

Experiences of Engineering Students during the Covid-19 Pandemic: A Qualitative Study

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Abstract: The current Covid-19 pandemic resulted an enormous effect to people all over the world. There is a major distraction as schools needed to quickly shift from traditional face-to-face learning to remote or digital learning. Literature shows how the Covid-19 pandemic make a toll on students' well-being and learning. Thus, the current research aimed to explore students' experiences and addressed the following research questions (1) What is the impact of the Covid-19 pandemic among engineering students? (2) What are the perceived advantages and disadvantages of remote learning? and (3) What are the coping strategies of engineering students during the Covid-19 pandemic? With this aim, a focus group discussion was carried out online and eight undergraduate engineering students participated in the study. Two general categories (*Fear and Anxiety & Opportunities*) with five codes were obtained for research question one, two general categories (*Advantages & Disadvantages of the Remote Learning*) with ten codes for research question two and three general categories (*Physical Activity, Support System & Personal Time*) with ten codes for research questions three. Results will help aid in the development of continuous support services for students in this new and challenging time.

Keywords: Covid-19 pandemic; Engineering students; Remote learning; Coping strategies

Background of Study

The coronavirus disease (COVID-19) had a huge impact on people's lives all around the world. Many schools and universities were obliged to make an unforeseen transition from traditional face-to-face studying to digital teaching and learning due to the health emergency triggered by the pandemic. This situation has affected teachers and students around the world from primary, secondary (Kaden, 2020; Lassoued, Alhendawi & Bashitialshaaer, 2020) and even in the higher education (Akour, Ala'a, Barakat, Kanj, Fakhouri, Malkawi, & Musleh, 2020; Rapanta, Botturi, Goodyear, Guàrdia, & Koole, 2020). While schools and universities rush to adapt and adopt digital systems for remote learning (Garcia-Alberti, Suárez, Chiyón, & Mosquera Feijoo, 2021), students encounter challenges like lack of access to academic resources and distractions in the home learning environment (Clabaugh, Duque & Fields, 2021) and might have experienced negative emotions due to the hurried switch to an unfamiliar learning situation (Park, Park, Jackson & Vanhoy, 2020) while parents were also struggling to educate

and care for their children due to school closure (Harris, 2020).

Research revealed that previous epidemics negatively affected people and society's mental health (Wu, Fang, Guan, Fan, Kong, Yao, Liu, Fuller, Susser & Lu, 2009, Wu, Liu, Fang, Fan, Fuller, Guan, Yao, Kong, Lu & Litvak, 2008). People may develop intense stress responses during crises which can have both short and long-term effects on mental health (Wu et al., 2009). Consequently, research on COVID-19 presented that young people are the most vulnerable to mental health crises (Cao, Fang, Hou, Han, Xu, Dong & Zheng, 2020). The World Health Organization also mentioned significant mental health concerns during the pandemic such as concerns about the risk of being infected, losing a family member or loved ones, uncertainty, the threat of losing one's life, the restrictions on social connection and interactions, and the like (WHO, 2020a).

For college students, the prevalence of the pandemic creates new stressors including fear and

worry for oneself or loved ones, constraints on physical movement and social activities due to quarantine, and sudden and radical lifestyle changes (Son, Hedge, Smith, Wang & Sasangohar, 2020). There were reported manifestations of distress, anxiety, depression, and insomnia in general populations as Covid-19 swept the world (Tee, Teem Anlacan, Aligam, Reyes, Kuruchittham & Ho, 2020). Approximately one out of every four students suffer from anxiety (Cao et al., 2020). It was supported by the study of Salari, Hosseinian-Far, Jalali, Vaisi-Raygani, Rasoulpoor, Mohammadi & Khaledi, (2020) that among the general populations in Asia and Europe showed the prevalence of stress (29.6%); anxiety (31.9%) and depression (33.7%). Consequently Brooks, Websters, Woodland, Wessely Greenberg & Rubin (2020) individual in quarantine experience psychological distress in the form of anxiety, anger, confusion and post-traumatic stress symptoms. For many students, the pandemic complicated their current plans, increased concerns over academic achievements, and changed their mode of functioning. Students try to cope, with either positive or negative coping strategies and seek support from others (Son et al., 2020). Hence, the effects of the pandemic on the mental health and well-being of college students must be assessed immediately (de Oliveira Araújo, de Lima, Cidade, Nobre & Neto, 2020; Zhai, 2020).

