Evaluating Digital Communication Skills and Attitudes Toward Online Learning Among Students in the Faculty of Engineering & Built Environment, Universiti Kebangsaan Malaysia

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ABSTRACT

As universities increasingly adopt online learning, digital communication skills have become vital for effective learning. This is especially true in technology fields such as engineering, where precise communication ensures technical accuracy. Concurrently, online learning poses unique challenges for engineering students, whose education conventionally relies on hands-on laboratory work and face-to-face interactions. Despite this, there are limited studies on engineering students' digital communication skills and their receptiveness of online learning. This study examines the digital communication abilities of first-year engineering students at Universiti Kebangsaan Malaysia in online learning environments. The self-administered survey assessed key aspects, including engagement, adaptability, interpersonal awareness, and English proficiency. Cronbach's alpha was used to assess the internal consistency and reliability of the 33-item instrument. With an overall reliability score of 0.9261, the instrument demonstrated good reliability. A total of 121 responses were received out of 133 registered students, yielding a response rate of 90.9%. The findings reveal no strong overall preference for online learning, with face-to-face settings remain preferred for classes and group discussions. Alarmingly, engagement during online classes was moderate, with only 45.4% feeling engaged, suggesting indifference or disconnection for many. In online classes, students excelled in basic communication tasks, such as following instructions (78.5%) and asking questions (66.9%), but only 43.8% felt confident leading online discussions. They excelled in interpersonal awareness, with 63.6% attentive to others in online discussions and 59.5% empathizing with others' emotions. However, only 42.2% were confident resolving conflicts through digital communication. English proficiency emerged as a concern, with 43.0% struggling to articulate ideas as intended in online conversations. These findings highlight the need for further research into digital communication challenges and strategies to improve students' competencies.

Keywords
Digital communication; Digital skills; Engineering education; Online learning; Soft skills

Introduction

In today's digitally driven world, communication skills extend beyond face-to-face interactions to encompass proficiency across digital platforms (Joglekar et al. 2022). Digital communication skills—the ability to effectively convey and interpret information via digital channels—have become indispensable particularly in technical fields such as engineering (Darling et al. 2003; Choren 2015; Nuralievna 2023). For engineering students, these skills are critical not only for academic success (Ray 2023), but also for employability in an increasingly digitalized work environment (Feijao et al. 2021; Gašová et al. 2018).

As universities normalize online learning, it becomes crucial to evaluate students' digital communication skills and attitudes toward this mode of education (Urbanek et al. 2023). Engineering students face unique challenges in this transition, as their education traditionally relies on hands-on laboratory work, peer collaboration, and direct interaction with instructors (Lal et al. 2020; Ferri et al. 2016; Wei et al. 2019). The self-directed learning required in online education (Conrad 2002; Ghazali 2022) can also be particularly demanding for engineering students navigating complex technical subjects. In Malaysia, these challenges are exacerbated by disparities in digital infrastructure (Ayob et al. 2022; Sayed Umar 2021), which risk widening the digital divide (Oyedemi et al. 2018; Mohamed et al. 2012) and leaving some students unable to fully participate due to connectivity issues.

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Most existing studies focus on digital skills and online learning among general university populations, often without addressing differences between fields of study or specific needs (Gutiérrez-Ángel et al. 2022). Studies by Sánchez-Caballé et al. (2020) and Marrero-Sánchez et al. (2023) indicate that university students generally lack advanced digital skills. Similarly, Zhao et al. (2021) reviewed studies on digital competence in higher education from 2015–2021, revealing that most students and instructors possess only basic levels of digital competence. Anthonysamy (2020) noted that despite being familiar with digital technology, university students often lack the digital literacy skills necessary for effective online learning. Additionally, Miltuze et al. (2021) and Sciumbata (2020) found that students tend to overestimate their digital skills, particularly in information and data literacy. Other studies, by Gašová et al. (2018), Dmitriev et al. (2021) and Joglekar et al. (2022) emphasized that universities are not adequately addressing the digital skills gap among students and often fail to effectively integrate digital competencies into teaching practices.

