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Redesign of a Large Statics Course for Neurodiverse Students in the Distance Learning Environment

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Re-design of a Large Statics Course for Neurodiverse Students in the Distance Learning Environment

Abstract

One of the first large courses that engineering students encounter is Statics, which teaches various foundation topics and rigorous assessment schemes. Statics is an important course in that it gives the student the necessary foundation to further succeed in their education and careers. 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 has the potential to be beneficial for the Civil Engineering (CE) profession. The objective of this paper is to report a re-design procedure of the Statics course to accommodate neurodiverse students and improve interpersonal rapport in the online distance learning environment, while maintaining academic effectiveness. The procedure includes implementing seven universal design of instructions (UDI) principles in an online distance learning modality. In Fall 2020, two Statics course sections were taught; one was the experimental group using the UDI components, and the other section was the control group. A formative evaluation regarding the UDI implementation has been conducted for the experimental group. For both sections, the summative students' evaluations of teaching were conducted at the end of the semester, and the results from these two sections were compared. The final goal of the re-design is to create a diverse and inclusive Statics course to accommodate neurodiverse students as well as all students with different learning styles and disabilities.

1. Introduction

The goal of undergraduate engineering programs is to teach how to solve problems [1] with critical thinking and other necessary skills. Engineering programs typically have had a narrow focus and rigid adherence to traditional instruction and assessment [2]. Blickenstaff [3] reported the lecture format that was adopted in most engineering courses can be detrimental in that it potentially creates a barrier between students and instructors. Felder *et al.* [4] and Suresh [5] found that performance in key introductory undergraduate courses is related to engineering persistence. Even long after Seymour and Hewitt's earlier study about students leaving engineering because of poor teaching [6], students are still leaving engineering because of the barrier courses with various reasons. Thus, an effort to foster diverse and inclusive learning environment in the barrier courses are desired and necessary.

Statics is an introductory engineering course, required for Civil, Environmental, Mechanical, material, and Biomedical engineering departments at the University of Connecticut (UConn). It is predominantly taken by freshmen and sophomore students. Total enrollment has been steadily increasing and is about 400 ~ 500 students per academic year. To accommodate the large number of students, the course was taught in 7 sections with about 70 - 100 students per section. The class had 50-minute lectures on Mondays, Wednesdays, and Fridays focusing on problem solving led by instructors. In 2016, this course employed a paper textbook, weekly homework, two midterm exams and one cumulative final exam. Being required for the degree and as a key introductory undergraduate course, Statics was an example barrier course which used the lecture

format, which was not ideal in fostering an inclusive learning environment. This course was thus in need of careful attention to be effectively and inclusively taught.

Over time, various engineering innovation strategies have been sought to strengthen this course by multiple instructors. The first change for Statics is the flipped classroom. The flipped classroom is a pedagogical method which employs asynchronous video lectures and practice problems as homework, complemented with active group-based problem-solving activities in the classroom [7]. The other change for this course was implementing a hybrid class size with smaller discussion sections. The meeting time was reduced from 3 times per week to 2 times per week. The first meeting was with the instructor as a large section, and the second meeting was with the teaching assistant as a small discussion section. One lecture section has 120 students, accompanying 4 discussion sections with 30 students in each section. In addition, the class response systems [15] was implemented for active learning activities. After a series of improvements, the course was still in need of transformation to accommodate the in-class activities with the large enrollment numbers and with consideration of the diverse population spread across different majors.

How can we promote a diverse and inclusive environment for Statics in learning? Historically, underrepresented minorities were defined by race and gender. For learning, neurodiversity – defined as natural differences of human brains that exist from one to another regarding sociability, learning, attention, mood, and other important mental functions [8] – is an important factor to consider. Recently, some researchers explored methods to include neurodiverse student populations to further increase diversity and enhance creative problem solving [9]-[11]. Rentenbach et al. [12] reported that the traditional lecture style engineering course penalized neurodiverse students, e.g. students with autism, attention deficit hyperactivity disorder (ADHD), or dyslexia, because of learning environments consisting of one-directional knowledge input, dry atmosphere, no breaks, strict adherence of homework policy, paper textbook, fast closed book exam, and so on. Thus, the re-design of the Statics course to accommodate neurodiverse students has the potential to be beneficial.