The government all over the world has imposed safety measures to prevent community transmission. As the Covid-19 pandemic posed an unprecedented challenge, higher education suspends face-to-face classes and moved toward remote learning (UNESCO, 2020). The unexpected change due to health crises forced students to adapt to new ways of learning that can potentially affect their academic. In the case of engineering education, a large part of the curriculum is based on the practical application of knowledge such as laboratory classes (Jacques, Quahabi & Lequeu, 2020), and the online setup could pose a significant challenge.

According to Martínez, Aguilar & Ortiz, (2005), online education has become a viable component of higher education in engineering subfields like electrical and computer engineering, computer science, and information technology, particularly at the master's or post-graduate level, over the last decade. From the traditional content centered (Bourne & Mayadas, 2005) to various pedagogical methodologies have shown efficacy in enhancing engineering education (Lima, Andersson,

& Saalman, 2017). Although online education is becoming a significant tool available to educators, with the unprecedented transition to remote learning, it is necessary to assess and properly handle Covid-19's direct and indirect threats to students' well-being (Burns, Dagnall & Holt, 2020). The sudden adjustment can be especially difficult for engineering students because most institutions based most of their learning on practical applications, laboratory classes, and direct contact with lecturers and other students (Baltà-Salvador, Olmedo-Torre, Pea, & Renta-Davids, 2021). As Park et al. (2020) stated, the transition was difficult. In a remote-learning environment, it is difficult to conduct lab courses, which are an important part of undergraduate engineering curriculums and are needed by the Accreditation Board for Engineering and Technology (ABET) for program accreditation. Hence, the instructional change may cause increased stress levels for students that ultimately impact their well-being, academic emotions, and college retention (Ramo, Lin, Hald, & Huang-Saad, 2021).

Despite the existing literature on online engineering education, to the best of my knowledge, there has been no thorough qualitative analysis of the experiences of engineering students at present. In view of the ongoing pandemic, it is in this light that the present study hopes to contribute to the existing literature with valuable results. It's an opportunity to learn more about engineering students' experiences of the abrupt move to online learning so that support services for students' general well-being can be developed. As a result, the present study addressed the following research questions:

1. What is the impact of the Covid-19 pandemic among engineering students?
2. What are the perceived advantages and disadvantages of remote learning?
3. What are the coping strategies of engineering students during the Covid-19 pandemic?

Method

Research Design

This study employed a qualitative research approach. Qualitative designs are beneficial for research that aims to look deeper into a specific topic. In qualitative research, the researcher aims to comprehend the participants' unique world by

listening carefully and attempting to capture the significance they place on their lives and experiences (Ponterotto, 2005). Particularly, a focus group was used in this study. The focus group technique allows for spontaneous information exchange as well as the expression of participants' knowledge and ideas.

Focus groups are a type of group interview that uses communication among study participants to gather information (Kitzinger, 1995). It enables interactive and in-depth exploration of respondents' experiences (Kitzinger, 1995) and the group process can help clarify each view that might not emerge from a one-on-one interview which the author believes best fits serve its purpose. In a focus group discussion, participants can think aloud and are free to say what they think. Moreover, information obtained from focus group discussions is deeper than from face-to-face interviews because of the social interaction among the participants (Thomas, MacMillan, McRoll, Hale & Bond, 1995).

Trustworthiness of the Research

Various strategies are used to ensure the validity and reliability of the research. As to ensure the trustworthiness of the study, the researcher took steps such as maintaining member-checking, auditing and engaging in "critical and sustained discussion" with knowledgeable colleagues (Morrow, 2005).

Participants

The participants of this study were comprised of eight (8) engineering students enrolled in the online class. Three (3) out of eight (8) students are second year students and five (5) students are in their third year and enrolled in different courses. Four students are taking industrial engineering, one student is taking computer programming engineering and three students are taking mechanical engineering course.

