2023 Annual Conference & Exposition
Baltimore Convention Center, MD | June 25 - 28, 2023
The Harbor of Engineering Education for 130 Years
ASEE
Paper ID #37265

Assessment of a Final Project of a Large Statics Course on Fostering Creativity and Inclusion

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Abstract

The goal of the inclusive classroom is to provide equal opportunity for success for all students, regardless of their background and characteristics, e.g., race, gender, and neurodiversity. To this end, re-thinking and re-designing our courses and curricula to provide greater flexibility and accommodate students' needs is of vital importance. The Statics course at this institution was recently re-designed to increase creativity and inclusion. One of the most important components of the course re-design has been the final project option, for which students may choose to create and solve their own problems as opposed to completing an exam to fulfill the learning objectives of the course. There are two options that students may choose for the final project: 1) the problem-solving track and 2) the creativity, or open-ended, track. This paper describes the final phase of the development of the project option and its assessment results regarding creativity and inclusion. The final project files from three semesters, between Fall 2020 and Fall 2021, and four sections were de-identified and rated for creativity by three experts in civil engineering, using the Consensual Assessment Technique. This paper reports the final project components and rubric, results related to students' demonstrated creativity for the problem-solving versus open-ended track, and the lessons learned, impact, and challenges of implementing the final project option.

1. Introduction

Undergraduate engineering schools provide a critical workforce to rebuild our nation's infrastructure. With growing technological sectors and innovations in machine learning, as well as artificial intelligence in the Computer Science Engineering sector, such development should be supported by novel solutions in many traditional engineering sectors, Civil Engineering, Electrical Engineering, and other departments. However, enrollment in traditional engineering departments has decreased significantly following the COVID-19 pandemic, with more students gravitating towards Computer Science or out of the engineering discipline. The lecture format adopted in most engineering courses may be detrimental to enrollment in that it potentially creates a barrier between students and instructors [1]. Suresh [2] found that performance in key introductory undergraduate courses is related to persistence in engineering education. Thus, an effort to foster a diverse and inclusive learning environment in these courses is necessary.

The Statics course is one of the first large courses that engineering students encounter and teaches various foundational topics using rigorous assessment schemes. It is also an important course in that it gives students the necessary foundation to further succeed in their education and careers. At the University of Connecticut, the Statics course is a required course in the Civil, Environmental, Mechanical, Material, and Biomedical Engineering departments. Students predominantly take the course in their sophomore year and course enrollment is typically 400 – 450 students per academic year. Being required for multiple engineering majors and as a key introductory undergraduate course, the Statics course needed careful attention to be effectively and inclusively taught.

Providing an equal opportunity for success for all students regardless of their background and characteristics – such as race, gender, or disability – is the goal of the inclusive classroom. There has been increased interest in acknowledging variations in cognitive and learning abilities, and in making the classroom accessible for a neurodiverse population. Neurodiversity – defined as natural variation in human brains that exist from one to another regarding sociability, learning, attention, mood, and other important mental functions [3] – is an important factor to consider. Researchers have begun to explore methods to include neurodiverse student populations to further increase diversity and enhance creative problem-solving in engineering [4]-[6][21][22]. The inclusive classroom provides the opportunity for success for all students. Re-thinking and re-designing our courses and curricula to provide flexibility and accommodate students' needs is of vital importance. Thus, the re-design of the Statics course to accommodate neurodiverse students has the potential to be beneficial for all.

With the accelerating change of pace in the 21st century, Cropley [7] stated that creative technological solutions will be required to solve new future problems. The creation of future solutions can be nurtured by promoting creativity and innovation in engineering education. Re-designs of the Statics course have been proposed to accommodate neurodiverse students, with the prospect that increasing diversity and promoting creative problem-solving skills have the potential to be beneficial for the Civil Engineering (CE) profession.

Recently, the authors put significant effort into re-designing the large Statics course at the University of Connecticut and reported the re-design components to the engineering education

society. The main change was implementing the key principles of the Universal Design of Learning (UDL) considering the characteristics of the large course including: 1) increased accessibility through captioning videos, and read-aloud functions of smart books, 2) increased accommodations for neurodivergent students and all students for their success in the course, and 3) creation of creative alternative assessments. The outcome of the development and course evaluation records have been reported in previous publications [8][8]. However, a systematic assessment of the developed alternative assessment for creativity was never conducted.