The department of Civil and Environmental Engineering (CEE) at UConn was funded by the National Science Foundation to create an inclusive learning environment that empowers neurodiverse learners. As a part of this program, Statics has been revised to address the strengths and challenges of neurodiverse students and improve the educational experience for all students with two other courses. The department level redesigning effort is reported in another publication in this conference. This paper will focus on the re-design procedure of the Statics course to accommodate neurodiverse students implementing universal design of instructions (UDI) to improve interpersonal rapport in the online distance learning environment. Two Statics sections were taught; one was the experimental group with UDI and the other section was the control group. The independent survey results regarding the implementation of the UDI from the experimental group is reported. The summative evaluations were conducted from two groups, and the results were compared.

2. Universal Design of Instructions (UDI) for Neurodiversity

The focus of re-design is to implement UDI for neurodiversity. The mode of both lecture and the discussion section is in Distance Learning mode, which was provided through the online meeting platform Blackboard Collaborate Ultra [13] due to the Covid-19 pandemic.

Universal design (UD) is the design of products and environments with the aim to be usable by all people, to the greatest extent possible, and without the need for adaptation or specialized design [14]. With UDI, the course products and environments meet the needs of potential users with diverse characteristics that include disabilities. Furthermore, making a course accessible to people with disabilities often benefits others. There are nine UD principles, and this course has been re-designed to satisfy seven principles as summarized (see Table 1).

The first principle, equitable use, is applied to make the design useful and marketable to people with diverse abilities [14]. This was implemented through the course website, textbook, syllabus, and captions. The course website was pre-designed and developed to be accessible to everyone including neurodiverse students. A digital textbook was adopted for text-to-speech functionality and automated pre-lecture quiz options. Pre-recorded videos were captioned. Syllabus and other course files were in accessible file forms and uploaded to the course website in advance. This package is designed as a stand-alone package of online course an instructor can keep using semester by semester, once it is prepared.

The second principle, flexibility and use, is applied to provide wide range of individual preferences and abilities [14] for the exams and assignment. For a large course with more than 100 students, having oral examinations or multiple project options is challenging. Instead, the largest component of the grade, the final exam, was chosen for flexibility and as a make-up opportunity for neurodiverse and all students. Students can choose the format of their final deliverable. In addition, 1.5 time or double time extension for all exams was allowed for all students without requiring an accommodation letter. There was no student who didn't want to receive this accommodation because students could finish the exam earlier if they could.

To note, for the midterm exam 1, the control group was not given the extended exam time. Due to students' complaints about giving extended time only for the experiment section, the control section was also given the extended exam time for the midterm exam 2 and the final exam. For comparison, the students who finished the exam (scored higher than 50/100) were counted for both sections. For the midterm exam 1, 100 students (85.5 %) finished the exam in the allotted time in the control section. Interestingly, 104 students (85.2 %) finished the exam in the extended time in the experiment section showing similar fraction of students who finished the exam in midterm exam 1 regardless of extended exam time.

The third and fourth principles are applied to make the design easy to understand and to communicate necessary information effectively to the user with a diverse background [14]. These were applied to the embedded captions in pre-recorded videos. In addition to this, the online presentation had captions as well as audio descriptions so that students can choose to either read or listen to the explanations and discussions.

The fifth principle 'tolerance for error' is applied to minimize adverse consequences of accidental or unintended actions [14], in other words, embracing mistakes and errors. This was applied by adopting a digital textbook package with online homework using McGraw Hill's Connect [17]. Doorn et al. [18] reported effectiveness of various online homework platforms for flexibility and individualized feedback. Because online homework is personalized for each student, they must work on their own sets of questions, and get feedback. Students were allowed to make mistakes and check their answers multiple times, thus strengthening their problem-solving skills.

Last but not least, online lectures, which were also necessary due to the COVID-19 pandemic, made the last two principles, 'low physical effort' and 'size and space for approach and use' principles feasible. The design can be used efficiently, comfortably, and with a minimum of fatigue [14]. In addition, appropriate size and space is provided for approach, reach and manipulation [14]. Students could use any accommodations they needed at home, and were allowed to use any posture and actions while muted. Frequent stretch breaks, screen breaks, and a one-time 3-minute transition break were used during online meetings. In addition to this, students had opportunities to reflect on their efforts and performance in class using self-reflection surveys (after two midterm exams). Smaller student tutor sessions were provided for under-performing students based on their choices.

