

Queer and International Experiences of Online Learning

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ABSTRACT

CONTEXT

Recognising the influence of students' identities on their learning, it is essential to understand how teaching and education technologies can shape their sense of belonging and psychological safety in classrooms. The COVID-19 pandemic accelerated technology adoption in engineering education. Existing literature on online learning experiences primarily focuses on gender, language barriers, and student performance. This has left a gap in understanding the experiences of international and queer engineering students in online learning environments.

PURPOSE OR GOAL

The purpose of this project is to investigate the impact of online education technologies on international and/or queer engineering students' affective learning experience. The study explores aspects that affect the students' perceptions of their collaboration, communication, and their performance online. It will develop our understanding of how learning through online technologies may affect the psychological safety and inclusion of these students in classrooms, which is incredibly important to their learning.

APPROACH OR METHODOLOGY/METHODS

The study was part of a capstone project which used an anonymous online survey to collect international and/or queer students' perceptions of their learning in an online environment. A mix of rating style and open-ended questions explored how students used mediating technology, how these interacted with their identities and how they felt it affected their learning. These responses were qualitatively analysed for emerging patterns and themes which represented student experiences. The eleven respondents identified as a mix of queer and international students, although most were based in country during online learning.

ACTUAL OR ANTICIPATED OUTCOMES

The analysis showed that many of the students, both international and queer identifying, felt safer in online spaces. They reported having a higher degree of control over how they were perceived, allowing them to represent their own identity in ways not always possible in face-to-face interactions. However, most students still felt it easier to communicate in-person, highlighting the unique benefits of face-to-face classes such as immediate tutor interventions in risky situations and better understanding of peers. Students' responses also indicated an opportunity for online technologies to explore ways of implementing protective measures such as anonymous reporting of malicious comments.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

The results of this study will contribute to our understanding of how to create more inclusive, safe, and effective engineering learning spaces. Understanding student experiences in engineering classrooms through multiple dimensions of identity and technology is imperative for engineering educators to adapt and tailor these technologies to foster collaboration and diversity within online classrooms.

KEYWORDS

Inclusion, educational technology, online learning

Introduction

Technology is increasingly being used in the design, delivery, and assessment of engineering education. It is valuable to understand the affordances and impact these technologies have on engineering students' learning experiences. The literature includes studies on engineering student experiences with online learning technologies which look at gender, language barriers, and student performance (Mamun et al., 2022; Saw et al. 2020; Tapanes et al., 2009; Chung et al., 2020; Naji et al., 2020). However, there is more scope to understand how these technologies affect specific groups of students, particularly international and/or queer students. Given how identity shapes a student's relationship with their learning journey (Bliuc, 2011; Altugan, 2015), it is important to understand the ways in which educational technologies impact this relationship. Engineering practice is highly collaborative and needs diverse contributions to continue being effective. Developing an understanding of how the educational technologies we use affect identity, collaboration, and perceptions of learning in the context of international and queer students can aid in making engineering learning spaces more inclusive, safe, and by extension, effective.

This paper explores the impact of education technologies on international and/or queer engineering students' affective learning experience. It looks at aspects that affect students' perceptions of their collaboration, communication, and performance in online classrooms. An analysis of collected data presents an understanding of how mediating technologies in engineering education can interact with personal identity to shape a student's learning experience.

This research uses the term queer as an umbrella term for all who identify as LGBTQIA+, or otherwise self-identify as queer in whatever ways pertain to them. "Safety" refers to psychological safety in classroom spaces including one's comfort with participation, communication, and engaging with the material being taught. Safety is also having one's identity acknowledged and respected in the classroom. Differences in physical safety may also contribute to this overall feeling.

Background

With the increased integration of online education technologies like Microsoft Teams alongside existing learning management systems and online delivery of content, there have been a number of studies on their impact on learning experiences of students. There is consensus that online technologies have increased accessibility to learning across parameters of disability, access to content via asynchronous lectures, and flexibility (Vielma et al. 2021; Abdulkareem et al., 2022; Chung et al., 2020; Boye & Machet, 2021). While some studies suggest that online forums for clarification on the study material, as well as the ease of access via email have been positive aspects of online learning (Martinez et al., 2020; Vielma et al. 2021), some also indicate that self-motivation for study, as well as the isolation of not being in physical classes among peers are disadvantages of employing education technologies for communication within the classroom. Online students were more likely to drop-out and exhibited higher attrition rates compared to those in face-to-face classes (Orlov et al., 2020; Tate & Warschauer, 2022). However, research did indicate that academic performance fared better in online classes with structured peer interactions than those without (Orlov et al., 2020).

