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Exploring Engineering: Peer-sharing Presentations in First-year Engineering Curriculum

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Exploring Engineering: Peer Sharing Presentations in First-Year Engineering Curriculum

This Complete Evidence-Based Practice paper discusses the use of peer sharing presentations across sections of a first-year engineering course at Clemson University. First, we discuss the rationale for and goals of this assignment series, titled "Exploring Engineering." Then, we provide an overview of the assignment, followed by an analysis of student outcomes and discussion of the assignment's effectiveness.

At Clemson, all students who intend to pursue an engineering degree must complete a first-year engineering program. The first required engineering course, titled "Engineering Disciplines and Skills," provides students with foundational engineering skills necessary to be successful in later coursework. Using the Reid and Reeping taxonomy [6], the course focuses on the Math Skills and Engineering Specific Technology / Tools domains, but also incorporates aspects from each of the Global Interest, Engineering Profession, and Academic Advising domains. The latter three domains are used to both expose students to the breadth of engineering and help students explore their interests and learn more about the engineering majors available to them. Ultimately, the goal is to provide students with the information and resources they need to make an informed decision about which major they want to pursue.

Many first-year engineering students know – or think they know – which engineering major they want to pursue upon matriculation to the university. However, helping students make an informed major selection is important because many of these students switch their intended engineering major choice during the first year [7]. Some of those students who switch their intended engineering major likely do so as the result of the "polarizing effect" of a first-year engineering program. This effect is so named because many first-year students are undecided if engineering or a particular major is the best field for them and use the first year to confirm whether or not to continue in engineering or a particular major [8], [9]. Therefore, the General Engineering department is always looking to improve how material relevant to major exploration is incorporated into its introductory course as it can have a significant impact on individual students as well as the retention and persistence statistics in the engineering majors.

Over the years, the General Engineering department has implemented a variety of methods to encourage and/or require students to learn about the different engineering majors offered at Clemson. For several years, students were required to complete a series of assignments as part of an "Individual Reflection Portfolio." These assignments required students to research information about the different engineering disciplines then write reflections related to engineering ethics and future engineering career goals. These assignments were typically completed at the end of the semester, and perhaps as a result of that, the quality of the assignments was often quite varied; it was clear that many students did not put much thought or effort into these activities, or did not even bother to attempt them.

A few years later, Clemson's Center for Workforce Development produced a series of online modules with a similar goal of helping students learn about the various engineering disciplines. The General Engineering department required the first-year engineering students to complete the

modules as a part of the first-semester course requirement. The modules allowed the work to be spread across several weeks and provided students with flexibility due to its self-paced and online nature. However, many students still delayed completion until the due date, or failed to complete the modules at all. Additionally, there were numerous technical difficulties, such as enrolling in the modules, updating information, and correcting errors in grading the module assessments, that added to frustration among both students and faculty and ultimately reduced the effectiveness of this initiative. Furthermore, these online modules primarily focused only on information about the specific engineering disciplines at Clemson and not wider topics relevant to the field of engineering at large.

Most recently, Clemson's General Engineering department has implemented a series of Exploring Engineering assignments as a way to help students learn more about the different engineering disciplines and other engineering-related topics. By having both in- and out-of-class requirements as well as a peer review, this assignment series was designed to encourage better participation among the students.

Exploring Engineering logistics

After successfully integrating a peer sharing presentation series in the learning strategies course of the General Engineering Learning Community [1], [2], the assignment was translated for use within Clemson's introductory general engineering courses. Given the name "Exploring Engineering," the adapted assignment allows students to engage with pressing issues and trends within the field of engineering and investigate the topics in which they are most interested. Additionally, the assignment requires students to communicate their findings and insights to peers, providing a space for students to become active learners as new knowledge around engineering is built between and by classmates. The assignment is required for students and makes up 7.5% of their final grade in the engineering course. The following sections detail the content and structure for each round (Figure 1) and provide information about how the assignment connects to other course outcomes.