Table 1. UD Principles and Implementation in Statics

UD Principles	**Implementation in Statics Course**
Equitable Use	▪ Course website on Blackboard is pre-designed to be accessible to everyone ▪ Digital textbook is adopted for text-to-speech functionality ▪ Captions are embedded in the pre-recorded video lectures ▪ Syllabus and course files are all accessible forms
Flexibility and Use	▪ Final project has an option of written or oral report choices ▪ Students have choices to read the textbook or listen to the textbook from the digital textbook ▪ All students are given 1.5 time to 2 time extension to exams
Simple and Intuitive Use	▪ Video recordings are captioned
Perceptible Information	▪ Video recordings are captioned ▪ Presentation during online meetings includes captioning options and audio description
Tolerance for Error	▪ Digital textbook provides guidance and background information when students work on homework ▪ Students are allowed unlimited homework attempts until the due date ▪ Students can check the homework answers multiple times, so that they can fix their answers before the homework submission date
Low Physical Effort	▪ Online lecture environment allows low physical effort. They can join the lecture in their own room with necessary accommodations with minimum fatigue ▪ During online lectures, frequent stretch breaks, screen breaks, and one time 3-minute transition break were used

Size and Space for Approach and Use	▪ Online lecture environment eliminated physical lecture space Students can use the dedicated space for their learning at home and are allowed to use any posture or actions while muted

As part of the research project, a formative survey regarding UDI implementation for the experimental section was conducted in the middle of semester. Within the section, there were 4 students who identified as neurodiverse. There were 19 survey questions used including: 1) UDI representation, 2) action & expression, and 3) engagement (see Table 2). Category 1 includes UDI representations: consistency of expectations regarding syllabus, accessibility of multiple lecture formats, instructional technologies to enhance learning, and multiple ways of assessments. The average score to these questions was 4.087 out of 5. For the score base, 5 means always, 4 means most of the time, 3 means about half the time, 2 means sometimes, and 1 means never.

Category 2 involves UDI action and expression, to check whether students were allowed to express their comprehension of material in multiple ways, and the score was 3.434 out of 5. This is low because this survey was conducted before the final project, and students are not allowed their comprehension by multiple ways for other assignments.

Category 3 involves UDI engagement, and this includes student engagement, communication, motivations, and respectful atmosphere. The average score for this category was 3.852 out of 5. Considering the fact that this course was re-designed and offered for the first time in Fall 2020 and offered as an online course, the score shows a sound start as well as room for improvement. The purpose of this survey is to check the implementation procedure. The comparison of the student feedback from the experimental and control groups will be shown in Section 4.

Table 2. Formative Survey Regarding UDI Implementation (for Experimental Section Only)

Category 1 UDI Representation	**Score**
○ My instructor presents information in multiple formats. ○ My instructor's expectations are consistent with syllabus learning objectives ○ My instructor ties the most important points to the larger objectives of the course. ○ Lectures are accessible to me in more than one format (e.g., live, recorded, captioned, transcribed, slides). ○ My instructor provides course materials in accessible formats that I can use (e.g., files can be enlarged, voiced, edited, or manipulated as necessary for accessibility). ○ My instructor uses instructional technologies (e.g., clickers, Blackboard) to enhance learning. ○ Materials for this course (except textbook) are accessible, clearly organized, and easy to use. ○ My instructor is highly approachable and available to students. ○ Information in this course is usually presented in more than one way. ○ My instructor is willing to make adjustments to the way content is presented or assessed when asked	4.087
Category 2 UDI Action and Expression	
○ Students are allowed to express their comprehension of material in multiple ways.	3.434
Category 3 UDI Engagement	
○ I am able to grasp the key points from instructional videos for this course.	3.852

○ I receive prompt, instructive feedback on all assignments. ○ In this course, technology is used to facilitate communication between students and the instructor. ○ In this course, I feel interested and motivated to learn. ○ I feel challenged with meaningful assignments. ○ My instructor offers contact with students outside of class time in flexible formats. ○ My instructor explains the real-world importance of the topics taught in this course. ○ My instructor creates a class climate in which student diversity is respected. ○ My instructor is highly approachable and available to students. ○ Information in this course is usually presented in more than one way. ○ My instructor is willing to make adjustments to the way content is presented or assessed when asked	

3. Strength-based Final Project for Creativity

The next component for re-design was the implementation of the strength-based final project in Statics for creativity and innovation. “Strength-based” means that students were able to choose how best to demonstrate their learning based on their individual strengths. This option is to substitute the final exam, which is 30% of the total grade. The criteria to develop the strength-based project are: providing sufficient time for completion for flexibility, providing multiple means of submissions, allowing open-ended project topic choices, and providing multiple steps of assessment to give timely feedback regarding students’ progress.