In this paper, we will report on the final phase of the creative alternative assessment, namely the Statics final project, and its assessment results regarding creativity and inclusion. The setup and components of the project of the final phase will be presented. The final project files from three semesters, between Fall 2020 and Fall 2021, and four sections were de-identified and rated for creativity by three experts in civil engineering, using the Consensual Assessment Technique [10]. The lessons learned, the impact, and the challenges of implementing the final project option will be discussed, followed by the conclusion.

2. Strength-based Final Project for Creativity

The strength-based final project option was offered to students in the Statics course as previously reported [8]. For completeness, the components of the final project option are described in this section.

The "strength-based" qualifier means that students can choose how to best demonstrate their learning based on their individual strengths. The goal of this project is to allow students to reflect on their strengths, use them to motivate their learning of the Statics course topics, and eventually prepare them to come up with creative and innovative solutions to new engineering problems in the future. The final project option is given to students as an alternative option to the final exam, with a duration of 4 to 4.5 weeks between the end of the midterm exam 2 and the finals weeks to provide sufficient time for completion. Students can choose the format of the final report for the project, generating either a written report or an oral presentation to provide multiple formats. Students may also opt out of the final project option any time before the preliminary report due date for a final exam option if they were unable to successfully finish their proposed final deliverables [8].

During the project time, multiple steps of assessment were provided to give timely feedback regarding students' progress. Students were to submit a letter of intent to show their motivation, which was done by a true/false question from the Blackboard platform. Students then submitted three major reports including a project proposal, a preliminary report, and a final report. The instructor provided individual feedback to students after the project proposal and the preliminary reports.

In the final phase, the project proposal, preliminary report, and final deliverables constituted 5 %, 5 %, and 90 % of the entire project grade, respectively. The percentages of the project proposal and preliminary report are much less than the final report to provide a chance to learn from mistakes and promote a low-risk environment. In addition, 5 % of the grade was assigned as

extra credit for those who consider global, cultural, environmental, and economic factors in their projects.

There are two different tracks:1) problem-solving track, and 2) creativity track to allow open-ended project topic choices. The project description and detailed rubric were posted immediately after midterm exam 1 so that students could review and have time for decision-making. Each track will be described in detail below.

2.1. Problem-solving track

The problem-solving track required the creation of 9 new problems from specific sections of the Statics textbook [11]. These sections include the most challenging topics in the Statics course: 3-dimensional equilibrium, a moment of a force in 3D about an axis, the centroid of volume, analysis of trusses and machines, bending moment diagrams of a beam, friction of wedges, and moment of inertia of a composite body. Each problem was graded separately based on the rubric evaluating learning objectives, creativity, correctness, and professionalism, and the total score (out of 90) was calculated. For example, a full score means a new problem was solved correctly and presented professionally. Creativity was assessed based on the novelty of the problem. The detailed rubric is shown in Table 1.

Table 1. Rubric for the problem-solving track in Fall 2021

Category	Poor (0 %)	Fair (60 %)	Good (80 %)	Excellent (100 %)
Learning objective (1 pt)	No or incorrect learning objective			Correct learning objectives included
Creativity (3 pts)	Textbook problem was used	Changed numbers of the textbook problem	Changed the major setting of the textbook problem	New problem developed
Correctness (3 pts)	Problem not solved	Problem solved with major errors	Problem solved with minor errors	Problem correctly solved
Professionalism – for written reports (3 pts)	The problem, figures, and solutions are not submitted.	Solutions are hand-drawn, missing 3-4 intermediate steps.	Problems are typed with the hand-drawn figure, solutions are hand-written.	The problems are typed with computer draw figures, and solutions are neatly hand-written.
Professionalism – for oral reports (3 pts)	Problem-solving video is not submitted.	-	Problem-solving procedure is explained with missing 1-3 steps. The problem-	Problem-solving procedure is clearly explained with a detailed procedure. Both