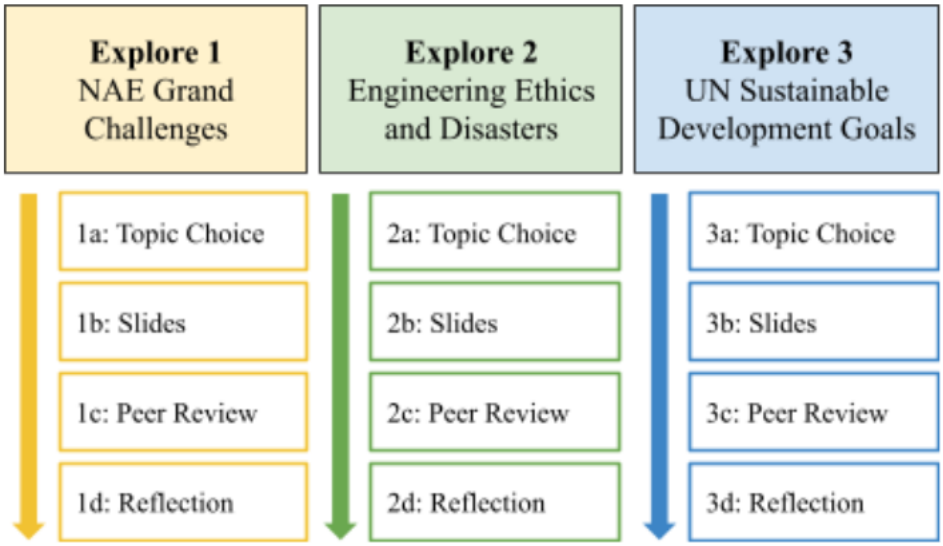

Figure 1. Exploring Engineering Content and Structure

Content

The Exploring Engineering assignment includes three rounds throughout the semester, each with a distinct focus on overarching themes relevant to the field of engineering. The three themes include Grand Challenges, Engineering Ethics and Disasters, and Sustainable Development Goals. These themes were selected as they connect with course outcomes and encourage students to think about how the engineering content they are learning connects to real-world issues. The first theme is based on the National Academy of Engineering's (NAE) Grand Challenges for Engineering [3] and details macro-level world problems requiring integrative solutions. The Engineering Ethics and Disasters theme focuses on the field's most impactful blunders and asks students to learn from mistakes made over the last 50 years. Finally, the third theme is adapted from United Nations' (UN) Sustainable Development Goals [4], which outline the most pressing global issues facing humanity. Specific topics within each of the three themes can be found in Appendix A.

While presenting traditional first-year engineering topics in class (e.g., temperature, energy, force, etc.), the Exploring Engineering themes are also used to help guide conversations and frame class problems. For example, while discussing energy, having a conversation about the Space Shuttle Columbia explosion allows for a "real world" application of the concept falling within the Engineering Ethics and Disasters theme. Drawing these connections for students emphasizes the relevance of course content in their future careers as engineers.

Structure

Each of the three rounds of Exploring Engineering includes four sequential assignment components: topic choice, slides, peer review, and reflection. Each round contains a total of 200 points, with slides holding the most weight (135 points), followed by the peer review (40 points), reflection (20 points), topic choice (5 points). To begin each round, the instructor introduces the new theme, the reason it was selected, and its relevance to engineering as a broad field through a short in-class presentation.

Following the presentation, students select the topic of their choice from a list provided by the instructor and submit their selection through Clemson's learning management system. For the first and third rounds, the instructor-given list was developed by the NAE and the UN, respectively. For the Engineering Ethics and Disasters round, students also have the option of submitting a topic not present on the list, given the topic is appropriate and relevant to the theme. After their selection is approved, students begin to learn about their topic through a combination of instructor-provided resources and credible resources sought out by the student.

Using their findings, students then create a set of four slides to explain the topic and relate it to their engineering major of interest. The peer sharing presentation slide format of our Exploring Engineering assignments is inspired by Slidedocs [10] and Speed Geek [11], both of which emphasize the creation of engaging and informative, yet brief, slides to be shared with an informal, rotating audience over a short amount of time. Accordingly, students create a presentation with four slides. The first slide includes the topic name, student name, intended

engineering major, and references. The second slide introduces the topic with an explanation and includes a picture illustrating the topic. The third slide focuses on application, asking students to describe why their topic is important and how their intended major can contribute. The fourth slide summarizes a recent news article relevant to the topic with a picture to illustrate the event.