The duration of the final project was for 4 weeks between the end of the midterm exam 2 and the final exam, 11/9/2020 and 12/7/2020. The project description and detailed rubric were posted immediately after midterm exam 1 so that students could review and have time for decision making. Students could choose the format of the final report, either as a written report or oral presentation. Students could also opt out from the final project option any time before the preliminary report due date for a final exam option if they were not able to successfully finish their proposed final deliverables.

During the project time, students were to submit four different reports: letter of intent, project proposal, preliminary report, and the final deliverable. The instructor provided individual feedback to students after the project proposal and the preliminary reports. Project proposal, preliminary report, and final deliverables consisted of 5%, 5%, and 90% of the entire grade, respectively.

There were two tracks: 1) problem solving track, and 2) creativity track. The problem solving track required the creation of 9 new problems from specific sections from the Statics textbook [16]: 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), and 9) moment of inertia of a composite body (section 9.2). These sections were chosen to include all course learning objectives and challenging Statics problems.

The rubric of the problem-solving track was carefully developed to ensure students' success. Each problem was graded separately based on the following rubric, and the total score was added. First, each problem should have at least one course learning objective to get 1 point. The problem-solving track, students will receive full score when they create a new problem, and receive full score when they solve the problem correctly. In the final deliverables either in written report or oral presentation, students should show professionalism and neatly present their work by typing or recording their problem solving. The example rubric is shown in Table 3.

Table 3. Example Rubric for Problem Solving Track

Category		**Not included (0%)**	**Fair (60%)**	**Good (80%)**	**Excellent (100%)**
Learning objective (1 point)		No learning objective included	-		At least one objective per problem included
Creativity (3 points)		Used textbook problem	Changed numbers in the textbook problem	Changed major setting in the textbook problem	Created a new problem
Correctness (3 points)		-	Problem solving procedure is wrong	There are 1-2 minor errors in calculation	Correctly solved without errors
Professionalism (3 points)	Written report	-	Problem solutions missing 3 - 4 components	Hand drawn figure, hand written problems and solutions	Typed with Computer-aided drawing.
	Oral report	-		Problem solving procedure is explained with missing 1-3 steps. Problem solving screen is recorded	Problem solving procedure is clearly explained with detailed procedure. Both face and problem-solving screen are recorded

The goal of the creativity track is to develop and work on their own project based on their individual strengths aligned with course learning objectives. Because this track is open-ended, students who wish to choose this track are required to contact the instructor and get approved their ideas in the proposal before working on the projects.

The rubric of the creativity track was also developed. The entire project was graded as whole. Students received full score if they included all course learning objectives in their final deliverables. Because this track requires creativity, 20 points were given as default. If the projects solve challenging statics problems, students get difficulty scores between 8 to 10 points. Students were able to choose any form of final deliverable as far as they fulfilled their proposal;

however, they must explain how their projects included all learning objectives and difficulty requirements to sell their ideas. The example rubric is shown in Table 4.

Table 4. Example Rubric for Creativity Track Final Deliverables

Category		**Poor (0 %)**	**Fair (60 %)**	**Good (80 %)**	**Excellent (100 %)**
Learning objectives (10 points)		Project include NO learning objective.	In-between	Project missing 3-4 learning objectives	Project includes all learning objectives
Creativity (20 points)		-			Automatically included
Difficulty (10 points)		-		Project solves Statics problems	Project solves (or deals with) challenging Statics problems
Final report (50 points)	Written report (10 points)	-		Project components are described with hand-written report	All project components are detailed with figures and typed words
	Final deliverable (40 points)	Proposal not fulfilled	-	Fulfill most components missing 1-2 items.	Fulfill all components proposed in the proposal successfully.
Total: 90 points					

***** Creativity track project should accompany a brief written report with student(s) name(s), and 1) the learning objectives it includes, 2) description of the project, 3) justification of difficulty, 4) explanation of final deliverable (artwork, videos, etc.), and 5) references (optional).