Despite the clear importance of digital communication skills, a significant gap exists in the literature. While studies like Gutiérrez-Ángel et al. (2022) and Zhao et al. (2021) focused on digital skills and online learning among university students, these are not specific to the unique context of *engineering* education. Engineering programs, with their traditional emphasis on laboratory work and direct interaction, present distinct challenges for students transitioning to online learning. This issue is particularly relevant in Malaysia, where disparities in digital infrastructure can further impact student learning. Research that specifically examines the digital communication skills and attitudes of engineering students in Malaysia remains limited. Therefore, this study aims to address this gap by providing an in-depth evaluation of engineering students at a public Malaysian university. Specifically, this study seeks to answer the following questions:

1. What are the learning modality preferences (online vs. face-to-face) of engineering students for different academic activities, such as classes, discussions, and assessments?
2. How do engineering students perceive their abilities in expressing technical and general ideas in an online learning environment?
3. What is the level of student engagement and participation during online classes and discussions?
4. How confident are students in their interpersonal skills within a digital context?
5. What is the self-perceived proficiency of students in using English for effective communication in online academic settings?

Methods

This study evaluated the digital communication skills and attitudes toward online learning of first-year Electrical and Electronic (E&E) engineering students at Universiti Kebangsaan Malaysia (UKM), from the 2024 intake year. This cohort was selected for their prior experience with online learning during high school education amid the COVID-19 pandemic. As newly admitted engineering students at UKM, where some courses are delivered online, they offer fresh perspectives into the online learning experience.

To collect data, a self-developed, 33-item questionnaire was used to assess key aspects of digital communication skills in the context of online learning. The instrument's development was informed by the thematic domains identified in previous research by Lifintsev et al. (2022), Fan et al. (2022), Ren et al. (2024), and Bukhori et al. (2023). To ensure validity, the questionnaire was carefully reviewed by for clarity, relevance to the research objectives, and comprehensiveness in covering the four proposed domains relevant to online engineering education. The four domains assessed were: (i) Explaining and Expressing Opinions (9 questions); (ii) Engagement in Online Classes and Discussions (9 questions); (iii) Adapting to Others and Resolving Conflicts (5 questions); and (iv) English Language Usage (4 questions). At the beginning of the survey, the respondents' general preferences for online learning versus in-person learning were also examined through 6 additional questions. The internal consistency and reliability of the instrument were assessed using Cronbach's alpha. The overall reliability for the 33 items was 0.9261, indicating good reliability. The alpha coefficients for the four sub-domains were as follows: Explaining and Expressing Opinions (0.9301), Engagement in Online Classes and Discussions (0.8801), Adapting to Others and Resolving Conflicts (0.8781), and English Language Usage (0.9261) — all of which demonstrate acceptable to good internal consistency.

The survey was divided into two sections. The first section gathered basic demographic data, including gender, age, quality of Internet access, and frequency of using online learning platforms. The second section featured the 33 questions, each rated on a 5-point Likert scale: 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), and 5 (Strongly Agree), to assess respondents' level of agreement with each statement. All participants were required to

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complete all 33 questions. This self-administered questionnaire was untimed and delivered through the Google Forms online survey platform. While responses were anonymous, students were asked to provide their student identification numbers to prevent duplicate submissions and ensure accurate analysis.

Demographic Description

The survey was distributed to all first-year students enrolled in the E&E engineering degree programs at UKM. A total of 121 responses were received out of 133 registered students, resulting in an encouraging response rate of 90.9%. Less than one-third of the respondents were female (26.4%), and 90.1% were below the age of 20. Majority respondents (76.0%) reported using English as their primary language for digital communication, while 23.1% primarily use the Malaysian Malay.

Internet access quality for respondents was generally good (Figure 1(a)), with 44.6% rating their access as “Good”, and 43.0% as “Average,”. This level of connectivity can be attributed to UKM's location in a well-developed urban area, further supported by free Wi-Fi access across the campus. When asked to rate their overall digital skills, nearly half (49.6%) selected "Good," followed by 39.7% who rated their skills as "Average"; see Figure 1(b). These ratings are supported by the respondents’ reported use of online learning platforms, shown in Figure 1(c), with 50.4% reporting usage as "Often" and 37.2% as "Always".