Prior to the COVID-19 pandemic, at the conclusion of each Exploring Engineering topic, students would present their slides in class to their peers. Instead of presenting to the whole class, students were paired and would present their slides to one other student in two minutes. Students would then switch roles for another two-minute presentation. After both students presented, everyone would switch partners and repeat the process. This process was normally repeated for a total of six rounds. For each presentation, students would also collect a handout of slides presented.

When instruction transitioned online due to the pandemic, we began using our learning management system to distribute slides for peer review. In the peer review process, students view the slides of at least four of their peers and make connections between their interests and those of their classmates. Since the peer sharing and review occurs online, students are expected to include more text than normally expected on their slides to fully convey their ideas in writing that would normally be included during an oral presentation of the slides.

The last component of each round is the reflection. After completing all previous components, students reflect on their experience and compose a write-up on the two "best" presentations they reviewed during the peer review process. The reflection includes details about what made them the "best" presentations and what was learned from each presentation.

Though the effectiveness of this instructional approach has been evidenced through anecdotes and previous research findings [1], [2], specific outcomes of the Exploring Engineering assignment from the perspective of students have not been systematically investigated. Subsequently, this paper aims to answer the following research question: How, if at all, are students connecting the Exploring Engineering topics to their learning as current engineering students and future engineering professionals?

Methods

To answer our open-ended research question, an exploratory qualitative approach was taken [5]. While the Exploring Engineering assignment series has been utilized in both in-person and online formats, the current analysis focuses exclusively on outcomes from the virtual format by drawing on the experience of the Fall 2020 cohort. While overall information about topic choice for students enrolled in the introductory engineering course in the Fall 2020 semester (n=1085) and descriptive data related to end of semester evaluations for a subset of students (n=586) are outlined for context at the beginning of the results section, a smaller subset of students from one section who provided IRB consent is included in the analytic sample (n=61). This smaller sample constitutes the primary analysis.

The specific data source for the qualitative analysis is students' reflections for each of the three Exploring Engineering rounds. One member of the research team, who was involved in the

development of the Exploring Engineering series but was not an instructor in the introductory engineering course, read each students' work sequentially, beginning with the first student on the roster. Accordingly, each student's Explore 1 was analyzed, followed by Explore 2, then Explore 3 before moving on to the next student. These responses were coded holistically, with the ultimate goal of uncovering salient themes [5]. The remaining authors reviewed the themes for accuracy based on their experiences facilitating the Exploring Engineering series as instructors of the course.

Results

Overall in Fall 2020, 1105 students were enrolled in the first-year engineering course; of those, 1085 completed at least one of the three required Exploring Engineering peer sharing presentations (i.e., slides component) throughout the semester. Additionally, responses from an end of semester evaluation indicate 66% of students found the Exploring Engineering assignment series somewhat, very, or extremely influential in selecting their major. In contrast, only 9.9% of students reported the assignment series was not at all influential.

Figure 2 demonstrates the breakdown of student topic choices for each of the three rounds; while some topics were more popular among students (e.g., providing access to clean water for Explore 1, Fukushima and the Ford Pinto for Explore 2, and affordable and clean energy and life below water for Explore 3), there was generally a good deal of diversity and even distribution in the selected topics. A sample presentation for each round was provided to students; students were not able to select the topics used (advancing personalized learning for Explore 1, the Cuyahoga River Fire for Explore 2, and quality education for Explore 3). For Explore 2, Engineering Ethics and Disasters, only topics selected by 3% of students or more are included in the figure for readability purposes. The complete list of topics made available to students is included in Appendix A.

The themes from the qualitative analysis include a heightened understanding of the utility of an engineering degree and engineering profession; greater understanding of engineering and other STEM facts, including the association between in-class concepts across STEM courses and real-world applications; enhanced connection between peers; and increased awareness of societal and global issues. Each of these themes is discussed in greater depth with student quotations as support in the sections below.

