure 5: Depiction of Example Problem Theme

As intended, a second outcome of the novel assessment method was *creative expression*. Often, this was in the form of a theme for the entire exam or a problem-by-problem theme. Figure 5 shows the tea with honey theme of one student’s problem for calculating viscosity. Exam-wide themes were Willy Wonka and the Chocolate Factory, sewage and interior design.

A third outcome was the *exposure of small gaps in fundamental preparation and understanding*. This refers to fundamental errors that otherwise would not have been apparent. This elucidation, in the opinion of this instructor, was more apparent than when students are solving design problems. Specifically, some students wrote exam problems that violated some theory from another course or from within the course. When an instructor is writing problems, they are always fundamentally sound. Therefore, a student just moves forward with solving the problems. When a student writes his/her own problem, gaps existing in the students’ fundamental preparation are likely to emerge. This was a serendipitous, yet very important, outcome of the assessment method. It is worth noting that student who scored lowest on authenticity had relatively little problem with these types of errors. This suggests that if the students had been more responsible for writing original problems, even more gaps would have been identified.

## Survey Feedback

Students provided quantitative and qualitative feedback to help determine how the assessment method could be improved and to communicate what the students considered most helpful. Twelve students enrolled in the course. Eleven students completed the optional pre and post surveys based on a five point Likert scale. Figure 6 shows the outcomes of the surveys both pre and post grading. The percentage of students who “strongly agreed” or “agreed” with the statement is reported. The pre and post grading surveys were an attempt to capture sources of student anxiety with the novel assessment method. Overwhelmingly, students found the rubric helpful. However, they didn’t find the practice exam as helpful. They expressed concerns about grading. Pre-grading, they also didn’t report the assessment method as “comparable.” Post grading, most scores improved – in particular the comparison to the traditional the exam format. However, more students shifted and disagreed that the exam was structured to reflect their knowledge of the content.

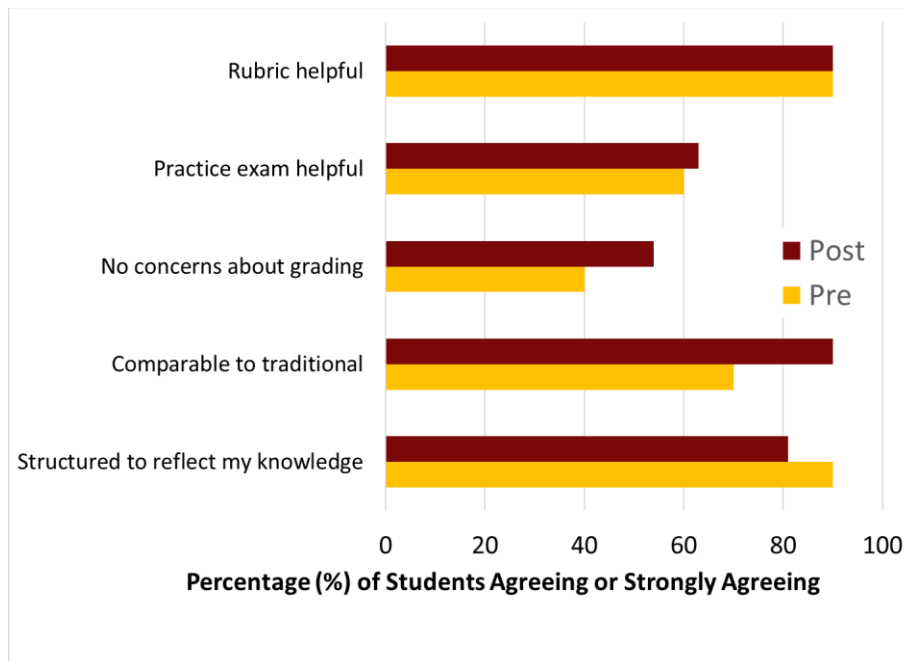


Figure 6: Spring 2020 Pre and Post-Grading Survey Feedback

In addition to the Likert scale responses to assessment items, students were also given the opportunity to provide qualitative feedback to explain their responses. Overall, the comments were very positive. The least favorable and most favorable/valuable comments are reported below:

### Least favorable comments:

- I am nervous to see my grade on exam 3 because it is different.
- The practice exam made it harder because those types of questions could not be used.