			solving screen is recorded	face and problem-solving screens are recorded

2.2. Creativity Track

The goal of the creativity track is to develop and work on projects based on individual strengths aligned with course learning objectives. This track is open-ended, and students who wish to choose this track are required to contact the instructor to have their proposed ideas approved before working on the projects. The rubric of the creativity track was also developed based on the inclusion of learning objectives, creativity, difficulty, written report, and the final deliverable. The entire project was graded as a whole. Students were able to choose any form of final deliverable as long as they fulfilled their proposal. However, they were required to explain how their projects included all learning objectives and difficulty requirements to sell their ideas in the written report. Students received a full score if they created a novel product that included all 9 course learning objectives and solved difficult problems with a complete written report. The finalized rubric and the learning objectives for the creativity track project are shown in Table 2 and Table 3, respectively.

Table 2. Rubric for the problem-solving track in Fall 2021

Category	Poor (0 %)	Fair (60 %)	Good (80 %)	Excellent (100 %)
Learning objectives (10 pts)	The project includes no learning objective	In between	The project includes 5- 6 learning objectives	The project includes all learning objectives
Difficulty (10 pts)			The project solves Statics problem	The project solves challenging Statics problem
Written final report (20 pts)	Written report not submitted		The written report didn't use the correct format. Most project components are detailed missing 1-2 items in the format.	The written report used the correct format. All project components are detailed with figures and typed words
Final deliverable (50 pts)	The proposal was not fulfilled		The proposal was fulfilled mostly missing 1-2 items.	The proposal fulfilled all components proposed in the proposal successfully.

Table 3. Learning objectives of the Statics course from the Syllabus

By the end of the semester, students should be able to: 1. Draw free body diagrams of objects with applied external forces 2. Calculate components of forces and solve the equation of equilibrium in 2D and 3D

3. Calculate the moment of a structure under a point load or a couple of forces
4. Calculate centroids of areas and volumes
5. Analyze trusses, frames, and machines by finding the internal forces and reactions
6. Analyze beams and cables
7. Calculate the moment of inertia
8. Determine the internal forces of systems with friction

This project option was well received by students, and the participation of students in the final project options increased year by year. The total enrollments of the experimental sections of the Statics courses in the Fall 2020, Spring 2021, and Fall 2021 semesters were 122, 84, and 236 (2 sections), respectively. In the Fall of 2021, students enthusiastically chose the final project option, and 164 students (70 % out of the total enrollment) submitted their projects. The creativity track projects covered a multitude of strengths including music videos, Augmented Reality/Virtual Reality modeling of structures, bridge design comparison, comic books, drawing, game design, skits, origami, social pipeline construction, and poems. The statistics of the number of problem-solving track and the creativity track over 2 years were shown in the previous publication [8].

The demanding grading procedure of the final project was a problem. Therefore, for both tracks, new project grading sheets, grading examples, and instructions were prepared so that graduate teaching assistants could assist in grading the final report. Before the Fall of 2021, the instructor alone graded the final projects, which took several days of intense effort. For Fall 2021, the instructor and 3 teaching assistants shared the responsibility of grading the proposals, preliminary reports, and final reports for the problem-solving track projects, which drastically reduced the grading time. However, the instructor graded all final reports for the creativity track projects.

In the Fall 2021 semester, an external evaluator was invited to conduct a summative evaluation of the final project option [8], which included a question about the use of students' creativity in their final project or exam. Among 236 students, 164 students chose the final project option; 72 students chose the final exam option. Survey response rates were 22% for the final project students; 17% for the final exam takers. Of students who responded to the survey, 94% who completed a final project, compared to 31% who completed a final exam, agreed to the statement, *"…this assignment allowed me to use my creativity."* These external evaluation results showed that the strength-based final project options allowed students to use their creativity [8].