Heightened understanding of the utility of an engineering degree and engineering profession

Students related learning from the presentations to their intended engineering major, the intended engineering majors of their peers, and the engineering field as a whole. A number of specific engineering majors offered at Clemson were mentioned, including bioengineering, chemical engineering, civil engineering, computer engineering, electrical engineering, environmental engineering, and mechanical engineering. Students remarked at the current issues these disciplines are tasked with solving (e.g., "bioengineers are working toward advancements in curing HIV," "mechanical engineers are working to design floating trashcans that are intended to

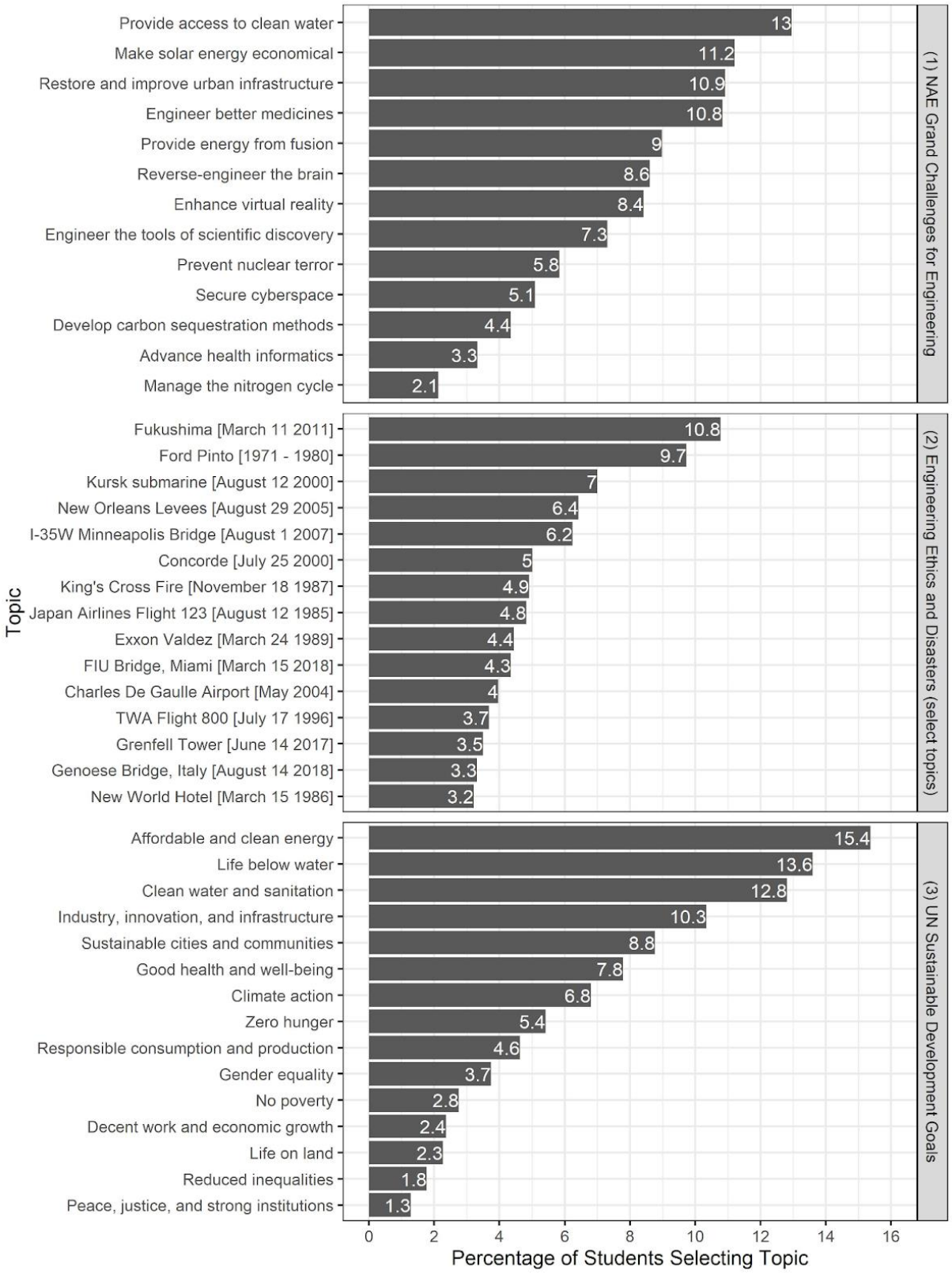

Figure 2. Student Topic Choices for each Exploring Engineering Theme

collect trash in the ocean"), along with the potential role they could play (e.g., "civil engineers had such a big impact on this topic [clean water and sanitation] and...they help with desalination to help provide clean water to more people," "mechanical engineers will actually be at the forefront of this challenge by helping to create and manufacture these tools that will aid with scientific discovery"). Additionally, students highlighted the connection between multiple professions within and around engineering. One student stated their realization that "computer engineers have a role in working towards good health and well being...they are responsible for creating the machines that health professionals use on their patients." Another went a step further, acknowledging the interdisciplinarity of the modern world: "it would take more than electrical engineers to solve a challenge such as this [reverse-engineering the brain]."