### Most favorable/valuable comments:

- Can't really mess up a rubric.
- Without the rubric, I would have been lost.
- I felt that this assessment method is efficient as you have to have a good understanding of the material to be able to come up with good questions and solutions to earn a good grade.
- I think it was a great idea to try something like this. You should do it again.
- It makes us think a little more.
- This was the most fun assignment I had during our time e-learning.

### **Second Implementation**

As indicated previously, the assessment method was employed again for Heat Transfer in Fall 2020. It was the same cohort as Spring 2020. It is noteworthy that the initial implementation was less than one month into the pandemic and the second implementation was more than seven months into the pandemic. By this point, pressures were mounting on students and a mental health crisis was emerging [8].

### Rubric 2.0

After the first implementation and feedback from internal and external colleagues, the rubric was refined to comport more explicitly with the language of Bloom's Taxonomy to provide a framework for analyzing this approach to assessment. The revised rubric is shown in Figure 7. One criterion is at the level 2 – comprehension. The primary criterion (weighted 4x) and one other are at level 3 – apply. One criterion is at level 5 – evaluate. Finally, two criteria are at level 6 – create or synthesize. One criterion was deemed to not fit the framework and was captured as professional skills.

### Outcomes

The results from the second implementation of the assessment method are shown in Figure 8. The results were similar to the first administration with a decline in the average creativity score from 8.92 to 8.27. Exam problems were still overall authentic but they were more similar to the practice exam than in the previous implementation. Rather than several students implementing themes throughout the exam, only one student implemented an exam-wide, hot wheels car theme. Because the entire term was virtual, it wasn't possible to compare the performance with a traditional exam administration to make determinations about equity elevation. Similar to the first administration, additional gaps were identified that resulted from students writing their own problems versus solving a problem that is inherently properly formulated due to the expertise of the instructor-author.

### Survey Feedback

Figure 9 shows the results from the pre and post survey assessments. One student in the cohort left the major. Thus, the class was eleven students. Nine of the eleven students completed the optional pre and post surveys. In the post survey, 100% of students reported that the rubric was helpful. Students were still somewhat ambivalent about the practice exam. Despite being the

same cohort that performed well in the previous administration, they still expressed concerns about grading.

As was the case with first survey, the survey provided an opportunity for students to give feedback to support their responses to the Likert scale items. They provided less feedback than the first administration, and the comment below captures the sentiment of what was expressed:

*“The assessment method efficacy was more challenging than I expected it to be this time around. The conditions due to the pandemic could have also played a role.”*