Out of 122 students in Section 1, 69 students submitted the letter of intent, and 51 students submitted the final deliverables, consisting of 45 projects. As shown in Figure 1, there were 40 individual projects and 5 group projects. There were 24 problem solving track projects, and 21 creativity track projects. All 5 group projects were creativity track projects. Creativity track projects included songs, drawings, comics, story-telling, tower crane modeling, wood table construction, and string art.

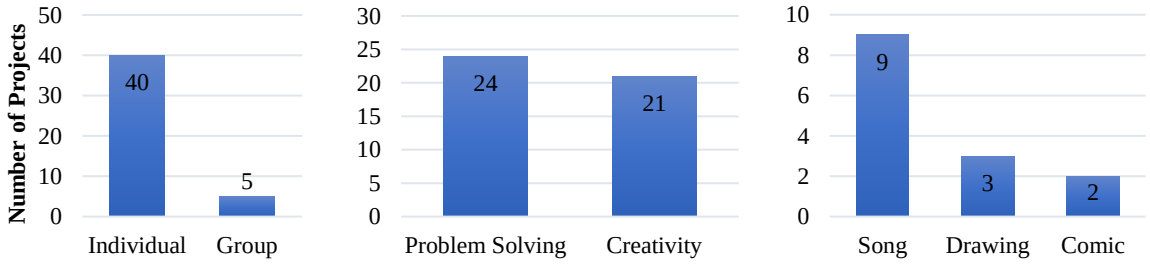
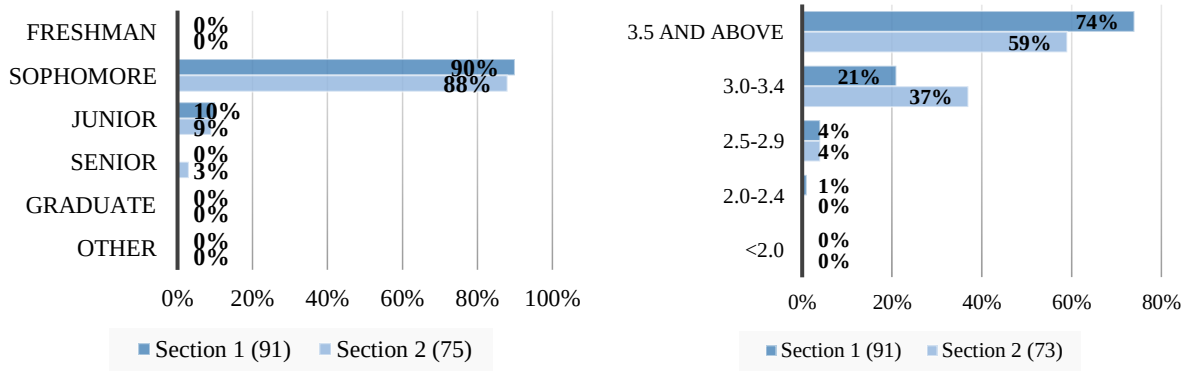


Figure 1. Project Submission Statistics (a) Individual vs group projects, (b) Problem solving vs creativity track, (c) Types of creativity track projects

4. Result: Student Evaluation Comparison

In Fall 2020, two sections of Statics were taught: Section 1 was the experimental section with re-design for neurodiverse students (enrollment 122) and Section 2 was the control section (enrollment 117). A summative evaluation was conducted for two sections using student evaluation of teaching (SET) conducted by the University. For Section 1, 91 out of 122 students (75%) responded; for Section 2, 75 out of 117 students (64%) responded.

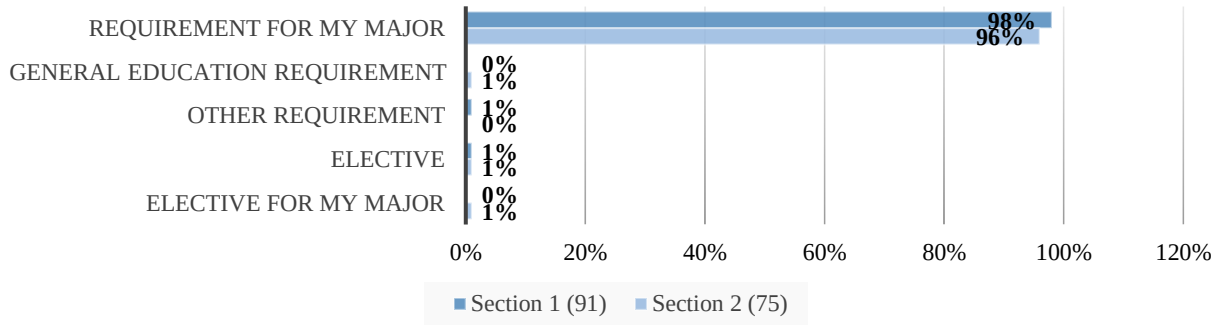
First set of survey was conducted for the information of the student pool as shown in Figure 2. For both sections, almost 90% of student population consist of sophomore students. Cumulative GPA distributions indicate that the Section 1 have high GPA groups considering the higher response rate. The reason behind this GPA distribution discrepancy between the two sections is not clear, and the correlation between GPA and specific section selection is considered as a future research topic.