Learning of the Grand Challenges, past disasters, and the Sustainable Development Goals, students considered the ethical component of the engineering profession. Students felt strongly about this aspect of engineering, providing justifications such as "engineers need to take responsibility and put the safety of everyone first before the cost of having to fix a problem," "engineers must sacrifice good looks and comfort for safety," and "engineers are capable of causing a lot of structural damage if a job is not done properly and whether you're a professional or not, it is always good to have your ideas/designs reviewed by others." Some students personalized this call to action, stating they "need to always check back over any design or structure's functionality because anyone who uses it, their life is in my hands if anything goes wrong."

Ultimately, many students used the reflection as a space to express their aspirations as future engineering professionals to make the world a better place. Examples of these expressions of hope are as follows: "I hope that I can help change that [inequality and equal access to opportunities] throughout my career," and "I liked being able to think about the positive impact I can have on the environment as an industrial engineer."

Greater understanding of real-world application of STEM concepts

Students reported their learning on issues within STEM fields including physics, chemistry, biology, astronomy, technology, and social science. While many reports were more open-ended (e.g., "solar panels are a big part of providing affordable and clean energy"), some were related to prior knowledge and specific course concepts (e.g., "I knew how the Fusion process required and [*sic*] extremely high amount of heat but I had no idea it required heating the hydrogen isotopes to 10 time [*sic*] the temperature of the suns [*sic*] core," "The ocean absorbs about 23% of CO2 emissions"). Many of the responses highlighted the role of these concepts in solving some of the most pressing challenges facing society today: "there is a lot more to virtual reality than playing games. It has the potential to bring about so much change. It also has the ability to help revolutionize the way we learn and interact with others."

Students also expressed new information that was surprising to them. For example, "I learned why we have tank shields that cover our fuel tanks in order to keep from leaks and explosions, which make it safe to drive cars," "I didn't even know that a short circuit could lead to an explosion. I guess it makes sense, since electricity and fuel probably aren't two...things anyone

would want to mix together. I hadn't thought about it before," "I knew that the ocean did a lot for humans, but I learned about a lot of new ways it provides for us also like how it produces around 50% of oxygen," and "I learned that Jupiter has 79 moons, which is more than I thought, and at least one of them is confirmed to have water vapor present on it."

Enhanced connection between peers

Observed in previous peer sharing presentation iterations in other courses [1], students experienced connection and sense of community between peers. One important aspect of this theme was positive affirmations offered between peers through compliments. Students used the words and phrases "interesting," "informative," "neat," "organized," "good explanation," "easy to read/understand," "clear," "well-designed," "creative," "helpful," etc. to describe their peers' presentations. Students also frequently acknowledged the hard work of their peers. For example, one student expressed "you really took the time to research your topic carefully and consider how your engineering discipline could help with the specific grand challenge that you chose." Another student commended the thoughtfulness of the presenter through the following statement: "I like that you included multiple causes linked to the disaster, I think it shows that you put some thought into your research."

Through the Exploring Engineering assignment, students realized connections between themselves and their classmates. For example, one student expressed the following: "from a personal standpoint, I like that we covered the same topic yet went different directions with it. That's to be expected since she's going for mechanical engineering while I'm working on computer engineering, but I still think it's neat. It reminds me of how broad some of these goals are and how anyone from any particular field can contribute to them." Another student shared their classmate's presentation "included some facts that I did not come across when I was researching this topic for my own presentation... I also enjoyed seeing the perspective of a [*sic*] intended mechanical engineering major and how mechanical engineers are working to solve this problem."

Students also discussed gaining new knowledge as a result of viewing an issue from the perspective of their peers. For example, "I really appreciate the fact that you made me consider the cost of solar panels...I always figured that they were cheaper because they are an alternative to traditional means of energy production," "your explanation...gave me a better viewpoint on the overall challenge," and "whenever I think of infrastructure I don't usually think of power grids and technology so this gave me a new perspective on that topic." Some students even expressed a desire to dive deeper into the topic as a result of their classmate's presentation: "[your slides were] very descriptive and interesting. I actually want to learn more about it [engineering better medicines] so I am going to do some more research."