Online safety practices such as using secure passwords were also commonly observed, with the majority (52.1%) indicating "Good" compliance and 26.4% reporting "Excellent" compliance. Regarding digital ethics, 53.7% rated their understanding as "Good," while 33.1% categorized it as "Average". Overall, the first-year E&E engineering students at UKM reported having reliable Internet access, good digital skills, frequent use of online learning platforms, and awareness of online safety practices and digital ethics.

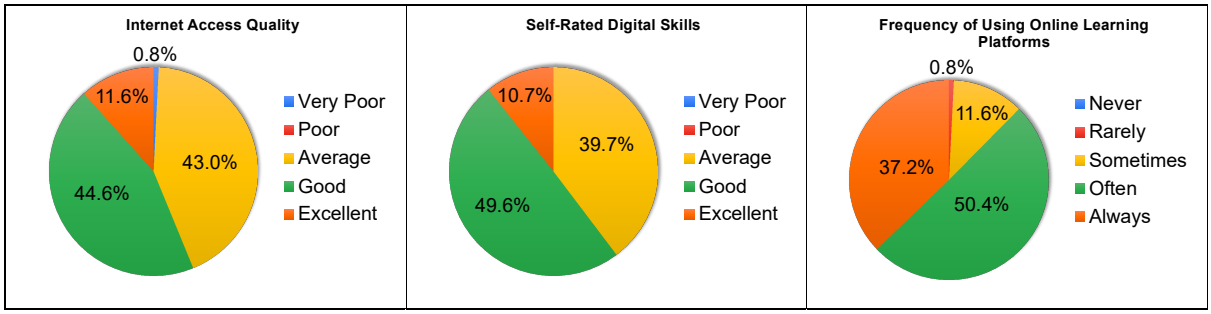

Figure 1. Distribution of responses based on: a) Internet access quality, b) Self-rated overall digital skills, and c) Frequency of using online learning platforms. Total respondents: 121 students.

Results and Discussion

In this section, we discuss the respondents’ general preferences for online learning versus in-person learning, followed by the survey results for each of the four domains that make up digital communication skills in the context of online learning.

Preferences for Online Classes, Online Discussions and Online Presentations

Figure 2(a) presents the responses from 121 participants to the statement, "I prefer online classes over physical classes." The majority (44.6%) expressed neutrality, while 39.7% disagreed or strongly disagreed with the preference for online classes, and 15.7% agreed or strongly agreed. This suggests that physical classes are generally preferred by most participants, with many being indifferent.

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However, when asked about their preference for online tests over face-to-face tests (Figure 2(b)), the sentiment shifted. While 29.8% remained neutral, a larger proportion preferred digital exams: 42.2% agreed or strongly agreed. In contrast, fewer participants preferred physical exams, with 28.1% disagreeing or strongly disagreeing. This indicates a nuanced distinction in the students' preferences based on the nature of activity, with physical classes favoured for learning and the online platforms preferred for assessments.

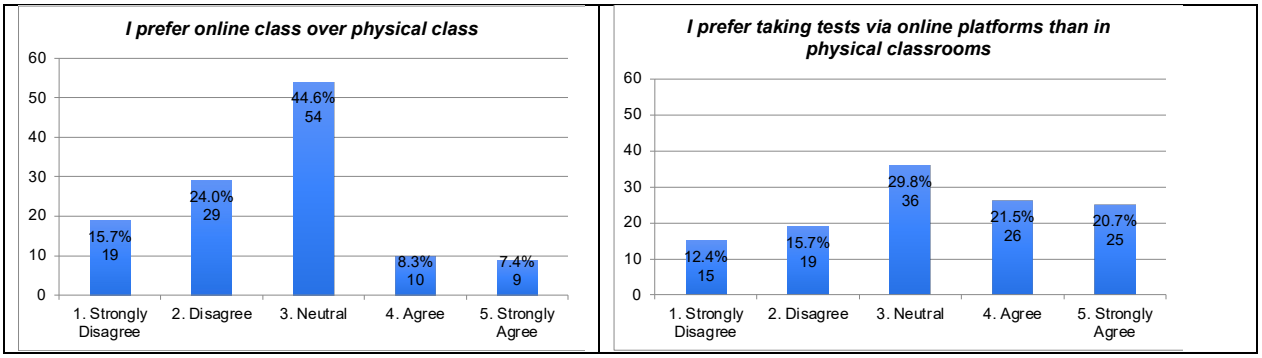

Figure 2. Responses to the statements: a) "I prefer online classes over physical classes," and b) "I prefer taking tests via online platforms than in physical classrooms," rated on a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). Total respondents: 121.