Purposive and convenience sampling is applied in this research. Both techniques are examples of non-probability sampling. The non-probability sampling focuses on sampling techniques where the group units under investigation are based on the judgment of the researcher. According to Patton (2002), purposeful sampling seeks cases with a lot of information that can be investigated in depth.

Procedure

Invitation to participate in the study was announced to the engineering students' council. The researcher sought assistance from the students' council to share and disseminate the letter of invitation to engineering students across levels. Students who opted to participate in the study received an email with further instructions about the online focus group discussion. They were informed that the platform we will be using is via Zoom and they were asked to use their university-assigned email addresses in joining the online discussion. Their consent in the utilization of the gathered data for research and program development was obtained as well via Google Forms. Participants were also informed that no identifiable information will be shared in the event that the data gathered from them will be used for research presentation or publication.

Data Analysis

The data analysis began with organizing the data. As the first step, the recorded Zoom meeting of the focus group discussion was transcribed verbatim and analyzed by summarizing content analysis. The initial step consisted of "immersion in the data" (Morrow, 2005) through careful listening to the recorded discussion, reading through the transcripts, and going through the whole data. Similar codes were brought together into the main categories. Two Ph.D. students in counseling psychology assisted and confirmed the codes constituted by the researcher. Furthermore, codes were used to protect the privacy of the participants.

Ethical Considerations

As a qualitative study is an in-depth examination of the personal experiences of the participants, the following precautions are taken to protect the participant's rights: 1) the purpose of the research was communicated to the participants in writing sent via email; 2) informed consent was sought from the participants; 3) participant anonymity is protected through the use of pseudonyms and lastly; 4) strict confidentiality is and will be maintained on all personal information shared.

Findings

Analysis of data revealed the experiences of the participants about the COVID-19 pandemic,

advantages and disadvantages of the remote learning and their coping strategies. Results of each research question were shown below.

What is the impact of the Covid-19 pandemic among engineering students?

Findings related to the first research question resulted in the categories and codes shown in Table 2.

Table 2. Perspective of students about Covid-19

General Categories	Codes	F
Fear and Anxiety	Fear of getting infected	8
	Fear of losing a loved one	8
	Uncertainty of the current situation	8
Opportunities	Rebuilding relationship	6
	Time for self-reflection	5

Table 2 presents two general categories such as fear and anxiety and opportunities while five codes are determined within these categories. Students are generally anxious about the Covid-19 pandemic indicated fear of getting infected, fear of losing a loved one, and uncertainty of the current situation. Students pointed out that this public health emergency affected people around the world with no exception. One participant reiterated that *“we are not ready, and we did not expect that this will last long, having that knowledge, knowing that we are all uncertain as to when it will end is very frightening”*. Another participant noted *“having the thought that my family member and loved one contracted this virus is very alarming, I am afraid to lose my family and loved ones”*.

Another category is “opportunities” wherein participants expressed that this pandemic brought them to rebuild relationships wither with their family members and or significant others and a personal time – a chance to understand themselves better. Some of the participants stated *“before the pandemic, we seldom eat together as a family, I am busy in school same with my siblings while my parents are busy with their work. We go home late most of the time. Because of the quarantine, we are able to have a meal together, there is a chance to talk, we had the opportunity to bond and look for*

ways not to be bored inside our house”. While other participants declared that the pandemic allowed them to have more time for themselves. One participant stated, *“I got a chance to have self-reflection, appreciating what we have, what I have, having a deeper understanding of myself is one of the good things that this pandemic brought to me”*.

What are the perceived advantages and disadvantages of remote learning?

Asking the participants about their remote learning education experience, two general categories, and ten codes were attained shown in Table 3.