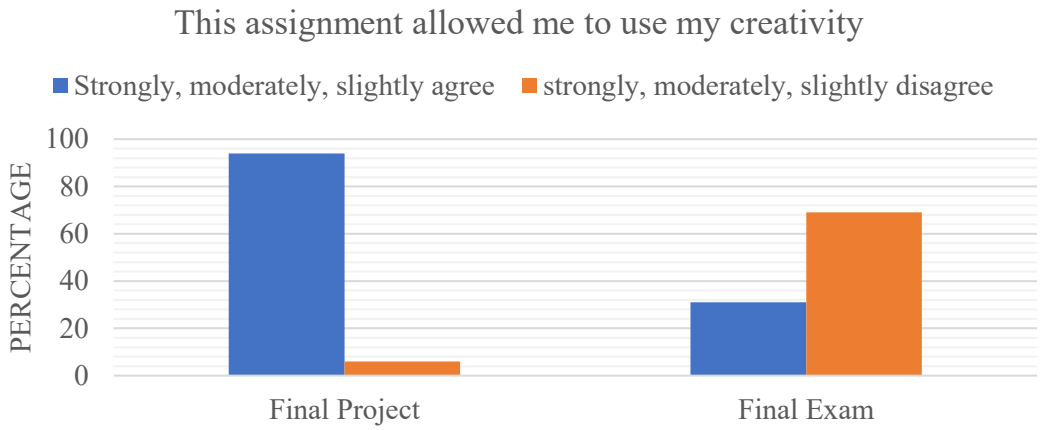

Figure 1. Student Responses Comparison between the Final Project and Final Exam [8]

3. Assessing Project Creativity using the Consensual Assessment Technique

The project files from the three semesters in which the project option was offered were collected, and each file was de-identified for evaluation. The names on the final reports were covered in the PDF file and deleted from the WORD file, and the portion of videos showing students' faces or names was cut from the video. After this procedure, there were 90 problem-solving reports, and 110 creativity final reports suitable for evaluation. The de-identified project files were saved in a shared Google drive, and access was allowed to three evaluators, who were selected to be subject matter experts (2 engineering professors and 1 graduate student). The number of de-identified project files from each section is shown in Table 4.

Table 4. Number of the de-identified project files per section

Semester	Fall 2020	Spring 2021	Fall 2021 Section 1	Fall 2021 Section 2	Subtotal
Problem-solving projects	23	9	29	29	90
Creativity projects	16	22	37	35	110

The three experts independently rated each project on a scale from 1 (*not creative at all*) to 7 (*extremely creative*), using the Consensual Assessment Technique (CAT) [10]. The CAT is considered the "gold standard" in creativity assessment [12][13]. Using this technique, creative products are subjectively rated by a group of experts or quasi-experts (i.e., individuals with greater than average experience) in a given domain. The level of consensus amongst ratings is then calculated and, if adequate, the ratings are combined to obtain a single creativity score [14]. The CAT has been used to assess creativity in a wide range of domains, including in studies focused on engineering. Examples can be found in the literature [15][16][17]. The grades students received on the projects were collected and de-identified as well.

3.1. Statistical method for assessments

The inter-rater reliability of the creativity scores was examined using Cronbach's alpha, which measures the consistency of the scores across raters. A simple linear regression was used to

determine if creativity on the projects predicted project grades. The equality of variances for the grades and creativity scores between the creativity track and problem-solving track projects were assessed using Levene's test. A statistically significant Levene's test suggests that the data is more widely dispersed around the mean for one group than for the other [18]. In this case, it is more appropriate to use Welch's *t*-test, which uses un-pooled variances, when analyzing data for mean differences between two groups [19]. Mean differences between the two groups were analyzed using independent samples *t*-tests.

4. Results

All three raters submitted creativity ratings for 195 of the projects. Inter-rater reliability for project ratings was sufficient, according to Cronbach's alpha ($\alpha = .74$). Total creativity scores were obtained for each project by averaging ratings across raters.

Distributions for creativity and project grades deviated substantially from normal, according to the standard scores of skewness and kurtosis (score divided by standard error >3.3; Tabachnick & Fidell, 2007) and the Shapiro–Wilk test ($p > 0.01$), even after removing data for one univariate outlier ($Z > \pm 3.5$ from the mean) for creativity ($Z = -3.65$) and one for project grade ($Z = -6.29$). For remaining projects ($N = 193$), total creativity scores ranged from 2.33 to 7.00 with a mean of 5.43 ($SD = .08$) and grades ranged from 58 to 100 with a mean of 91.54 ($SD = .62$).