When asked about their preference for online meetings over face-to-face meetings, responses were mixed. While 36.4% remained neutral, 38.0% expressed a preference for face-to-face meetings, either strongly disagreeing or disagreeing with online meetings. In contrast, 25.6% agreed or strongly agreed with preferring online meetings, suggesting a slight overall leaning toward face-to-face meetings (see Figure 3(a)). This preference for face-to-face meetings aligns with respondents' communication preferences for group work, shown in Figure 3(b). A significant portion (46.3%) disagreed with using online communication for group discussions, compared to 23.1% who preferred it. These highlight that, while many respondents are neutral, the majority still prioritize face-to-face interactions for collaborative group work.

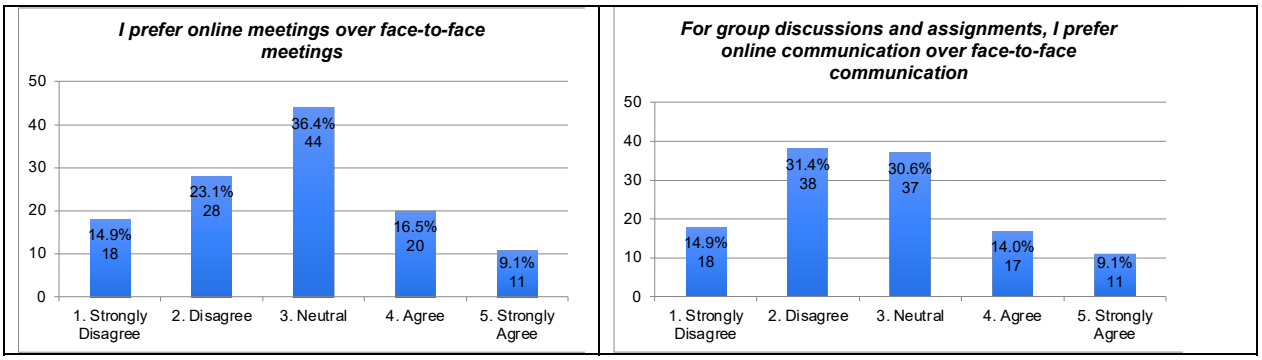

Figure 3. Responses to the statements: a) "I prefer online meetings over face-to-face meetings," and b) "For group discussions and assignments, I prefer online communication over face-to-face communication," rated on a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). Total respondents: 121.

One of the required outcomes of accredited engineering programs in Malaysia is the ability to give presentations (Board of Engineers Malaysia 2024). Regarding the preference for giving online presentations over face-to-face presentations (Figure 4(a)), the sentiments were mixed. While 34.7% remained neutral, 35.6% disagreed, and 29.8% expressed agreement with preferring online presentations. When asked about the preference for explaining ideas in digital communication compared to face-to-face communication (Figure 4(b)), a clearer trend emerged. Although a larger majority (39.7%) were neutral, a significant portion (35.5%) preferred face-to-face communication. In contrast, a smaller group of 24.8% favored digital communication for explaining ideas, either agreeing or strongly agreeing.