A final aspect of this theme was students' support of their peers' interests. In response to a female student's presentation on the Sustainable Development goal of gender equality, a male student highlighted her presentation and stated, "I fully support this goal as I firmly believe every single person should have the same opportunities and rights as others regardless of gender." Another student stated "I like how...you were able to naturally encompass your major into accomplishing this goal." Similar admiration was conveyed in the two following quotes: "I could

feel and see how passionate you were about the topic of peace, justice, and strong institutions...it in a way made the presentation more meaningful and powerful," and "I can tell you care about the topic [making solar energy economical]."

Increased understanding of societal and global issues

Perhaps most notably, students expressed a new awareness of societal and global issues as a result of engaging in the Exploring Engineering peer sharing presentations. In at least one of their three reflections, almost all students reported learning something related to this theme.

Many students cited the most salient aspects of the presentations being related to misaligned interests across issues relevant to STEM fields. For example, after hearing about the safety malfunctions of the Ford Pinto from a classmate's presentation, one student said that she learned many car manufacturers "would rather pay lawsuits than make lifesaving fixes to their cars." Another student, in reference to the gas leak in Bhopal, India, stated they learned "criminal negligence seems to be a very common trend among big businesses." These comments highlight the perennial struggle between profits and people that often lead to preventable disasters. Some students suggested solutions by leveraging this unfortunate pattern. For example, "a potential way to keep oceans free of waste would be to mine resources from it. Once people realize how valuable the oceans are, people might take care of it [*sic*] more."

Students also expressed their frustration with some disturbing realities brought to light through the presentations. These primarily included the dark side to advancements in technology. For example, several students discussed issues with virtual reality: "VR [virtual reality] is a hard business to create in because technology advances so fast that once a product is actualized, the technology is out of date." Others commented on the impact of technological issues in medicine: "medical costs per person are going up each year...with all the new advancements and technologies in the medical industry, costs are going to go up with more and more advancements."

A number of students also highlighted pressing concerns related to inequality. These comments were often related to inequality at large though statements like "this [inequality] is such a big problem that my generation is dealing with today because there are so many people that do not have the same chances as others." Other students focused on specific aspects of inequality, such as discriminatory practices impacting specific groups by gender, disability status, and race. In regards to gender, students stated that "even today, gender equality is still not 100% there," "31% of young women aged 15 to 24 are not in education, employment or training in 2020, more than double the rate for young men (14%) which was very surprising to me," and "it was shocking to me that it's going to take 95 years to close the wage gap. I personally think that is ridiculous." An astute awareness of ableism was reported by another student: "I learned that the disabled are less-likely [*sic*] to receive aid and [have] more complications with child birth in developing countries." Students also highlighted "a major group in the United States that faces the most deaths are African Americans."

The reflections conveyed an acute sense of issues in need of urgent attention, both within the United States and globally. While many students were previously aware of these issues, even just peripherally, the presentations reiterated the critical importance of addressing these issues. One national problem commonly highlighted was access to clean water. For example, one student addressed a misconception around access to clean water: "usually, this issues [*sic*; access to clean water] is associated with underdeveloped nations, but it's something that impacts modern America as well." Another issue focused on was the maintenance of infrastructure, with students stating, "I learned that there is not enough funding that goes into the upkeep and improvement of out [*sic*] infrastructures even though they [are] important for us to live our everyday lives," and "it would cost approximately $4.5 trillion to fix all of America's infrastructure." Finally, a number of students discussed the importance of responsible consumption through the following responses: "as a nation [we] produce a lot of waste and if we don't learn how to clean up after ourselves and dispose of this waste properly we're going to hurt ourselves, our environment, and other living beings such as fish or birds" and "the United States needs to do a better job of reducing our waste and increasing the recycling within the country."