Linear regression was used to examine if creativity on the projects predicted project grades. The model was statistically significant, $F(1, 191) = 8.40$, $p = .004$, $R^2 = .04$, with creativity positively predicting project grades ($\beta = .21$).

Differences between problem-solving projects ($N = 88$) and open-ended projects ($N = 105$) in grades and creativity scores were examined using Levene's test for equality of variances and independent samples *t*-tests. Levene's test did not indicate a significant difference in the variability of project grades [$F(191) = 3.05$, $p = .08$]. However, grades for problem-solving projects ($M = 93.33$, $SD = 8.08$) were significantly higher than grades for open-ended projects ($M = 90.04$, $SD = 8.84$) according to an independent samples t-test, $t(191) = 2.69$, $p = .008$ as shown in Figure 2.

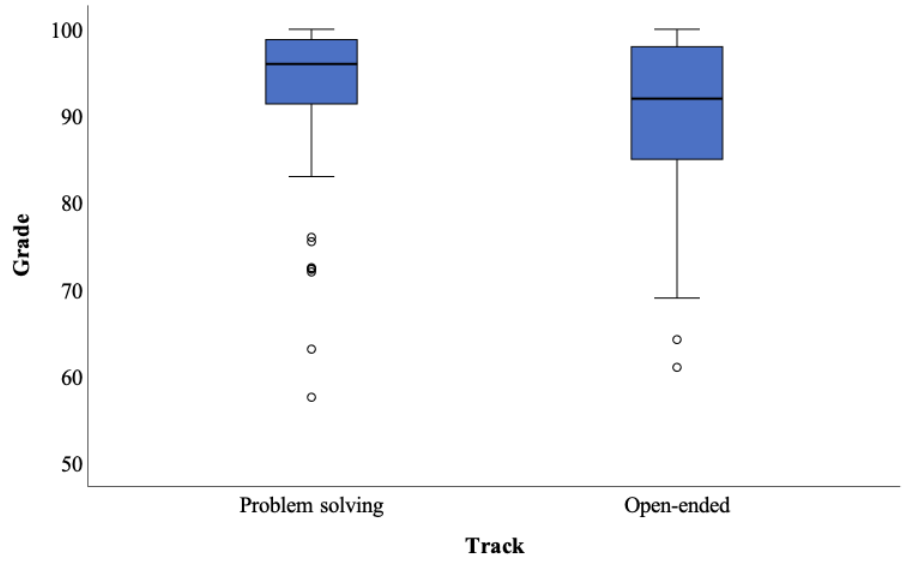

Figure 2. Student Grades Comparison between Problem-Solving and Open-ended Tracks

Levene's test indicated that problem-solving projects demonstrated significantly greater variability in creativity scores than open-ended projects, $F(191) = 21.40$, $p < .001$. However, mean creativity scores for problem-solving projects ($M = 4.86$, $SD = 1.13$) were significantly lower than creativity scores for open-ended projects ($M = 5.90$, $SD = .73$) according to an independent samples t-test, using un-pooled variance and corrected df, $t(143.79) = -7.41$, $p < .001$ (see Figure 3). Thus, although creativity positively predicted project grades overall, open-ended projects were rated as more creative than problem-solving projects. However, problem-solving projects received higher grades than open-ended projects.

