Engineering Students' Interaction in Online Classes via Google Meet: A Case Study During the COVID-19 Pandemic

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Abstract—Online or distance learning became a commonly used alternative internationally during the COVID-19 pandemic. Video conferencing and e-learning platforms were therefore created to meet this need. The study aims to examine engineering students' interaction via Google Meet, their satisfaction as well as suggestions for improving their interaction when studying on this platform, which was based on Moore's interaction framework of *learner-content, learner-learner* and *learner-teacher* interaction. A 5-point Likert scale and a semi-structured interview were used with the participation of 115 engineering students from a private university. The results indicate that the interaction and satisfaction of the participants was perceived at a positive level, but not very high. Of the three types of interaction, engineering students' interaction with their teachers was slightly higher than the other two types. Several reasons were cited: passive learning styles, lack of physical interaction, and need for private communication. To improve student interaction, it is suggested that more physical classroom activities be included in each online lesson. Engineering students should then become more proactive and prepare lessons in advance. It is also recommended that Google Meet developers add private meeting room and messaging features, as suggested by participants. In general, instructors and students should consider these types of interactions from the students' perspective to maintain an effective learning environment during the pandemic.

Keywords—Google Meet, online learning, interaction, perception, COVID-19 pandemic

1 Introduction

Since the first outbreak of coronavirus disease (COVID-19) in Wuhan, China, in 2019, many parts of the world have been negatively impacted. Some emerging impacts of COVID-19 have been recorded as social life, economy, and academic progression [1], [2]. In particular, students have been suffering from the interruption of direct school attendance, so online learning is dominant in most educational institutions. Traditional teaching methods have been shifted to innovative web-based approaches or computer

and mobile-assisted learning applications and tools to meet the requirements of institutional curricula [3], [4], [46]. Online teaching and learning have been so far prominent in the pandemic, which have changed students' learning styles, collaboration and seen as a future work demand [4], [5], [6], [47]. In engineering education particularly, distance learning benefits students since it does not reduce students' performance as in a study in France [18], [19]. However, in other places, some disadvantages have been witnessed such as shortage of Internet connection or network capacity and portable devices (laptops or smart phones) [1]. As a result, their academic performance has been adversely affected due to the gap between what they have learned and what final examinations have expected them to achieve [7].

In a Vietnamese teaching and learning context, various virtual platforms and conferences such as Google Meet, Microsoft Teams, Zoom have been introduced and applied for use to maintain both the quality of academic progression and learning outcomes during the COVID-19 pandemic. Each educational institution could choose one suitable way of teaching which fits the current situation in the crisis. Each virtual platform has its own benefits and drawbacks, but many universities in Vietnam adopt Google Meet as a preferable platform for teaching and learning during COVID-19 pandemic. The adoption of virtual platform of Google Meet has brought students several benefits as reducing fear of education failure [8] and avoiding the interruption of educational activities [9]. However, studies argued that lack of face-to-face interaction could make online learning less effective [10], [11], [12] since some science subjects and experimental tasks are not conducted well through online platforms [13], [14]. Therefore, exploring different aspects of interaction on the virtual learning environment could be put in consideration.

According to Moore's framework of interaction [15], three types of interaction, namely learner-content interaction, learner-learner interaction, and learner-instructor interaction are emerged in every classroom, especially for distance education. To argue that interaction plays a vital role in online classrooms in general and via Google Meet in particular, the study aims to gain insight into the extent that engineering students interacted with subject content, other students and their teachers as well as their satisfaction and suggestions to improve their interaction when they were involved in online classes via Google Meet. Therefore, the study is to seek out the answers for the following questions:

1. To what extent do engineering students interact with the subject content, other students and their teachers via Google Meet?
2. How do engineering students interact with the subject content, other students and their teachers via Google Meet?
3. To what extent do engineering students satisfy with these types of interaction via Google Meet?
4. What are some reasons and suggestions from engineering students' perspectives to enhance these types of interaction via Google Meet?

2 Literature review

2.1 Learner-content interaction

Moore [15] described the importance of learner-content interaction since real learning does not really take place without this type of interaction. In other words, it is the process in which learners get exposure to knowledge or intellectual content of a study filed that leads to changes in learner's understanding, learner's perspectives, or learners' cognition. Besides, the type of content can be displayed through textbooks, audios, videos, webpages, and computer software [16]. It is apparent that learner-content interaction correlated with students' learning outcomes and satisfaction in a course [17]. Although students gain more confidence when they study online, their interaction with the subject content is not highly appreciated [20]. Therefore, the role of using a mediating tool [21] and designing a course, which gets students engaged with the subject content is significant to encourage more interaction [22].