International issues discussed by students span multiple domains as well. One of the most frequently discussed issues by students was the lack of access to clean water. Some comments focused on the facts, such as "1 in 6 people don't have access to clean water," while others went deeper by discussing their personal reaction to these realities or identifying the underlying reasons for the issue. Students in the latter category stated, "I had no idea that there are that many people going without a basic human necessity," and "I learned that politicl [*sic*] and economical [*sic*] reasons are what keep water out of places that need it most." Students also discussed the need for affordable and clean energy, linking this crisis to climate change through statements such as, "[affordable and clean energy] is one of the more neglected goals, as there aren't many initiatives in place to tackle it," "producing energy helps but it comes with a price if we don't think of ways to produce it efficiently and effectively, such as Global Warming," and "climate change will reach a drastic point in the future that will be economically and environmentally devastating." Considering the potentially devastating consequences, many students highlighted the need for immediate attention in nuclear terror: "I enjoyed looking at your presentation because I believe this issue [Preventing Nuclear Terror] should be addressed as soon as possible" and "if a solution is not found to prevent these nuclear terror attack methods millions of lives could be lost, ecosystems ruined, and endless destruction/war."

Especially relevant to current circumstances within our world, many students made connections between these issues and the COVID-19 pandemic. Some highlighted the priority status given to mitigate the impact, stating that "many projects that were in place to help achieve this goal [good health and well-being] were put on the back-burner in order to help with Covid-19." Others linked the pandemic to other crises around the globe, highlighting how "the virus Covid-19 is affecting access to clean water a lot more than it seems." Students also discussed their new awareness of COVID-19 funds and vaccination plans, as well as experts working to stop the spread. For example, "the United Nations has a COVID-19 fund that aims to support people that have lower income and more vulnerable groups that are dealing with the impacts of the pandemic," "UNICEF purchased over 520 million syringes for 2021, for COVID-19

vaccination," and "because of this goal [good health and well-being], scientists have learned about blood tests that can predict who will suffer from COVID-19 the worst."

In addition to highlighting current issues, many students remained hopeful by citing a variety of initiatives currently being undertaken to make progress. These initiatives included local, state-wide, national, and international efforts, as well as governmental and corporate interventions. At the local and state levels, students discussed what it personally meant to them to have those around them solving problems: "Clemson is making advances in genetically modifying yeast to create new drugs. This was interesting to me because I did not realize that advancements in this field were being made so close to where I live. I think it is very cool that Clemson gets to participate in helping solve this grand challenge and I hope that I will be able to do something similar through Clemson in the near future." In addition to citing broad national policies, such as "the government is offering a 30% tax credit to citizens who use solar energy," students discussed the work being done in specific states. For example, several students referenced Maine's clean energy initiative, stating that "this year, Maine approved 17 renewable energy projects that will reduce the greenhouse emission each year" and "Maine is really stepping up with its renewable energy projects. Reducing greenhouse emissions by 500,000 tons a year sounds incredibly impressive." Most notably on the global front, students discussed the Paris Agreement: "I learned more about the Paris Agreement, and I would love to see the US added back into it," "I learned about the Paris Agreement, and how it was created/implemented in an effort to reduce the effects of global warming on our planet. I also learned that global warming is basically irreversible at this point, and that this agreement is only in place to slow its progress," and "10 developing countries have implemented their climate action plans." Some of the specific companies and organizations working towards these challenges and goals cited by students include Aqua Africa, Neuralink, Technisoil, and Conversation International.

Discussion

Through the qualitative analysis, we sought to uncover how, if at all, students are connecting the Exploring Engineering topics to their learning as current engineering students and future engineering professionals. The four themes determined through the analysis reveal students are building connections between the content conveyed by their peers, real-world issues, and their role as aspiring engineering professionals and team members. The students' responses are indicative of long-term goals and an authentic understanding of what it means to be an engineer in the world today.

The brief presentation of numerical data related to the broader population of students enrolled in the introductory engineering course also demonstrates the students generally engaged positively with the Exploring Engineering assignment series. Over 98% of enrolled students completed at least one round; this demonstrates a significant level of engagement with this assignment not observed with previous assignments described in the introduction. Additionally, the majority (66%) of students who engaged in the Exploring Engineering assignment felt it had some impact on their choice of major. It should be noted this number does not fully capture students who still found the assignment valuable or enjoyable, even if it did not directly impact their major decision. These data, when considered alongside the qualitative themes and collaborative,

contextualized nature of the assignment, support the idea that the Exploring Engineering series is a meaningful assignment for students in their first year.