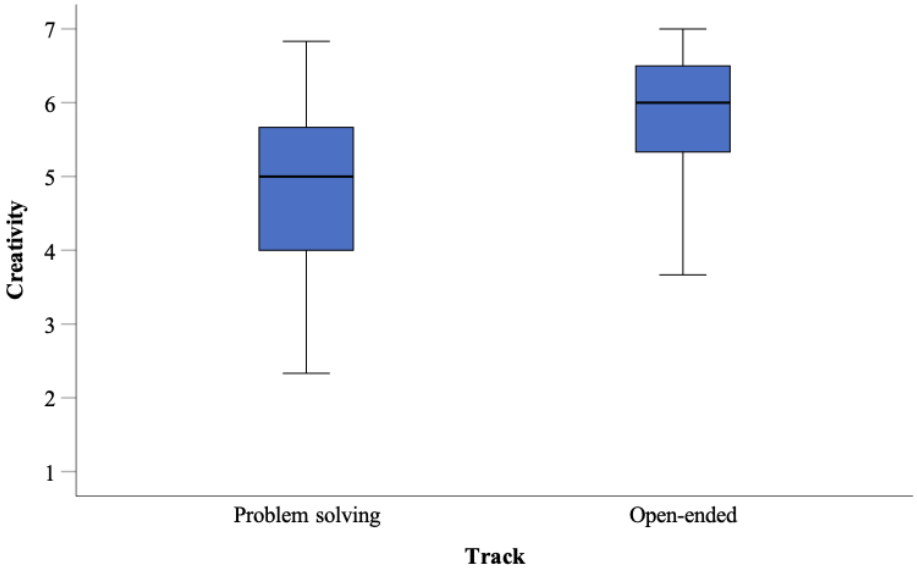

Figure 3. Student Creativity Comparison between Problem-Solving and Open-ended Tracks

5. Discussions

5.1. Observations regarding the analysis results

Creativity positively predicts project grades
Higher creativity ratings on projects were associated with higher grades, suggesting that students that demonstrate more creativity may receive higher project grades no matter which project format (i.e., open-ended or problem-solving) they choose. Creativity score was typically related to the student's individual talent or strengths.

Grades were higher for problem-solving projects than for open-ended projects
The Statics course is indeed focused on learning problem-solving skills. The problem-solving projects required clear and direct problem-solving, as well as the generation of multiple problem and solution sets. In contrast, the creativity track projects required a bit more subjectivity in terms of grading and it was more difficult to recognize the learning objectives from the final deliverables, e.g. drawings. This may have led the instructor and teaching assistants to assign higher grades to the problem-solving projects, resulting in the average score from the creativity-track projects being less than that of the problem-solving track projects. Further investigation is required to determine if this is indeed the case, or if there are differences in the intellectual rigor and/or demonstrated knowledge of problem-solving and open-ended projects. Nonetheless, the average grades of both tracks were above 90, showing that students performed satisfactorily on their projects overall.

The average project score was greater than that of the final exam
The average score for both project tracks was 91.7, which was greater than the final exam score, of which the average was 80.35 with a standard deviation of 17.92. We could argue that the higher project score is because the students used their strengths and were better motivated, which was seen from the final deliverable and students' enthusiasm toward the project. However, we do not have enough evidence to support that argument. This could be due, in part, to students being able to drop the project option if they were not able to complete their project before the preliminary report submission. Underperforming students who originally chose the project option may have gone back to the exam option out of necessity. As a result, higher performers may have completed the projects, and a few under-performers (who originally chose the project option) took the exam. Indeed, most completed projects met the expectations defined in the rubric to some degree.

Creativity ratings were greater for open-ended projects than for problem-solving projects, but problem-solving projects demonstrated greater variability in creativity
Creativity ratings were greater for open-ended than for problem-solving track projects, with average scores of 5.90 versus 4.86 (out of 7), respectively. This shows that the open-ended track project is helpful for students to use and demonstrate their creativity. However, creativity scores on problem-solving track projects were greater than the median point of the scale, suggesting that the problem-solving track projects also allowed students to use and demonstrate their creativity. Note that although a creativity score of 7 indicates that *the project is extremely creative*, a score of 3 or 4 indicates that *the project is creative, only to a lesser extent*. However, the creativity ratings of problem-solving track projects varied significantly more than that of

open-ended projects. This suggests that there may have been more creativity scores closer to the extremes for problem-solving projects, with some projects rated as extremely creative and some as much less creative. Indeed, the lowest creativity score for the open-ended projects was 3.67, whereas the lowest creativity score for the problem-solving projects was 2.33.