Table 3. Students View about the Sudden Shift to Online Learning

General Categories	Codes	F
Advantages of the remote learning	Increased comfort	8
	Less stress from commuting	4
	Reduced expenses	7
	Learning flexibility	6
	Decreased tardiness	8
Disadvantages of the remote learning	Poor internet connection	8
	Increased workload	8
	Excessive screen time exposure	8
	Limited interaction with classmates/professor	4
	Inability to focus	4

As seen in Table 3, five (5) codes each were labeled both for category 1 (advantages of the remote learning) and category 2 (disadvantages of the remote learning). Participants have identified the benefits and the downside of digital learning. Most of the participants declared the comfortability that they are just at home and no need for them to get up early to go to school. One participant stated *“the online class that we have is flexible, you follow your synchronous class and then work on your other tasks during the asynchronous schedule. You can still have time for other chores. Also, no lates in class”*. Another participant remarked is that *“in this time of the pandemic, somehow, I was able to help the family to reduce the expenses like you don't need allowance every week or month, so there are some savings”*. While some students happily reported that they are no longer stress due to commuting, as one participant mentioned, *“I don't need to wake up super early just to avoid the hassle of commuting”*.

Within the framework of the second category, participants identified the downside such as poor internet connection, online classes require a bigger workload, excessive screen time exposure, minimal interaction with classmates/professors, and inability to focus. One participant expressed *“I think our major concern here is that the poor internet connection we have here in the country. There are moments when you cannot fully understand your professor’s lecture because it’s either me or him is lagging.* Participants agreed that the excessive screen time tends them not to work with their other tasks at the end of their class. As one participant mentioned, *“I am too tired after our class”.* While another participant stated, *“I miss the face-to-face class, that much better, you can freely talk and discuss things with your friends/classmates, you can easily clear things out to your professors, you can hang out with your friends after class, I just miss it so much”.* They remarked that their online learning requires them to work alone which they are not used to.

What are the coping strategies of engineering students during the Covid-19 pandemic?

Findings related to the third research question about their coping strategies in this time of pandemic were formed into three categories and ten codes shown in Table 4.

Table 4. Coping Strategies of Students in this time of Pandemic

General Categories	Codes	F
Physical Activity	Exercise/Yoga	5
	Walking with pets	6
	Biking	4
	Gardening activities	4
Support System	Quality time with family/loved ones	8
	Connecting with friends	8
Personal Time	Spending time with hobbies	8
	Social Media (Netflix/Facebook/Youtube/video games)	8
	Taking a break (screen break/resting)	8
	Pampering self (reward)	8

Table 4 presents three general activities and ten codes for the category of students’ coping strategies in this time of the pandemic. The general categories are physical activity, support system, and personal time. Within the context of physical activity as one way of coping, participants identified exercise/yoga, walking with pets, biking, and gardening activities. One participant stated, *“boredom strikes honestly. The limited move we have due to restrictions is really something and I found exercising a way of coping. It helps me to get a healthy body and even improved my functioning”.* Supported also by another participant, *“it helps also in maintaining a healthy weight given that we are just home. Likewise, meditation like yoga, keeps not only your mind healthy but as well as your inner self”.*

The next category was very remarkable to the participants. All of them declared that in this time of the pandemic, social support is very important. They see the value of family relationships and significant others. One participant mentioned, *“during this time, we only have our family, it opens to rebuild a healthy relationship”* while some also reiterated *“connecting with friends also a way of coping – knowing that you have people around you are a good feeling”.*

Lastly, the third category is related to how they have valued their personal time. For them, the pandemic gives them a chance to know themselves better. One remarkable statement that they agreed with is that it allows them to focus on their interests, hobbies, and even unlock other skills they thought they cannot do. More so, participants expressed that personal time helps them connect to their emotional and physical well-being.

Discussions

The Covid-19 pandemic has caused significant changes in education all over the world and in every aspect of life in general. The education system imposed a safety measure for transitioning from face-to-face education to remote or distance learning. This safety measure has also a significant effect on students’ lives. As students are the primary stakeholders in the educational system, it is critical to understand their perspectives. Having a better understanding of their experiences can help improve the delivery of remote or distance learning as well as expand the services and programs intended for them.