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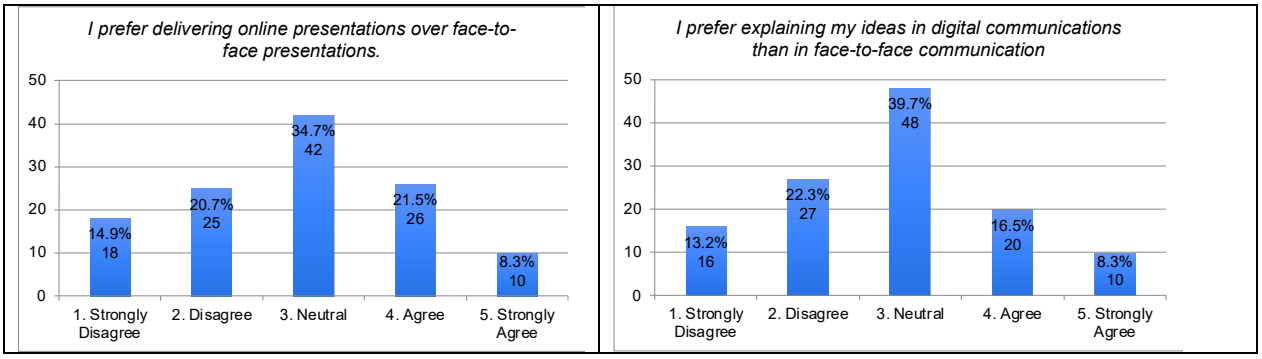

Figure 4. Responses to the statements: a) "I prefer delivering online presentations over face-to-face presentations," and b) "I prefer explaining my ideas in digital communications than in face-to-face communications," rated on a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). Total respondents: 121.

Overall Preference for Online Learning Versus In-Person Learning

In summary, while certain aspects, such as online examinations, are preferred, there remains an inclination toward the conventional face-to-face settings for classes, group work, and discussions. This nuanced preference, where physical classes are favored for learning, but online platforms are preferred for assessments, aligns with trends observed in post-pandemic higher education (Urbanek et al., 2023). The preference for face-to-face classes may reflect the unique needs of engineering students, whose curriculum traditionally benefits from hands-on laboratory work and direct, synchronous collaboration (Ferri et al., 2016; Lal et al., 2020). Conversely, the preference for online tests could be attributed to factors like convenience and reduced anxiety, which has been noted as a benefit of flexible assessment formats (Shraim 2019). A moderate preference for online presentations was also observed, likely due to increased convenience. These findings suggest that face-to-face learning is still favored for many aspects of engineering education. However, most respondents appeared indifferent toward specific learning modes, indicating no strong overall preference.

Domain 1: Explaining And Expressing Opinions

In this domain, students' abilities to explain and express ideas online were assessed through nine statements, each targeting a specific skill. The response distributions for each statement shown in Figure 5. Across all statements, the "Agree" response was the most frequent, ranging from 40.5% to 56.2%, indicating confidence among students in their abilities. The statements "I am able to explain simple facts to classmates online" and "I am able to give simple instructions to classmates online" received the highest combined "Agree" and "Strongly Agree" responses, at 75.2% and 74.4%, respectively. These results highlight strong confidence in performing straightforward online communication tasks.

However, fewer students expressed confidence in tasks requiring clarity and accuracy. The statements "I am able to clearly explain my ideas via online platforms" and "I find that my online communications are understood as I intended" received lowest combined "Agree" and "Strongly Agree" responses of 59.5% each. Notably, the former also received the highest "Disagree" rate in this domain at 7.4%, suggesting challenges in effectively articulating complex ideas online. In general, the students reported more confidence in simpler tasks, such as giving instructions, compared to explaining complex ideas or ensuring their communication is understood. This gap underscores the need for further development of advanced online communication skills.