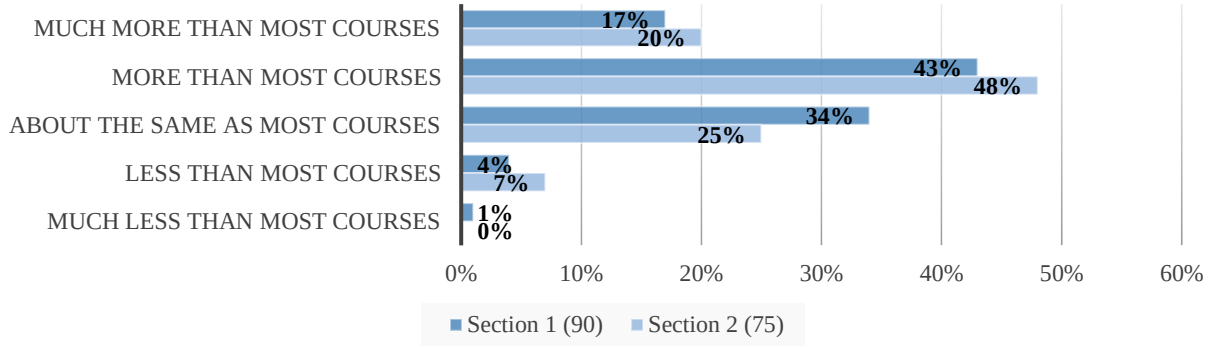
(a) What is your academic level? (b) What is your cumulative GPA?

Figure 2. SET Results

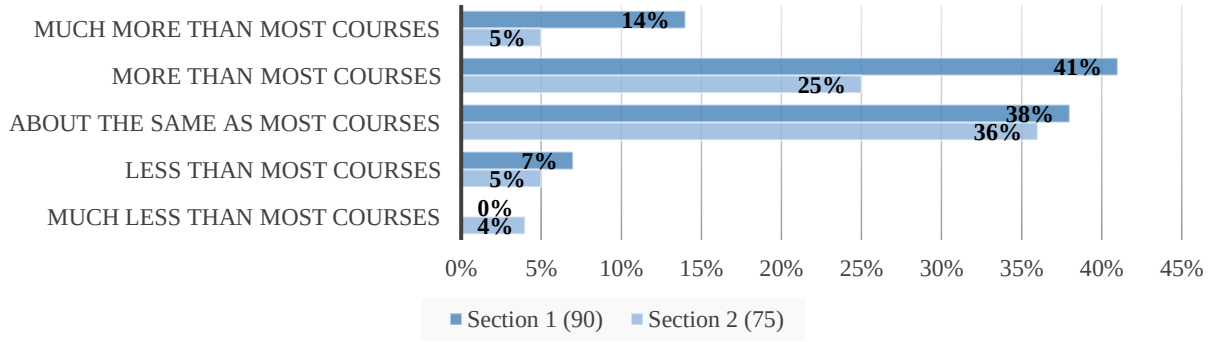
The next survey was about the course characteristics and self sufficiency. As shown in Figure 3, more than 95% students took this course for their requirement for both sections. 60% and 68% responded students from Sections 1 and 2 felt Statics was more or much more difficult than most courses. The next question was 'Overall, how much do you feel you've learned in this course?' 38% and 36% of students responded they learned about same as most courses from Section 1 and 2, respectively, as expected. 14% and 41% of students from Section 1 responded that they learned much more and more than most courses, respectively. 5% and 25% students from Section 2 responded to the same categories, respectively. This indicates 280% and 164% of students in the Section 1 than those in the control section thought they learned more than most courses.



(a) Which best describes this course for you?



(b) For me, the level of difficulty of the course content was:



(c) Overall, how much do you feel you've learned in this course?