5.2. Discussions on the implementation of the final projects

The final project was part of the re-design effort of the Statics course for neurodivergent students using UDI so that we could reduce stress and help diversity and inclusion by increasing flexibility and improving accessibility. The positive and enthusiastic student evaluation results from the past two years suggest that most re-design components were favorably accepted by students. Among them, the final project was the major player in accommodation. In the summative evaluation from students, they reported that the final project option reduced their stress because they were working on the project for 4 weeks, instead of 2 hours for the final exam. Also, most students who were working on the project were motivated and enthusiastic about the project option, and they asked many questions about the Statics problems, and subsequently learned much in the process. In addition, the students who chose the creativity track were creative and pushed their limits to create the final deliverables in a variety of formats, showing their diverse strengths and interests, which we may consider in our engineering education in the future to solve our new problems in the future.

However, the time commitment required for grading the projects and student interactions remains a significant challenge. In the final phase, this responsibility was shared between the instructor and teaching assistants, making individual commitments manageable. Hiring a trained graduate teaching assistant helped continue this effort. Additionally, after the first offering of the re-designed Statics course, several students who took the re-designed version returned to the course as undergraduate teaching assistants. These teaching assistants were very helpful and greatly motivated the students in the course. To successfully implement the project option in future courses, the grading sheet, grading examples, and a tutorial session with the teaching assistants should be planned before beginning the final project.

5.3. Future directions

Though this represents the final phase of development of the final project option, several questions may be addressed with future research. First, it may be useful to understand the individual differences that influence whether students choose the final project or exam. Second, projects and exams may be rated for other characteristics, such as intellectual rigor and demonstration of knowledge, to ensure that all options are equivalent to these factors. Third, examining how the scores on final projects and exams relate to scores on other course requirements may provide insight into how well these options predict day-to-day performance in the class.

6. Conclusions

In conclusion, this paper presented the impact of the final project option in a large Statics course for assessing creativity. The final project option replacing the final exam was part of the re-design process for neurodivergent students as reported in the previous publication. The components, rubric, and statistics of the final phase of the final project option in the Fall 2021 semester were presented. By involving the teaching assistants in grading and interactions with students, the final project option was manageable to implement for even large courses. A total of 200 de-identified project files from both the problem-solving track and the creativity track were rated based on creativity. Results demonstrate that creativity scores were positively related to project grades. The creativity scores were higher for the open-ended creativity projects, whereas the project grades were higher for the problem-solving projects. Nonetheless, the average of the project grades was higher than that of the final exam grades. Given that the prohibitive time commitment required for instructor grading and student interactions may be solved by recruiting others to assist with these tasks, the final project options for the Statics course can also be transferrable to other institutions. The reported assessment of the final project option showed great potential to increase creativity in the Statics course, which could have a further impact on the engineering education curriculum.

Acknowledgments

This material is based upon work supported by the National Science Foundation under IUSE/PFE: RED Grant No. 1920761 (PI: Prof. Maria Chrysochoou). Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. The authors would like to thank Prof. Mousumi Roy and Caressa Wakeman for their valuable assistance in rating projects.

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Appendix. Final Project Assignment Description

CE 2110-001 Applied Mechanics I: Statics
Identity and Agency Development (IAD) Projects

As a part of [project name] project, this course provides an opportunity to make your choice over the final exam or final project. Review the following project descriptions, and notify the instructor if you choose the final project by the Midterm Exam 2 date (3/23). If you choose the final exam option, you don't have to notify the instructor. There are two tracks; 1) problem-solving track, and 2) creativity track.

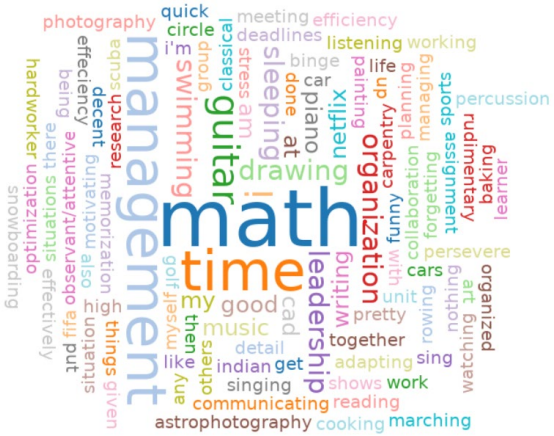


Figure 1. Strength Survey of Fall 2020 Statics Class (9/4/2020)