2.2 Learner-learner interaction

The definition of learner-learner interaction is described as the interaction between one student and other students, alone or in groups, with or without presence of a teacher in a classroom [15]. Learner-learner interaction takes place via computer-mediated communication or computer conferencing as an instructional strategy [23], in which students get involved in reciprocal communication [24]. Moreover, lack of interaction with peers in the online learning environment could weaken students' sense of community [25], so to increase students' satisfaction toward learner-learner interaction, it is significant to foster students' sense of community in their online classrooms [26]. Studies also showed that online classrooms caused less interaction among peers in comparison to offline classrooms [27], [28]. Therefore, instructional strategies should be proposed to enhance students' interaction with other students in their online courses [29], [30].

2.3 Learner-instructor interaction

Learner-instructor interaction is defined as the interaction between the learner and the expert who prepared the subject material, or some other experts playing a role as an instructor or teacher [15]. In other words, it is mutual communication taking place between course instructors and learners [31]. Moreover, it is also examined that when the instructor is in charge of delivering knowledge and information, encouraging learners, giving feedback [32], and facilitating collaboration [33], the purpose is to maintain learners' interest during their class time [15]. To enhance learner-instructor interaction in the virtual learning environment, teachers are encouraged to apply pedagogical techniques as posting messages on a discussion board or forum for quick responses [31] [34], giving timely feedback [35], and using artificial intelligence (AI) system storyboards [36].

2.4 Google Meet in teaching and learning

Web-based learning or virtual conferencing has been used by thousands of educational institutions as an effective mode of online courses, workshops, seminars [37], [38]. However, to facilitate online learning, some characteristics should be considered such as regular participants' posts, online participants' needs, participant-to-participant collaboration, community and technological support [39]. Google Meet is a video-communication service developed by Google, which is available for mobile devices (iOS and Android), with more than 100 million users for daily access and up to hundreds of participants in one host meeting as specified by Google. In fact, the use of Google Meet in learning and teaching have been ranked effective in many parts of the world [8], [40], [41], [42]. Therefore, Google Meet has been chosen as the best tool for video conferencing in comparison to Zoom, Skype and Microsoft Teams [43]. Some reasons for this choice have been examined as Google Meet can help users separate their connections, and share information with privacy and more security since it employs anti-hijacking features and secure meeting controls with the support of multiple 2-step verification options including security keys.

Thanks to its benefits, the utilization of Google Meet has been recorded in different educational settings. Many schools, colleges and universities preferred Google Meet as the ultimate tool for virtual and distance learning and teaching [8], [41], [44], [45].

3 Methodology

3.1 Participants

A random sampling technique was employed to select 115 engineering students at a private university in Vietnam for this study, aged from 18-24. All of them have experience in learning via Google Meet for at least 6 months. 15 out of 115 participants were also invited for a semi-structured interview to gain deeper understanding of reasons why their interaction was perceived at a high or low level as well as some possible suggestions to enhance their interaction via Google Meet.

3.2 Instruments

The research data were collected through a 5-point Likert scale questionnaire of 12 questions that were employed and based on Moore's framework of interaction [15]. The questionnaire aimed to examine the extent of students' interaction and their satisfaction when they attended their classes via Google Meet, with their level value from 1 to 5, accordingly 1 for "very low", 2 for "low", 3 for "average", 4 for "high" and 5 for "very high". Following this, sub-questions were also designed for a semi-structured interview to get more exposure to students' reasons and suggestions for interaction improvement through this online platform. The interview questions are listed:

1. Does Google Meet reduce your interaction during online classes? How and why?
2. Do you have high level of interaction with the content during online classes via Google Meet? Why or why not?
3. What are your suggestions to improve your interaction with the content during online classes via Google Meet?
4. How is your interaction with your classmates during online classes via Google Meet compared to that of offline classes? Can you explain?
5. What are your suggestions to improve your interaction with your classmates during online classes via Google Meet?
6. Do you maintain good interaction with your teachers during online classes via Google Meet? Why or why not?
7. What are your suggestions to improve your interaction with your teachers during online classes via Google Meet?