Studies specifically surrounding engineering students' experiences with online learning are less numerous, but largely correlate with broader studies on the topic. Engineering students too faced difficulties when it came to self-study and learning outside academic environments (Asgari et al. 2021) due to varying access to the internet and other resources for online learning (Abdulkareem et al., 2022; Asgari et al. 2021). There is evidence that students obtained better grades in online learning due to open-book evaluations and a shift from examinations to problem-based learning approaches (Martinez et al., 2020).

There is limited study on how diversity has been impacted by online engineering education. While studies look at gender, language, and linguistics as a predominant cultural barrier (Mamun et al., 2022; Saw et al. 2020; Tapanes et al., 2009) they fail to look at aspects of identity beyond these. Mamun et al. (2022) found that students who identified as men were likely to be more motivated in online classrooms, while Chung et al. (2020) and Naji et al. (2020) found no significant correlation between gender and a student's academic motivation. A difference in language contributed to decreased participation from international students in online engineering classrooms (Tapanes et al., 2009, D'Netto & Hannon, 2007). When adjusted for this difference, however, Tapanes et al. (2009) found that there was minimal difference between international and domestic students' perceptions of participation. Further marginalised groups, such as female international students, continue to be underrepresented in studies on engineering education (Gan et al., 2021).

There is limited research on queer experiences in online engineering classrooms. Existing studies explore larger experiences of queer students in engineering education and other STEM fields. Kersey & Voigt (2020) found that queer students often found their classrooms non-accommodating of their queer identities and operating in a "vacuum to the external world". Stout & Wright (2016) found that women queer students felt like they belonged the least in computing courses and may thus be likelier to leave the field.

These align with studies on the experiences of queer students in higher education, across other streams. Allen et al. (2019) found that students felt unsafe at university, either due to heightened visibility, or a lack of structural support from universities. A study by Wright (2021) which explored safety of queer participants in online learning found that the absence of online collaboration left participants unsure about how to perceive their classmates, and in turn how they themselves were perceived. Participants' decision to disclose personal identity was influenced by factors such as privacy, political climate, and feelings of safety in a classroom.

Drawing from this literature, it is known that online education affects students' perceptions of safety and their perceptions of their ability to perform well at their studies, particularly in terms of how communication and collaboration are enabled and supported. These factors were highlighted as aspects to investigate in the context of queer and/or international students.

Methodology

The methodology used for this project is qualitative content analysis to allow a broad range of questions to be asked while giving freedom to participants in how they answer, with no singular reality being examined (Teherani et al., 2015). Data was collected through an online survey, and subsequently analysed for any emerging trends or ideas without developing a generalised theory on these experiences (Teherani et al., 2015; Austin & Sutton, 2014).

While the experiences of all engineering students are important, the population this project focuses on are international and/or queer engineering students. The inclusion of both international and queer students in the study allows for greater anonymity, making the data non-re-identifiable (which may not have been the case if only the intersection of international *and* queer students in this sample group were analysed).

Data was collected through a targeted online anonymous survey at an Australian university. This method was employed as hard-to-access groups, such as minority communities and queer youth, are easier to reach via online means given their heightened visibility in online spaces (McInroy, 2016). As this research touches upon aspects of personal identity, an online survey allowed participants the comfort of privacy, anonymity, and freedom in how they choose to answer the questions – with the ability to withdraw at any time prior to submission with no data collected. An online survey was also the most efficient way of reaching offshore international students.

The survey was disseminated through university collectives and societies after obtaining permission from relevant administrators. Only current engineering students at a single Australian university were included. In the participant information and consent statements, respondents

were informed about the study and the eligibility criteria and self-identified themselves as being eligible without specific information on their identities being collected. Within the responses, however, some participants identified these aspects of their identity. This study assumes that all participants honestly considered their eligibility for the survey and proceeded accordingly.

The survey used consisted of a series of open-ended questions designed to elicit answers that would support an understanding of how engineering students perceive their *collaboration*, *communication*, and *performance* in online classrooms mediated by education technologies. The survey, addressing identity perception, safety, and the interaction between learning and self-identity in online classrooms, underwent a pre-test with four randomly chosen students to ensure clarity and minimal survey fatigue, which are common sources of questionnaire bias (Choi & Pak, 2005). Questions were iteratively developed to minimise any potential discomfort to participants that could arise from being questioned on identity. No identifiable information was collected, and participants were free to answer the questions from any aspect of their identity(s). In line with ethics approval, no direct quotes from participants have been included, and have been paraphrased where required.