Project duration: 3/29/2021 – 4/26/2021 (4 weeks)
Project due: 11:59 PM on 4/26/2021 Blackboard submission link

1. Problem-solving track

Create your own problems from your home, workplace, or any structures in your major (civil, mechanical, biomedical, ..) in the most challenging subjects in Statics. You are to solve **in total 9 problems** in the following topics, **one per each section**:

1) 3D equilibrium (section 2.5)
2) Moment of a force about an axis (section 3.2)
3) Equilibrium in three dimensions (section 4.3)
4) Centroid of Volume of a composite body (section 5.4c)
5) Analysis of Trusses (section 6.1)
6) Analysis of Machines (section 6.4)
7) Shear force and bending moment diagrams of a beam with all types of loads (section 7.1)
8) Friction of Wedges (section 8.1)
9) Moment of Inertia of a composite body (section 9.2)

It is NOT allowed to use the existing problems in the textbook or The Statics Gallery as is. If you wish to modify the existing problems with some point deductions, you must change the major settings (not just numbers, but different members, reactions, etc.). After solving the problems, the final report can be submitted in either written format with a word processor

(scanned hand-written sheets are NOT allowed), or problem-solving videos. Separate documents regarding different formats will be posted later.

2. Creativity track

Create your own project based on your strengths – This must be aligned with course objectives. Some possibilities but not limited to:

a. Compose a song about challenging statics topics and perform it (group project is possible –virtual choir, virtual piano trio, virtual quartet, etc.). For example, you can use an existing song, and write lyrics about Statics topics.
b. Create a painting or artwork on the most challenging statics problems, solve those challenging problems, and present it.
c. Draw challenging statics problems in the real world in Sketch-up (software) and import them into Virtual Reality (if you need expert help, Prof. Alexandra Hain can help you with this.)
d. See The Statics Gallery for ideas, but do not use their ideas as is.

If you wish to choose this track, prepare your ideas and **get approved by the instructor** before working on the project. See the detailed rubric on the last page.

Project Timeline

Date	Milestones	Notes
3/23/2021, Tuesday	Deadline to notify the instructor	After this date, you will not be able to choose the project option
3/29/2021, Monday	Start your project	Planning on - Which problems to solve - Which track do you want to work on - Individual or team* projects - Consult with the instructor regarding your project if you have any questions
4/5/2021 Monday	Project proposal submission to HuskyCT link	Submit in a Word file - Your name and major - Project track and topic (if creativity track) - Proposal contents • PB track: Problem statements 1) ~ 7), and plan for 8) and 9) • Creativity track: Project components, milestones, and current status
4/9/2021 Friday	Instructor feedback	Receive instructor feedback and make changes in your project tasks
4/19/2021 Monday	Preliminary report to HuskyCT link	Submit a rough draft of your final deliverable, e.g. - draft your written report - handwritten problem-solving (all problems) - rehearsal video or score - 80% done artwork (photo of the artwork) - If you are not sure, ask the instructor, and submit an approved form of the preliminary report.

4/26/2021 Monday	Deadline of the final deliverable	Submit your report/presentation/video in the Blackboard link

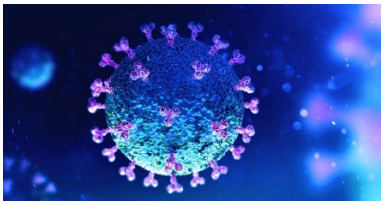
* If team projects, each team member's contribution must be clearly summarized in each document (proposal, prelim report, and final report). Based on the contribution, the final score of each team member can be different.

Project Grading:

Components	Points
Project proposal	5
Preliminary report	5
Final deliverable	90
Total	100

* Late submissions will be accepted, and there will be a 10 % deduction per each day after the deadline, and a 100% deduction one week after the deadline.

Stretch goal (5%):



Your problem(s) (or project topic) include(s) consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.