3.3 Data collection and analysis

Students were invited to participate in an online survey, which was sent to them via Google Forms. The questionnaire was sent to 200 engineering students at a private university, but 115 responses were returned (accounting for 57.5%). At the time of conducting the study, the participants had at least 6 months of learning experience via Google Meet. It took approximately 10 minutes to complete this survey. To ensure the questionnaire reliability, the collected data were analyzed by SPSS software (version 25). The result of Cronbach's Alpha value was .831, which was considered reliable for research. After this stage, 15 students were invited to participate in an online semi-structured interview via Google Meet. It took nearly 10 minutes for each interview. The interviews were in Vietnamese, then recorded and manually transcribed and coded by thematic interview protocols.

4 Results

4.1 Results from the questionnaire

As indicated in Table 1, the overall mean score of the participants' perceptions on types of interaction via Google Meet was 3.76 (SD=0.65). Besides, the result for a One-sample t-Test indicated that there was a statistically significant difference in the mean score between 3.76 and 3.0 (t=9.791, p=0.000) (see Table 2). Therefore, it was higher than the average mean scores of the 5-point Likert scale (M=3.00). As a result, participants' perceptions on types of interaction via Google Meet were at an above-average level. In addition, it is apparent that their perceptions on learner-instructor interaction (M=3.81, SD=0.94) were recorded slightly higher than other types of interaction. Noticeably, learner-learner interaction was perceived the lowest (M=3.54, SD=1.06). The results indicated that the interaction between students and teachers was slightly better than the other types when students attended their online classes via Google Meet.

Besides, the ways those students interacted with the subject content via different means were also examined such as audios, videos, e-books, applications or software, online lessons, Google search engines and so on.

As shown in Figure 1, students interacted more with the subject or course content through e-books and online lessons, accounting for 90 participants (78%) and 88 participants (76.5%) respectively. In addition, applications and software were not a good choice when only 55 participants (47.8%) preferred this mean. The results described that the participants significantly interacted with the subject content through a variety of means via Google Meet.

Table 1. Mean scores of participants' perceptions on types of interaction

Interaction	N	Mean (M)	SD
Learner-content interaction	115	3.79	.79
Learner-learner interaction	115	3.54	1.06
Learner-instructor interaction	115	3.81	.94
General Mean	115	3.76	.65

Table 2. One-sample t-test of general means (Test value = 3)

	t	Df	Sig. (2-tailed)	Mean difference	95% Confidence Interval of the Difference	
					Lower	*Upper*
General Means	9.791	114	.000	.713	.567	.857

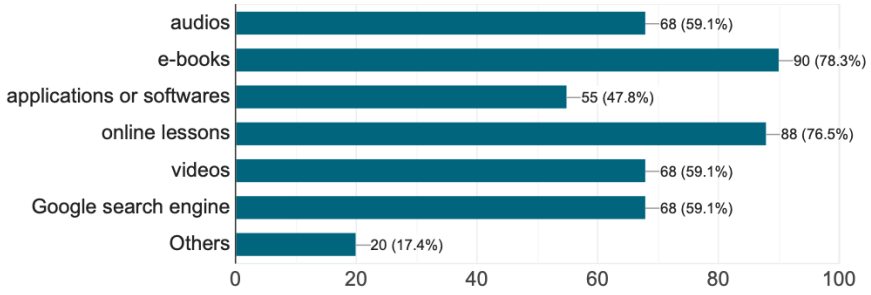

Fig. 1. Participants' means of interaction with the subject content

In addition, different ways of interaction among those students were described as Zalo (a popular social networking site in Vietnam), Facebook, Google Meet (directly), calls and video calls, Zoom, short messages and so on.

The results showed that engineering students preferred interacting with their peers or classmates directly via Google Meet, with 107 (93%) participants (see Figure 2). Moreover, Facebook and Zalo were also common means that those students chose to interact with their friends during their class time via Google Meet, figuring at 96 and 88 students respectively. Interestingly, Zoom was rarely used for mutual communication or interaction when they studied online, which was the choice of only 3 students.