Results

The survey was divided into three sections: communication, collaboration, and performance. Eleven participants responded with valid answers, ten of whom completed the whole survey, and all of these have been included in the results.

Communication

The communication section received eleven full responses. Participants were asked about how online learning impacted their ability to communicate within the classroom, and how this affected their feelings of safety, if at all.

Overall, seven students found communicating with peers easier in in-person classrooms. The most common reason given was the option to remain anonymous (to a certain extent) by opting out of turning cameras on, and the ability to immediately physically disconnect if needed. When it came to feelings of safety in online communication, again seven participants felt safer within the learning space online as opposed to in-person, while three participants found in-person classrooms safer, and one felt equally safe in both environments. One participant responded that they prefer online communication as they expected that when in-person, their peers may treat those who do not 'conform' differently. In-person communication was more comfortable to some due to the supervisory presence of a tutor or teacher. One participant felt uncomfortable with the attention that online interaction may give by focussing everyone's attention to the speaker on screens. Only one international student found it difficult to adapt to new forms of teaching and communication, which adversely affected their learning experience.

When it came to the influence identity in the online classroom, three students felt that their gender and sexuality affect how they communicate: one participant mentioned that their communication is impacted by their identity's visibility. One participant spoke of this impact based on whether they prefer to present as either masculine or feminine, while another participant sometimes hid their sexuality when interacting with people they did not know very well. Conversely, another participant felt that their identity was occasionally relevant but not usually significant to others in their classroom. One participant felt that the environment of online classes with limited peer interaction created a disconnect between them as a person and the classroom.

Most participants did not make use of any features in educational technologies to voice identity, due to a variety of reasons spanning fear of safety, to feeling it unnecessary to display personal information in the classroom. Those who used these features did so by displaying their pronouns.

When prompted for how they thought online technologies could be made more inclusive, however, students overwhelmingly felt that better visibility of pronouns and more options to

customise names and icons would be beneficial. The feature to report hurtful comments easily and anonymously was another suggestion to improve the environment in online classrooms.

Collaboration

The collaboration section received answers from ten participants. This section looked at how online tools affected students' ability to collaborate on projects, their ability to empathise with each other, as well as the influence of identity on groupwork in the classroom.

Nine participants felt that it was more difficult to collaborate during online tutorials, and engagement with peers and the material was much lower in online classes as opposed to in-person classrooms, despite the time convenience of online learning. Participants noted malfunctioning technology, different time-zones, and a limitation in communicating technical concepts, as well as unavailability of group members as reasons for this. One participant noted that online collaboration developed asynchronous communication skills, which are important in engineering. Efforts by tutors to replicate an in-person experience by enforcing microphone and camera usage and creating effective breakout rooms significantly helped online collaboration. One participant did not find any difference in their ability to collaborate in both online and physical classrooms.

When it came to the impact of identity on groupwork, especially around engineering projects for community, responses were mixed. Participants elaborated that many of them had not had experiences where their identity affects the engineering work on which they collaborate, but that it affects their peer interactions within groups. One participant mentioned that their identity made them more cautious in group settings, while another mentioned that the heavy emphasis on only cisgender male perspectives is something they had found themselves contending with. For those that felt their identity strongly affected their ability to collaborate, it was the *perception of their* identity by their peers that influenced how effectively and safely they could contribute to groupwork. Another student felt that their nationality impacted how they were perceived to an extent, as people tend to group peers of the same (perceived) race together.

Four participants felt that online learning negatively impacted their ability to empathise with classmates due to the additional distance and the inability to form personal connections online. This in turn affected their ability to understand and emotionally invest in each other and the collective work. Six participants felt that online learning did not affect their ability to empathise as they similarly interacted with groupmates across modes of learning.

Interestingly, six participants felt that online learning impacted the empathy they themselves received from classmates. Participants mentioned that it was difficult to be understood and have personal difficulties recognised during online learning. Four participants felt no difference, with one mentioning that while they received empathy, it was less personal in nature.

Five participants felt no difference to their safety in groups whether online or in-person, while five others did. Participants who felt safer in physical groups cited reasons such as the ability to better understand and assess safety among groupmates and immediate intervention by tutors if needed. Two participants felt the disconnect of online classes offered safety in that their peers cared less about their identities. One participant felt that while physical classrooms could be overwhelming, there was potential for ruder interactions while online.