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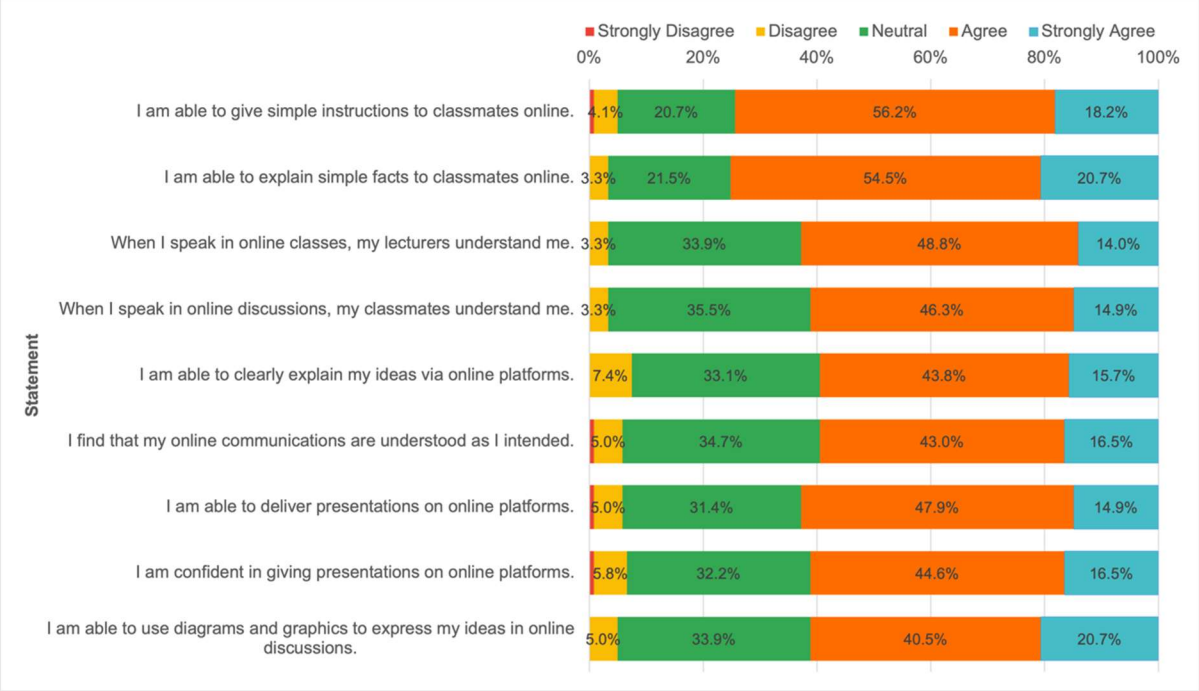

Figure 5. Distribution of responses for Domain 1: Explaining and Expressing Opinions. Responses for each statement were rated on a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). Total respondents: 121.

Domain 2: Engagement In Online Classes and Discussions

In this domain, the respondents' engagement in online classes and discussions was examined. As shown in Figure 6, the students' most notable strength lies in their ability to follow instructions in online classes, with 78.5% agreeing or strongly agreeing. Similarly, 66.1% indicated they could answer questions in online classes, and 66.9% felt confident asking questions and seeking answers in online settings. These findings reflect a solid foundation in the digital communication skills necessary for effective online learning.

However, engagement and participation levels showed variation. While 58.7% agreed or strongly agreed that they actively participated in online classes, only 45.4% reported feeling genuinely engaged during these sessions. "Neutral" responses were also notable for both statements, with 34.7% and 46.3%, respectively, indicating a significant proportion of students may feel indifferent or disconnected during online classes and discussions. This finding supports the conclusions of Anthonysamy (2020) and Zhao et al. (2021), who argued that students often possess only basic digital competencies and lack the deeper skills needed for effective online collaboration.

A concerning finding was students' hesitancy in taking leadership roles during online discussions. Only 43.8% agreed or strongly agreed they were capable of leading online discussions—the lowest level of agreement across all statements. Despite this, students still contributed meaningfully to online group discussions (57.1% agreement) and asked questions when they did not understand others (52.1% agreement). Overall, the data suggest students are stronger in passive online communication skills such as following instructions and answering questions, than in proactive roles, such as leading discussions.