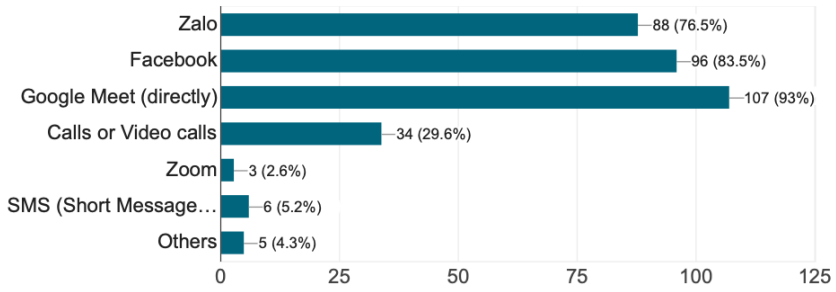

Fig. 2. Participants' means of interaction with other students

When examining how the participants interacted with their teachers in their online classes via the platform of Google Meet, the above-mentioned means were also used for data collection.

The results from Figure 3 described that 109 engineering students (94.8%) still preferred direct interaction or communication with their teachers via Google Meet. Facebook was the second choice for learner-instructor interaction, with a record of 79 students. Meanwhile, those students did not choose Zoom as their way to interact with their instructors.

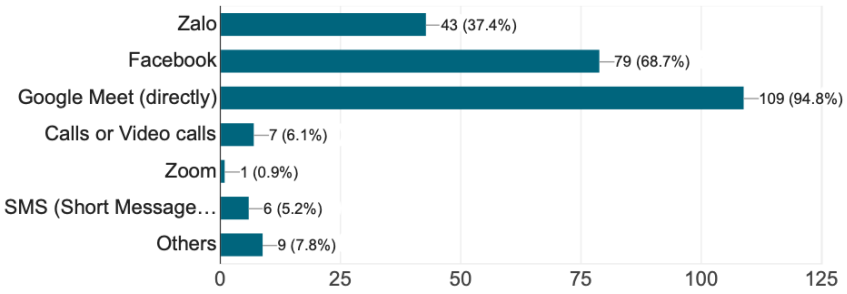

Fig. 3. Participants' means of interaction with their teachers

The analysis of participants' satisfaction about types of interaction via Google Meet. Descriptive statistic tests were employed by SPSS to examine engineering students' satisfaction on three types of interaction when they studied via Google Meet.

The results from Table 3 showed that participants' satisfaction on three types of interaction was 3.81 (SD=0.74). Moreover, the results from One-sample t-Test (see Table 4) described that there was a statistically significant difference in the mean score between 3.81 and 3.0 (t=11.882, p=0.000). The results from those tests indicated that students' satisfaction about three types of interaction was positive. Specifically, learner-instructor interaction was ranked the highest among three types (M=3.98, SD=0.85). The figures for the other two were also recorded at a positive level (M=3.82 and

M=3.64). It was suggested that the participants felt satisfied with the interaction occurred in their online classes via Google Meet.

Table 3. Mean scores of participants' satisfaction on types of interaction

Satisfaction	N	Mean(M)	SD
Lerner-content interaction	115	3.82	.85
Learner-learner interaction	115	3.64	.80
Learner-instructor interaction	115	3.98	.85
General Means	115	3.81	.74

Table 4. One-sample t-test of general means (Test value = 3)

	T	df	Sig. (2-tailed)	Mean difference	95% Confidence Interval of the Difference	
					Lower	*Upper*
General Means	11.882	114	.000	.814	.679	.950

The analysis of participants' reasons and suggestions to enhance interaction via Google Meet. To gain deeper insights into participants' opinion and their suggestions to improve their interaction in their online classes, 15 participants were involved in interviews for analysis.

The general results showed that 86.7% of engineering students supported the idea that interaction should be enhanced by some ways since online classrooms via Google Meet reduced their interaction. The reason for this was that lack of physical classroom activities made students become more sedentary as well as reduced vision sitting in front of the monitor for several hours during classes. As participants 3 and 8 mentioned that:

"When I study online, I can see clearly that I don't interact with my friends and teachers as I used to. After 6 months learning via Google Meet due to the lockdown in my place to avoid Coronavirus, I see myself more passive in some classes." (Participant 3)

"I sit at my laptop for long hours, but I don't move because the classroom activities are mainly focused on speeches or quizzes. I become lazier and not active in my online class." (Participant 8)

A majority of participants (11 out of 15) stated that their interaction with the subject content was not high because they were not proactive since they relied on their teachers who provided them with learning materials during their course time. When learning via Google Meet, students picked up their textbooks and prepared online lesson slides from their teachers. To make students more interactive with the subject content via Google Meet, the participants suggested that reading more materials before class such as summaries from teachers' planned slides or notes could help. One of the participants said that:

"The content I can get is from my textbooks and PowerPoint slides that my teachers prepare before class. I read the slides and get information to do my quiz. I don't usually

read a lot in advance because I don't know what I should focus in my books my teachers recommend." (Participant 13)

Besides, 80% of the participants agreed that their interaction with their classmates was dropping significantly in comparison to the time they attended on-site classes. The reason was examined as students did not have much face-to-face communication during online classes. Therefore, more physical classroom activities should be included more classroom activities in group work in forms of presentations or debates. In addition, more features on Google Meet should be added such as private breakout rooms to help students randomly worked with different students as on Zoom.

"I seldom work in groups when I study via Google Meet. I think it's not easy to work with my classmates there because Google Meet doesn't have the feature of breakout rooms. I still prefer Zoom for this feature. I wish my teachers could give me more tasks to work for presentations. I like to debate with my friends in group discussion." (Participant 4)

In terms of learner-instructor interaction, a majority of participants (9 out of 15) supported that they still tried to maintain their direct interaction with their teachers via Google Meet by hand raising feature. However, it was not an ease to contact their teachers online since some students preferred messaging privately there. Students hoped that their teachers could give longer time for questions and answers (Q&A) sessions. Interestingly, students wished that Google Meet could add a new feature for private messaging. Participants 6 and 11 presented that:

"When my teachers ask questions, I raise my hand to answer, or when I have a question, I just ask directly. However, sometimes I feel a bit shy asking questions, so I wish to ask questions privately, but Google Meet doesn't offer this feature. That's too bad!" (Participant 6)

"I also hope to have more time for questions and answers at the end of each lesson to know more about I can't follow or understand." (Participant 11)

5 Discussion

Since the study aimed to examine engineering students' perceptions towards three types of interaction, namely *learner-content*, *learner-learner* and *learner-instructor interaction* when they students online via Google Meet at a university. The researchers discovered that students' perceptions on their interaction via the platform of Google Meet was above average. The interaction between students plus the subject content and their teachers was a bit higher than student-student interaction. In other words, students generally perceived their interaction in a positive way. The result was similar to the findings of Al-Marrof et al. [8] and Ironsi [42].

Moreover, engineering students showed their satisfaction with Google Meet in terms of interaction at a positive level. Learner-instructor interaction was more slightly dominant than the other two. The finding indicated that Google Meet could be an effective tool for online or distance learning, which was consistent with Almusharraf and Khahro [40], and Nasution & Nadiyanto [41].

Students preferred a variety of means to interact with the subject content as textbooks and online lessons; with their peers and teachers directly through Google Meet or other social media sites. The finding suggested that students could interact and study better via a preferable mediating tool, which was in line with the study by Lenkaitis [21].

Some suggestions drawn from engineering students' perspectives could be described to improve each type of interaction. They included reading in advance learning materials such as planned slides or notes for summaries, providing more classroom activities in group work in forms of speeches, giving more chances to communicate directly with their teachers as well as private communication, and adding some more features to make Google Meet hands-on. These findings indicated that interaction would be enhanced once many elements were met and mutually constructive to maintain the effective online learning environment, which were accompanied with the characteristics mentioned by Collison et al. [39]. Therefore, it is recommended that improving students' interaction was not an easy task as it required an effort to adjust and give more support in online classes.

6 Conclusions

The findings of the study indicated that engineering students interacted positively in their online classes or courses via Google Meet. However, the level of interaction was just at above average. Among three types of interaction, students' interaction with their teachers was higher than their interaction with classmates and the subject content. The reasons for reduced interaction were examined such as passive learning styles, lack of physical interaction, and needs of private communication.

Engineering students' satisfaction toward three types of interaction was also graded positive, but not very high. Therefore, students suggested some ways to improve their interaction in the online learning environment via Google Meet. The first suggestion was that more and more physical classroom activities should be included to enhance students' interaction with friends and teachers. In addition, students should become more proactive to get more exposure to knowledge and information as required by subject or course objectives. Finally, more emerging features as private breakout rooms or messaging should be added to Google Meet to secure privacy.

In brief, it is suggested that both students and teachers would be more aware of interaction types and recommendations for interaction improvement to maintain the effective online learning environment.

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