The present study revealed some noteworthy findings. Data obtained from the focus group discussion showed that the majority of the students were affected by the Covid-19 pandemic. Participants in the present study expressed and identified fear and anxiety because of the pandemic (ex. fear of getting infected, fear of losing their loved ones, and uncertainty of the current situation). Supported by the previous research about the impact of Covid-19 on students' lives, young adults experienced internalizing and externalizing both physical and mental health problems brought by the pandemic (Cao et .al, 2020; Son et .al, 2022; Tee et .al, 2020). Students identified fear and worry about their health and their loved ones. However, it was noteworthy to know that participants in this study also saw some opportunities despite the pandemic. Participants in the present study also highlighted the opportunity of rebuilding the relationship and time for personal reflection. It seems that this group saw the importance of social support and appreciation of oneself. Similar to the study of Alghamdi (2021) on the impact of the Covid-19 pandemic on the social and educational aspects of students in Saudi Arabia, the findings also highlighted that students perceived the Covid-19 pandemic helped them to be connected strongly with their family members.

Despite the considerable documentation of online learning in higher education in general and in engineering courses in particular, students identified both the advantages and disadvantages of remote learning. Participants in the present study agreed that remote learning offers both advantages and disadvantages. However, participants highlighted the disadvantages of online learning. They reiterated the poor internet connectivity in the Philippines, the increased workload, limited interaction with classmates and their professors, the inability to focus, and the excessive screen time. According to Young (1997) the most frequent disadvantage of remote or distance learning is the lack of interaction between instructors and learners and learners themselves. It also causes interaction problems such as being superficial in their communication and having no cooperative tasks among students (de Oliveira et .al, 2018). Likewise, despite the recognized advantages of online learning for higher education, challenges have been reported in online learning in engineering education. As Potkankjak, Gardner, Callaghan, Mattilla & Guetl (2016) argued, there is a unique demand for active and interactive laboratory sessions through hands-on experiences. On the other hand, participants

declared advantages of remote learning such as increased comfort, less stress from commuting, reduced expenses, learning is flexible and can decrease tardiness. Participants associate it with not coming late to class since it is remote learning. As Wheatley and Greer (1995) posited that one of the primary benefits of distance learning is students' arbitrariness of studying according to their schedule.

Furthermore, participants in this study also identified some of the coping strategies they have. Each student has a unique set of resilience and not all are responding to the pandemic in the same way. According to Bono, Reil, & Hescocx (2020), there are resilience factors that become apparent during disasters and traumatic events, one of which is coping strategies. Participants in the present study identified different coping strategies. The categories apparent for this group are physical activity, support system, and personal time. Connecting themselves to their loved ones in these trying times and having quality time with them help ease the uncertainty as there is a feeling of comfort and safety. Personal time on the other hand allows them to connect with themselves while physical activities are vital to keep and maintain a healthy body. As Lazarus (1991, 1999) & Lazarus & Folkman, (1984) theorized coping is the changing thoughts and actions that an individual uses to manage the internal or external demands of a specific person-environment transaction that is appraised as stressful. Coping strategies help an individual to adapt to new and challenging times.

Conclusion and Recommendations

The transition from face-to-face to remote or distance learning took a toll on both educators and students. Although online education has been visible throughout the last decades even for engineering courses, the pandemic has drastically hastened the process. The result of the data obtained from the focus group discussion supports the previous findings on how the Covid-19 pandemic impacted the lives of students in general. It captured the positive and negative effects of the pandemic and students' coping strategies in these trying times. It is noteworthy to know that despite the uncertainty, students were able to see both the advantages and disadvantages of remote learning. Data gathered showed that these engineering students tried to maximize their coping strategies to maintain both their physical and mental wellness. Moreover, results showed that these engineering students are

trying to balance the positive and the negative effects of the pandemic in their lives. Through the coping strategies they employed, participants in this study were able to exercise and regulate their capacities in these trying times.

Hence, it is, therefore, recommended that interventions should be available for students to address their academic, personal, career, and even psychological needs exacerbated by the pandemic. Intensifying counseling services could be one as well as other support services available in the university. The results of the present study should also be interpreted with some limitations that can be addressed in the future research. Therefore, a follow-up research study not only limited to engineering students' may also be conducted.

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