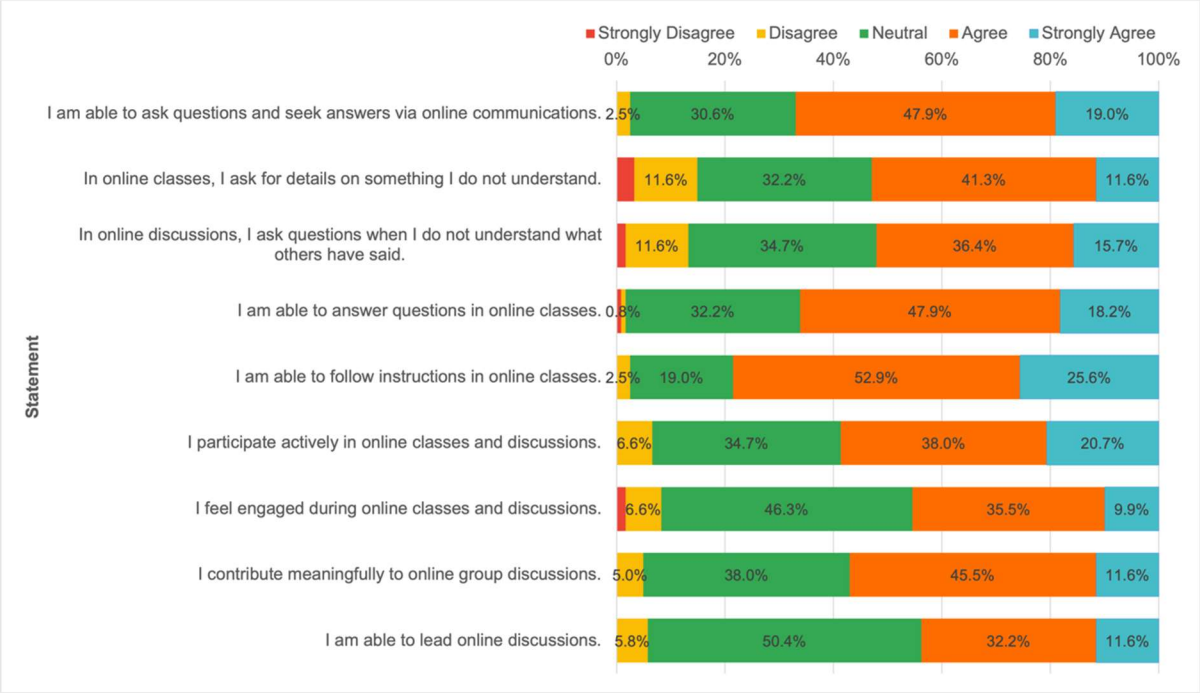

Figure 6. Distribution of responses for Domain 2: Engagement in Online Classes and Discussions. Responses for each statement were rated on a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). Total respondents: 121.

Domain 3: Adapting To Others and Resolving Conflicts

The responses shown in Figure 7 highlight the students' abilities to adapt to others and resolve conflicts through digital communication. Students reported being attentive to others in online discussions—this element received the highest agreement (63.6%). It is therefore not surprising that the second highest agreed statement is their ability to empathize with others' reactions in online interactions, with 59.5% agreement. This also aligns with their confidence (52.0% agreed) of using digital communications to understand others' perspectives during conflicts, further highlighting their strength in interpersonal awareness in the digital space.

On the other hand, the students indicated moderate confidence in their ability to resolve conflicts through digital communication. While 46.3% agreed or strongly agreed that they could effectively communicate using digital platforms to resolve conflicts, fewer (42.2%) felt confident in resolving conflicts in via online communications. These suggest that students excel in understanding others' perspectives but are less confident in actively resolving conflicts in digital environments.

In general, the students demonstrated a strong ability to understand and empathize with others in online settings. This suggests a solid foundation in passive interpersonal awareness. However, their confidence dropped significantly when it came to the active skill of resolving conflicts via digital platforms. This disparity indicates that while students are comfortable interpreting social cues online, they are less equipped to engage in difficult or high-stakes communication. This highlights a specific area where digital communication pedagogy needs to be enhanced, moving beyond basic interaction to complex problem-solving and negotiation, a critical competency for future engineers (Darling et al., 2003).

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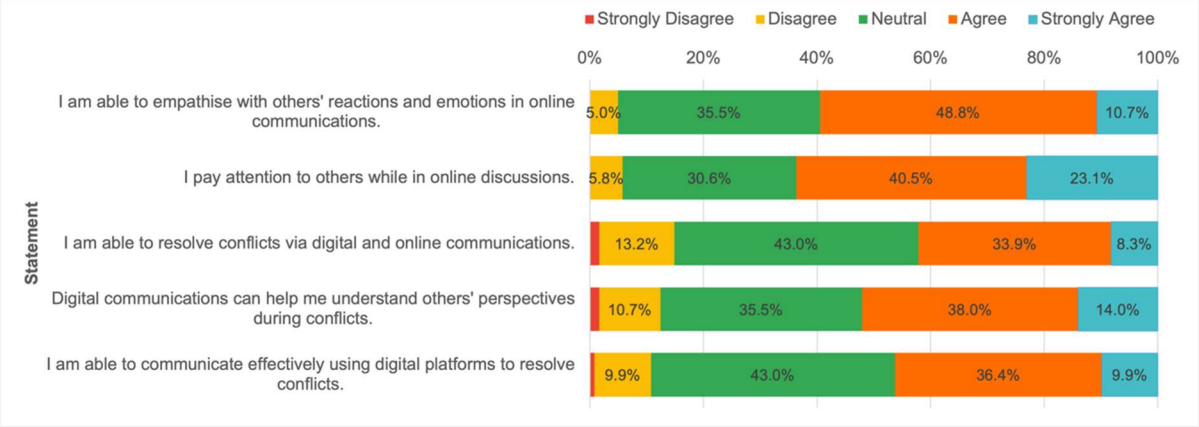