While completion and grade data may have indicated students met the course objectives with the previous assignments described in the introduction, the Exploring Engineering assignments and the related student artifacts allow us to obtain deeper, richer information about what the students have gained from meeting the course objectives and how the experience may be applied to their major decisions. The reflections specifically detail what students found to be impactful and what they learned from their own research and their peers' presentations, rather than just providing a cursory response to indicate something was learned about the various engineering fields.

Limitations and future work

Several limitations minimize the potential impact of this study. First, the relatively small sample represents students who provided consent from one section of the course taught by one instructor during one semester. Though promising, these results cannot be extrapolated to first-year engineering students at all colleges and universities, including other students at Clemson.

The reflections required students to consider what they appreciated and learned from the presentations, and an item in an end of semester survey directly captured students' perceptions of the Exploring Engineering assignment in informing their major choice. Through additional exploration in the form of follow-up interviews or focus groups, we could glean a deeper understanding of students' long-term takeaways and impressions of the assignment. For example, we could obtain information about students' perceived value of the assignment, what aspects were most meaningful, and why they found it influential. Armed with this knowledge, course designers could continue building the course to optimally meet students' needs as first-year engineering majors.

Recommendations and lessons learned

A large component of implementing new instructional techniques is providing space for modifications in subsequent iterations. Based on the Fall 2020 experience, modifications were made for the Spring 2021 semester. The primary changes for the Spring 2021 semester include an expansion of the reflection piece of the assignment. At the conclusion of each module, students are still expected to comment on the two best presentations that they reviewed, but then continue their reflection by responding to provided prompts. As an example, for the NAE Grand Challenges theme, students are asked which Grand Challenge they would invest funding in if given a large sum of money to do so. Students then expand on this challenge and the importance of solving it. Finally, students connect one of the Grand Challenges to their future career as an engineer by discussing the challenge they believe their career will impact the most.

Conclusion

This Complete Evidence-Based Practice paper outlined the use of a peer sharing presentation assignment, named "Exploring Engineering," at Clemson University. Drawing on student reflections from each of the three rounds, the Exploring Engineering assignment series adds value to the first-year engineering student experience. More specifically, students gain a deeper

understanding of what it means to be an engineer, how their current STEM courses relate to the engineering profession, how they fit within the engineering field, and how the world benefits from solutions to pressing issues created by engineers as a result of engaging in the assignment with their peers.

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Appendix A

Round	Exploring Engineering Topics
1	**Grand Challenges** (based on National Academy of Engineering Grand Challenges Video) • Make solar energy economical • Provide energy from fusion • Develop carbon sequestration methods • Manage the nitrogen cycle • Provide access to clean water • Restore and improve urban infrastructure • Advance health informatics • Engineer better medicines • Reverse-engineer the brain • Prevent nuclear terror • Secure cyberspace • Enhance virtual reality • Engineer the tools of scientific discovery
2	**Engineering Disasters** • Bhopal India [December 3 1984] • Cuyahoga River Fire • Exxon Valdez [March 24 1989] • Fukushima [March 11 2011] • New Orleans Levees [August 29 2005] • Seveso Italy [July 10 1976] • Brumadinho Dam, Brazil [January 25 2019] • FIU Bridge, Miami [March 15 2018] • Genoese Bridge, Italy [August 14 2018] • Grenfell Tower [June 14 2017] • Hyatt Regency [July 17 1981] • I-35W Minneapolis Bridge [August 1 2007] • Kursk Submarine [August 12 2000] • New World Hotel [March 15 1986] • Rana Plaza [April 24 2013] • Stava Dam [July 19 1985] • Charles De Gaulle Airport [May 2004] • Concorde [July 25 2000] • Ford Pinto [1971 - 1980] • Japan Airlines Flight 123 [August 12 1985] • King's Cross Fire [November 18 1987] • KLM Flight 1736 and Pan Am Flight 4805 [March 27 1977] • MV Dona Paz [December 20 1987] • TWA Flight 800 [July 17 1996]

3	**UN Sustainability Goals** (based on UN Sustainable Development Goals) ● No poverty ● Zero hunger ● Good health and well-being ● Gender equality ● Clean water and sanitation ● Affordable and clean energy ● Decent work and economic growth ● Industry, innovation, and infrastructure ● Reduced inequalities ● Sustainable cities and communities ● Responsible consumption and production ● Climate action ● Life below water ● Life on land ● Peace, justice, and strong institutions ● Partnerships for the goals ● Quality education