Performance

This section gathered a total of ten responses on how online learning and personal identity affected students' perceptions of their academic performance, as well as how these shaped their professional identities as engineers.

Participants overwhelmingly felt that studying online affected their ability to produce work of satisfactory quality. Most commonly, it was a lack of engagement that affected motivation and involvement with the coursework. The disconnection of online learning made it harder to form connections, which in turn negatively impacted the quality of work, and grades. Two participants

felt that their work was better online as it gave them more time to focus on assignments due to not spending time in commuting to campus. Only two participants felt no difference to their ability to produce satisfactory academic work.

Participants were asked whether their personal identity affected the direction of the assignments that they chose to work on, including topics or communities they would design solutions for. Some students were neutral or indicated that they felt that there was little impact due to the nature of the engineering profession, however one of these students did explain that it influenced the 'small details' like the choice of inclusive language and ethic data handling. Others indicated they were more likely to be enthusiastic about projects that involved helping their communities and wanted to bring their own unique perspectives to groups projects. Many students felt there were barriers to applying their personal identity to their choice of engineering work either due to the nature of the engineering profession (as purportedly being a neutral environment) or because of marginalisation of their ideas and lack of agency in the choice of assignments.

Six participants felt that safety affected their perceptions of their academic performance. Most commonly, feelings of anxiety negatively affected a student's ability to engage and learn in class. Online learning offered a way to reduce this anxiety as it removed the perceived risk of harm to an extent, but it allowed for easier disengagement which meant that students would learn less from classes. One participant also mentioned that speaking up in online classes to the tutor increased their feeling of being perceived by their peers, which caused them stress.

Eight of the ten participants felt that their personal identity impacts their professional engineering identities. Students mention that the visibility of their identities may lead to them being seen as less capable, with their authority and knowledge undermined. One participant felt the need to hide their identity(s) in the workplace for safety. Students also felt strongly about the ways in which their identities and perspectives could improve diversity, visibility, and engineering solutions. International students too need to contend with stereotypes around work ethic and language, according to some responses. One participant felt that a professional engineering identity came down to one's academic performance and technical understanding. Almost none of the participants felt that online learning and education technologies allowed them to complete their work closer to that professional identity.

Discussion

The responses show that many of the students, both international and queer identifying, felt safer in online spaces. Their responses suggest that online spaces provide a higher degree of control over how their identities are perceived, thus potentially reducing the risk of harassment or discrimination. Despite this feeling of safety, however, most students felt it easier to communicate in-person and identified that in-person classes offered unique safety in terms of potential for interventions by tutors in risky situations and the ability to understand peers more closely. The responses highlighted four main relationships when it came to international and/or queer engineering student experiences with online learning.

Personal Identity and Learning

The results suggests that individuals recognise the potential influence of personal identity factors, such as race, gender, or sexuality, on their communication and collaborative dynamics. It may be expected in the nature of the students sampled, and the focus of the study, that the participants are particularly aware of their personal identity as an influencing factor. However, even those responses which indicate students perceive no impact, when expanded on, do acknowledge the influence that personal identity brings to learning (such as consciously changing gendered language in their university work). Stereotypes around race and ethnicity may also negatively impact a student's learning, as there is a tendency to group those of the same race together in terms of communicative or technical abilities. This highlights the strong link between personal identity and learning for these students. The data indicates online learning affects this relationship most significantly in terms of students' perceptions of the quality of their academic work and their

engineering identity, connected by their feelings of safety. These echo the findings by Stout & Wright (2016) and Wright (2021), where identity greatly influences a sense of belonging in learning spaces. Personal identity also influenced participants' preference for community-focused engineering work, highlighting the importance of technology-mediated teaching that ensures comfort, accessibility, and safety in the classroom to support a diverse student body and thereby support diverse communities in practice.

Safety and Online Learning

In this study, most students did not display their pronouns, as they either felt it unnecessary, or that displaying their pronouns would single them out as queer students and increase their potential risk to harm. The motivations for this choice may vary. Some participants might prioritise privacy and anonymity, especially in online settings where there is little control over the dissemination of personal information. Others, as the responses suggest, may feel it unnecessary to display their identity for the learning process. This selective disclosure of identity found in this study aligns with the existing literature on queer experiences in STEM, as detailed by Kersey & Voigt (2020), Allen et al. (2019), and Wright (2021), who all mention that marginalised students tend to hide their identities in the classroom, for fear of safety in institutional spaces.