Figure 7. Distribution of responses for Domain 3: Adapting to Others and Resolving Conflicts. Responses for each statement were rated on a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). Total respondents: 121.

Domain 4: English Language Usage

To conclude the research, English language usage in online settings among students was examined through four items, as shown in Figure 8. Majority respondents reported ability to use English in online classes and discussions, and were also confident of doing so. These two elements received the highest agreement of 66.1% and 57.1%, respectively. However, a significant proportion of respondents (43.0%) expressed uncertainty about their ability to convey ideas as intended in English during online conversations. This item received the lowest agreement level (47.1%) and the highest "Disagree" response (9.1%) in this domain. These findings suggest that English language usage in digital communication warrants further investigation.

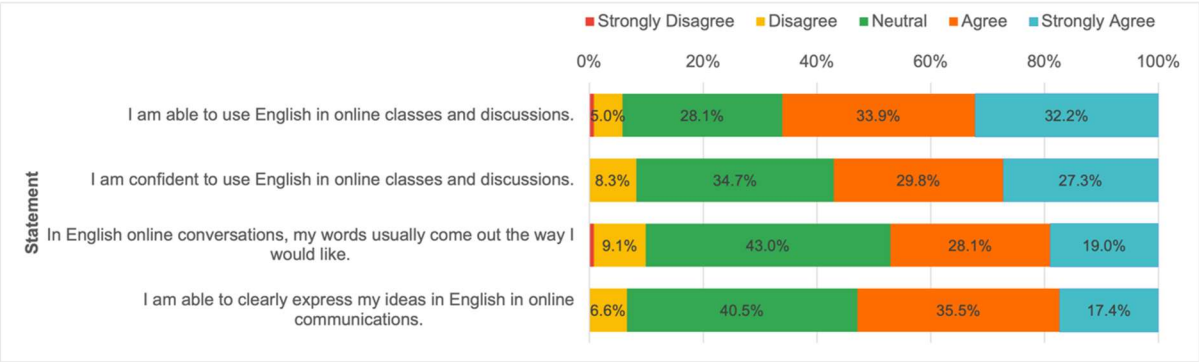

Figure 8. Distribution of responses for Domain 4: English Language Usage. Responses for each statement were rated on a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). Total respondents: 121.

While the students were generally confident using English, their uncertainty in articulating ideas clearly emerges as a significant concern. This challenge is likely amplified in the online environment, where the absence of non-verbal cues can make conveying nuanced technical ideas more difficult. This finding suggests an intersectional challenge where digital communication difficulties are compounded by linguistic insecurities, warranting further investigation and targeted support for students communicating in a second language within a technical field.

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Conclusion

In summary, this study provided some valuable insights into the digital communication skills and online learning receptiveness of first-year engineering students at UKM. Notably, there is no strong preference for online learning over in-person learning, with face-to-face settings remain preferred for classes and group discussions. An optimal learning experience may involve a hybrid approach, combining the benefits of traditional classroom instruction with the flexibility of online learning. In the digital space, students face challenges in effectively articulating complex ideas, feel less engaged during online classes, and hesitate to take on leadership roles in online discussions. They excel in understanding others' perspectives but are less confident in resolving conflicts through digital communication. Finally, the students are generally confident of using English in online settings but encounter difficulties in conveying their ideas as intended in online conversations.

Conflict of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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