	Unsatisfactory (6)	Needs Improvement (7)	Satisfactory (8)	Very Good (9)	Exemplary (10)
<b>Apply theory: problem statements and solutions</b>	more than 3 major technical errors identified (24)	at least one major technical error identified (28)	more than 2 minor technical errors but no major technical errors (32)	only 1-2 minor technical errors identified (36)	no technical errors identified (40)
<b>Apply theory: assumptions</b>	4 or more assumptions are not clearly stated OR the solutions are not legible	3 assumptions are not clearly stated	2 assumptions are not clearly stated	1 assumption is not clearly stated	all solution assumptions clearly stated
<b>Evaluate exam length<sup>1</sup></b>	length appears to be more than 40 minutes too long or too short	length appears to be approximately 30 minutes too long or too short	length appears to be approximately 20 minutes too long or too short	length appears to be approximately 10 minutes too long or too short	based on time to write solutions and other factors, length appears appropriate
<b>Comprehend content</b>	four or more questions or sub-questions are not appropriate for the material covered	three questions or sub-questions are not appropriate for the material covered	two questions or sub-questions are not appropriate for the material covered	one question or sub-question is not appropriate for the material covered	all of the questions are appropriate for the material covered
<b>Synthesize/Create<sup>2</sup></b>	unsatisfactory	sub-par	satisfactory	very good	exemplary
<b>Professional Skills<sup>3</sup></b>	The exam is not typed.	Exam is typed but superscripts, subscripts, Greek symbols, etc. are not used <b>and</b> it has multiple typographical errors.	Exam is typed but superscripts, subscripts, Greek symbols, etc. are not used <b>or</b> it has multiple typographical errors.	Exam is typed well.	Exam is typed well and uses high quality images.
<b>Synthesize (authenticity)</b>	In at least one question or sub-question, the exam was identical to another problem.	The exam appears to be almost identical to the sample exam provided to the class, problems in the textbook or other obvious sources with superficial adjustments like changing the numbers.	The exam appears to be very similar to the sample exam provided to the class, problems in the textbook or other obvious sources.	The exam appears to be somewhat similar to the sample exam provided to the class, problems in the textbook or other obvious sources.	The exams appears to be the authentic work of the student.
<sup>1</sup> On the solution page, report the time required to write the solutions after the questions were identified.					
<sup>2</sup> creativity - demonstration of transcending traditional ideas, rules, and patterns to create meaningful new ideas, forms, methods and interpretations; imaginative					
<sup>3</sup> Solutions are not expected to be typed. This refers to the exam only.					

Figure 7: Write-Your-Own Exam Rubric 2.0

## Reflections

With the implementation of any new pedagogical tool or approach, faculty time investment is a consideration. For a traditional assessment, the faculty member must prepare the assessment and grade the assessment. For this assessment, apart from preparing a rubric that can be used each time the method is implemented, faculty must invest time to grade. It is the perception of the author that the time commitment is greater than traditional exams. For a traditional exam, often, all students are taking the same exam. Thus, if a student does well and has a well-formulated

solution, grading goes quickly. Even in cases where a student struggles, the errors are apparent to the instructor fairly quickly, and the instructor can assign partial credit based on the established grading scheme.

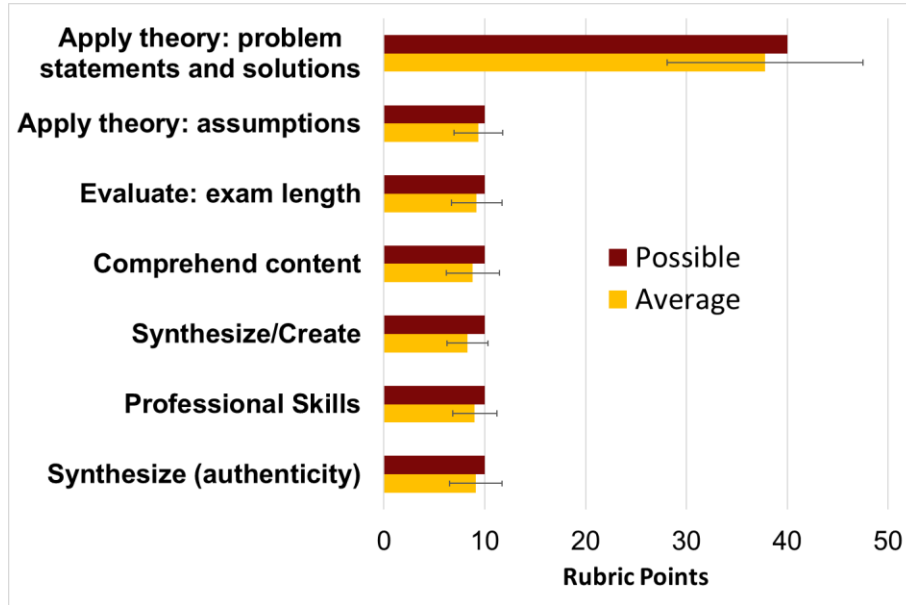


Figure 8: Fall 2020 Rubric Results (error bars represent  $2\sigma$ )

Grading for this method is more comparable to grading for design projects. As with design projects, the expectation is that every student will have a different answer. Thus, more time is invested in grading the project according to the rubric or established grading scheme. Per rubric criterion, it is comparable to grading for design projects. However, for a design project, the instructor must prepare a problem statement. For the assessment method in the study, the instructor doesn't prepare a problem statement.