Figure 3. SET Results (a) Course description (b) Difficulty (c) How much learned

The following question involved promoting learning in Figure 4. In total, 75% students in Section 1 either strongly agree or agree to this statement, and 61% students in Section 2 either strongly agree or agree to this statement. 9% and 25% students in Sections 1 and 2 neither agree nor diagree this statement, respectively. 16% and 13% of students from Section 1 and 2 disagree or strongly disagree this statement, respectively. This shows more students in Section 1 felt the pedagogies used by the instructor promoted their learning than Section 2.

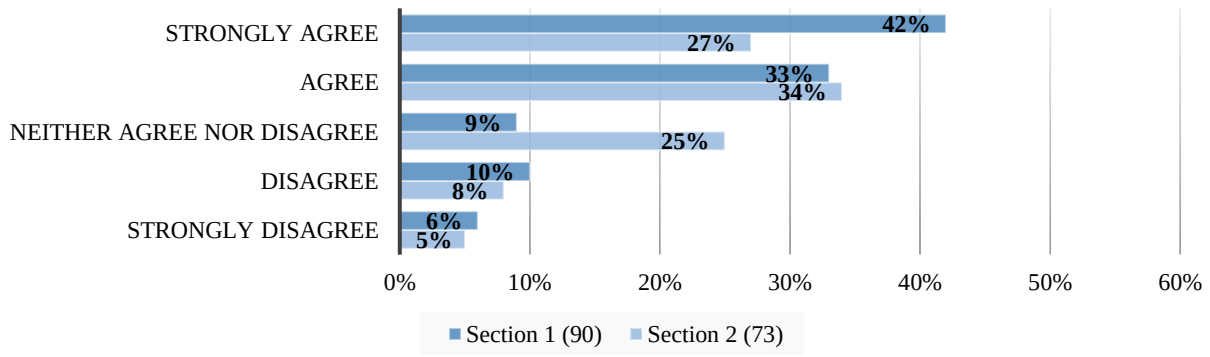


Figure 4. SET Result: The instructor's teaching methods promoted student learning

Last but not least, three open-ended questions were given to students on top of the default questions in the SET to share their feedback. The first question was 'Do you feel the course activities and course modifications reduced your stress and helped your learning?' Out of 62 responses, 59 (95.2 %) were yes, and 3 (4.8 %) were no.

The next question was about sharing the most positive interventions for their learning. The shared comments are shown in Figure 5. 23, 17, and 16 students chose extended exam time, frequent breaks, and materials availability as useful interventions, respectively. Others chose the digital textbook, final project option, and smaller tutor sessions.

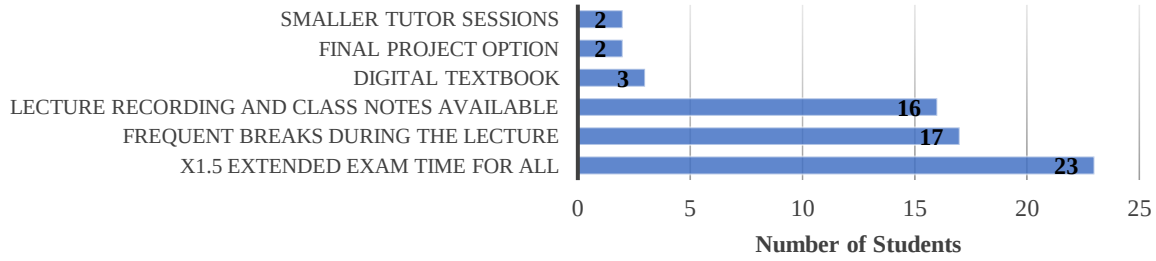


Figure 5. SET Result: Additional feedback question

5. Discussions and Future Work

In general, implementation of UDI helps diversity and inclusion by increasing flexibility and improving accessibility. The results of the SET survey suggests that the implementation of UDI was favorably accepted by students. This can be attributed to several factors. To provide more evidence, a systematic research based on carefully designed survey questions for the experimental and control groups are desired and planned for the future work. This section provides more discussions and suggestions for future work.