Despite this, the overwhelming suggestion to improve online learning was enabling easier display of pronouns and customisable icons, indicating students' recognition of the need to normalise such features for a safer and more effective online classroom. This impact of online tools on safety, and subsequently performance, of students is a significant opportunity for the development of more measures to ensure inclusion and comfort of all students, e.g., through having pronouns displayed a default practice in order to normalise this act of inclusion, or allowing users to report malicious or discriminatory comments more safely or anonymously. This is a prompt to educators too to normalise the use of these online tool affordances to model inclusive practice. Also, to structure activities in such a way that it is possible for immediate and effective intervention and harm reduction by tutors regardless of the mode of teaching.

Online Safety and Academic Performance

Online learning adversely affected participants' perceptions of their academic performance due to the lack of engagement and involvement that distance creates. Online learning provides limited opportunity to form personal connections with peers and tutors, reducing motivation to engage with the academic material. Students who reported feeling reduced empathy, motivation, and discipline all tied it to the separation from the classroom environment, echoing the studies by Orlov et al. (2020), Martinez et al. (2020), and Vielma et al. (2021). However, the safety online learning provided to some students improved their academic performance as they did not have to expend energy ensuring their safety or could easily disengage as mentioned in other responses.

While the distance of online learning did provide a sense of safety and security, participants felt that the disconnect between the classroom and themselves made it difficult to get an accurate sense of their peers to establish comfort more concretely, similar to the findings in a study by Allen et al. (2019). Students also felt a reduction in the empathy they received from peers when online. These variable feelings of safety within the learning space overwhelmingly impact students' ability to perform academically, as unsafe environments caused anxiety and an investment of energy into avoiding danger as opposed to engaging with their learning.

This indicates that there is an opportunity to both a) improve *online* teaching with more involved engagement (e.g., through continued, greater integration of collaborative tools and applications), and b) to improve *in-person* teaching by leveraging the affordances collaborative online tools must support safety by explicitly including these collaborative tools in in-person classes. These findings also highlight the incredible importance of psychological safety in the learning experiences of marginalised students, greatly influencing their classroom engagement and academic performance.

Engineering Identity and Learning

Engineering identity was influenced by participants' personal identity. How they were viewed, and the issues their communities face, influenced the way they navigated their studies, their perceptions of the engineering world and the work they were motivated to do. Most participants mentioned the discrimination they faced manifested in a dismissal of their technical and professional capabilities. Stereotypes especially affected gender-diverse and international students. Despite these additional barriers to professional integration, participants were committed to creating engineering spaces that promoted a diversity of voices, and working towards solving issues within community. This indicates that personal identity is not separate from one's professional path, and understanding this is further impetus for engineering educators to ensure the safety of a diverse body of students within the classroom to foster effective and diverse engineering experiences.

The sample size of this research is small as a result of surveying students within a single Australian university. The findings are not representative of the experiences of all international and/or queer engineering students, or even those within Australia, but they do provide a rich insight into the lived experience of students. The results echo the experiences of other marginalised students in STEM, indicating a degree of common experience within engineering classrooms. Further studies on this topic could expand on this research with more students, perhaps from multiple universities, to build on the understanding of this demographic's experiences.

Conclusion

This study found that safety of online learning is critical for these students to focus on their engineering learning. However, the distance of online classes negatively impacted performance, corroborating existing research. Collaborative tools can mitigate some challenges, but there is a need for safer and more inclusive engagement, both online and in-person. Regarding personal identity, how students were viewed and the issues their communities face influenced the way they navigated the engineering world and the work they were passionate about. Thus, it is important to manage teaching and use of technology in engineering education, prioritising the comfort of all students to facilitate the growth of community-focused engineering within the classroom space. These responses also highlight the need for engineering educators to consider the ways in which they may improve classroom safety for all, in order to make their classrooms more accessible and inclusive.

This impact of online tools on safety, and subsequently performance, of students is a significant opportunity for technologies to develop more measures to ensure inclusion and comfort, be it through having options for pronoun displays to be the default, or for safe and anonymous reporting of malicious or discriminatory comments. Classes should be structured in such a way that it is possible for immediate and effective intervention by teachers in unsafe situations regardless of the mode of teaching. Overall, the findings show that online learning (and its safety affordances) interacts with personal identity to impact the engineering learning experience.

This study hopes to contribute to making education technologies more inclusive and effective. Understanding student's affective experiences in engineering classrooms through multiple dimensions of identity and technology could help improve engineering education practices to accommodate all potential engineers by creating space for their identities and experiences, and thus creating space for better engineering solutions for all.

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