Another consideration is the learning management system (LMS). The Blackboard LMS allowed the rubric and surveys to be imbedded. This facilitated the ease of grading and analysis of data with reports automatically produced. An LMS that is not configured for rubrics would increase the time investment for this method.

The duration of the pandemic impacted performance for the second administration because students were experiencing pandemic-induced mental and physical health challenges. Consequently, the instructor does not plan to implement the assessment method again during the pandemic. Students are in a fragile state and currently focused at the lower level of Maslow's Hierarchy of Needs, safety. This level encompasses health, personal security, employment, resources...all at the forefront for students during the pandemic. This distraction seems to temporarily prevent them from accessing the higher levels of Maslow's Hierarchy, esteem and self-actualization, necessary to excel with an assessment method that is grounded at the highest levels of Bloom's Taxonomy. However, there are plans to continue to use the method under

more typical public health conditions as a more favorable alternative to the occasional take home exam that circumstances sometimes necessitate.

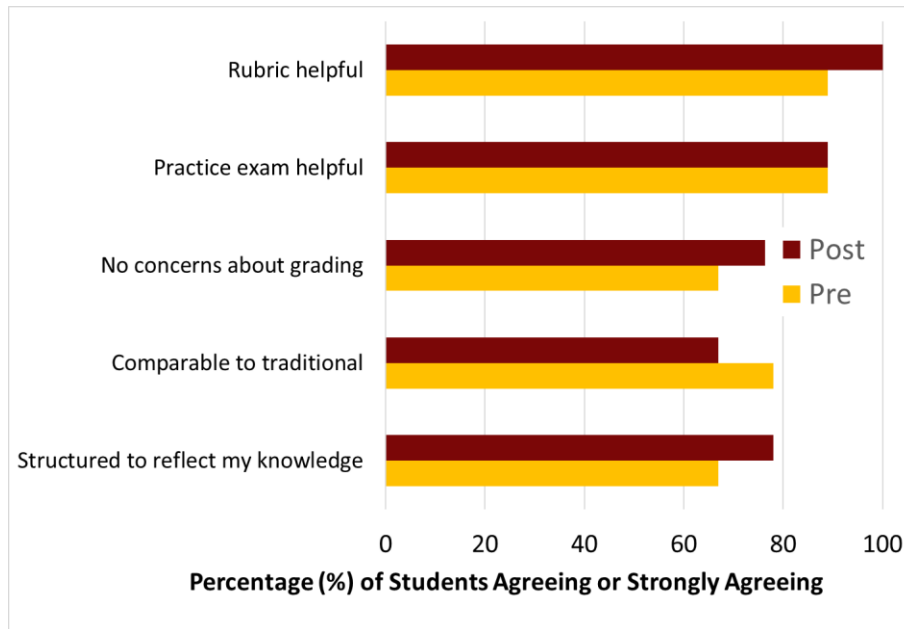


Figure 9: Fall 2020 Pre and Post-Grading Survey Feedback

## Conclusions

This study described a non-traditional approach to assessment in which students are assigned to write their own exam along with the solutions as if the student is the professor. The results and literature suggest that it is an effective approach to assessment that shows promise for increasing equity, providing a pathway for creative expression and identifying small gaps in fundamental preparation and understanding. Overwhelmingly, the students found the rubric helpful. The literature supports the use of rubrics as a learning tool, and this study further confirms its efficacy as a pedagogical tool. It is noted that the duration of the pandemic impacted performance for the second administration because students were experiencing pandemic-induced mental and physical health challenges. However, there are plans to continue to use the method under more typical public health conditions as a more favorable alternative to the occasional take home exam.

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