The initial development requires a major investment for successful implementation. The creation of accessible material and pre-recorded videos require considerable time and effort of the instructor. An organized online course webpage is desirable to function as a course hub, accessible to instructors, TAs, and students. In the end, the whole re-design procedure took one year; planning meeting and workshop in Spring 2020, actual courseware preparation in Summer 2020, and course administration in Fall 2020. This procedure was a group effort transforming

multiple courses in CEE department, collaborating with the Center for Excellence for Teaching and Learning (CETL), Center of Students with Disabilities, and a colleague in the NEAG School of Education.

During the semester, the instructor also needs to provide individualized feedback to students regarding the proposals and the preliminary reports. Giving feedback per student took about 3 ~ 6 minutes, resulting in about 3-5 hours of instructors' time per assignment. This may be addressed by training TAs to provide feedback, and by limiting the number of creativity track projects. In addition, grading final deliverable took time, about 10 minutes per student resulting in a total of 8 - 10 hours. Considering the fact that the instructor should grade the final exams which typically takes about 5 minutes per student, 4 - 5 more hours were spent to grade the final projects. The problem-solving track projects could be graded by TAs once they are trained; however, the creativity track projects are recommended to be graded by the instructor because of the open-ended nature.

In Fall 2020, both the experimental and control groups attended class virtually due to the COVID-19 pandemic. The differences in perceived learning between the two sections could be partially due to pedagogies in the experimental group that were more conducive to remote learning. For example, implementing frequent breaks and eliminating the need for attending classes in person. However, most pedagogies in the experimental group can also be used for Face-to-Face modality. Specific interventions for 'low physical effort' and 'size and space for approach and use' categories can be modified for in-person classes. For example, implementing fidget breaks and changing seats in the classroom allowing stretch breaks and preparing a dedicate space with more room for disabled students. In Fall 2021, two Statics sections will be offered as in-person classes, and the interventions for the in-person classes are under development.

One question is whether the interventions used in the experimental group helped to attain the project goals of increasing diversity. Because it is sensitive to ask students to disclose their neurodiversity or disability status with identity, only the aggregate number was measured. In Fall 2020, there were 4 students who identified as neurodiverse within the experimental section as mentioned earlier, and their evaluation of this course regarding the implementation of UDI principles were included in the survey shown in Table 2 in Section 2. It is difficult to measure the effectiveness of the UDI principles from neurodiverse students directly; however, the overall goal of the re-design is to accommodate all kinds of neurodiversity through UDI principles assuming everyone has different learning styles.

Another question is whether the pedagogies used in the experimental group promoted creative problem-solving skills. It was indirectly shown from the final project outcome. Students created challenging problems in Statics fulfilling all course learning objectives and solved them to achieve the highest score. In the experimental group, the average of the final project score was 96.7 out of 100, and the standard deviation was 5.7. Most students received over 90 points, and there were 2 students who received 72 and 72.5, because they used the textbook problems as is in their final projects. Because most students attained higher scores in the final project which includes creative problem-solving points, the study has a potential to actually promote creative problem-solving skills; however, this study was not set up to address this question. More

systematic evaluation of these goals with new surveys are currently under discussion with our Institutional Research Board.

The strength-based final project was run relatively successful due to the detailed rubric. Students tried to fulfill the rubric components as much as possible to achieve the highest score. Still, the rubric items can be revisited and modified. For example, the default creativity score of 20 for the creativity track can be reduced or eliminated, because creativity is required for both tracks.

The results and UDI components are general to other CEE courses Fluid Mechanics and Mechanics of Materials, and the results are reported in other publication [19]. This course was administered in Spring 2021 with improved interventions. The results will be shared in the conference.

6. Conclusions

This paper reported the initial re-design of a large Statics course to accommodate neurodiverse students using UDI in an online environment. Seven UDI principles were successfully implemented for the Statics course with a digital textbook, course website, accessible materials, a final project option, extended exam time, and frequent breaks, among other improvements. Among them, extending exam time, providing breaks in instruction, and making class notes available to students are the interventions with a low cost of implementation for faculty using more traditional pedagogies. In addition, the final project option was created to reward creativity so that students could use their own individual strengths to learn the course material. In total, 51 students participated in the final projects options to replace the final exams, and 49 students successfully completed with higher scores than 90. The students' feedback regarding perceived learning were compared which suggested overall positivity regarding the re-designed section compared to the control group. The reported re-design process showed great potential to increase diversity and inclusion using UDI in another institution. The re-design process is still on-going, and this paper presents the overall structure of the UDI components, instructor's reflection, and students' feedback. More systematic surveys regarding the re-design and statistical analysis will be included in future work.

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