

Evaluation On the Adaptation and Transition of Engineering Education To E-Learning

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Abstract: - During the COVID-19 pandemic, students might experience similar but also additional challenges. Other than regular online education, emergency remote learning during COVID-19 involves learning in suboptimal spaces and isolation, putting a higher load on learners' resource management. Because of not having access to their regular study environment such as the library or other university buildings, students might have trouble to find a quiet study space, which potentially influences their attentional regulation. Generally, the study aims to evaluate the adaptation and transition of engineering education to e-learning. Sharing the findings of this observational study with other educators may help to ensure a more robust continuity of engineering education during the ongoing pandemic. It can also help with overall improvement and, as a result, further promotion of online engineering education in the post-pandemic era, particularly for universities that previously relied on traditional face-to-face instruction.

Key Words: — *E-learning, Online Class, Engineering.*

I. INTRODUCTION

The entrenchment of the COVID-19 pandemic in the daily lives of billions of people around the world has had a profound impact on how activities involving human-to-human interactions that did not require a second thought prior to COVID now require careful pre-planning before they can be carried out. Higher education institutions (HEIs) have been drawn into this new mode of social interaction as well. They have had to quickly adapt to an environment in which traditional face-to-face (F2F) classroom settings are significantly more difficult (Bryson & Andres, 2020).

During the COVID-19 pandemic, e-learning has emerged as a critical option for reforming the entire traditional education system.

Teachers and students alike have had to modify their behaviors, teaching/learning styles, assessment methods, and so on. This reform has resulted in a number of benefits, but it has also resulted in tensions and frustrations among both the beneficiaries of the teaching act and educational actors. E-learning has demonstrated the importance of modeling the behaviors of all parties involved. To streamline the educational process, particularly in the university setting, creative and constructive interventions are required. These would address specific issues and could lead to the long-term viability of education.

Traditionally, engineering education has been content-centered, hands-on, design-oriented, and centered on the development of critical thinking or problem-solving skills. Various pedagogical methodologies, such as active learning, flipped classrooms, and project-based learning, have demonstrated efficacy in improving engineering education. Online education has become a viable component of higher education in engineering subfields such as electrical and computer engineering, computer science, and information technology, particularly at the master's or post-graduate level, over the last decade.

Sloan's online learning consortium has defined the five pillars of high-quality online education as: learning effectiveness,

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student satisfaction, faculty satisfaction, access, scale, and cost. Given these factors, we designed and conducted surveys among engineering faculty members and students at Holy Angel University to systematically investigate the challenges encountered during the abrupt transition from face-to-face to the online mode of instruction.

Given the sudden shift to emergency remote education at the start of the COVID-19 pandemic, combined with external stress factors, such as uncertainty about the situation, distraction at home and reduced social interaction (Son et al., 2020), as well as higher levels of autonomy, resource-management strategies may have played an important role in adapting successfully to emergency remote education. Students probably already adopted effective cognitive and metacognitive strategies because of their experience of independence during higher education, but they had to quickly adapt these strategies to apply them in the new situation (Wood et al., 2005). Effective resource-management strategies have been shown to have a positive link to cognitive, emotional, and motivational aspects of learning. In relation to cognitive factors, resource-management strategies, specifically effort regulation, time management, and attentional regulation (concentration and dealing with distraction), were positively associated with academic performance in both face-to-face (Richardson et al., 2012) and online learning environments (Broadbent and Poon, 2015; Broadbent, 2017). With regard to emotional factors, facets of resource-management strategies, such as the organization of academic study time and motivation to invest effort in studying, are negatively affected by negative emotions (Mega et al., 2014). Furthermore, resource-management strategies, such as effort regulation and time management as well as intrinsic motivation, have been found to be positively associated with academic adjustment (van Rooij et al., 2018), which might be an indicator of their importance in adapting to emergency remote learning.

II. METHODS AND PROCEDURES

2.1 Research Design

The researchers used a quantitative design to acquire information regarding the evaluation on the adaptation and transition of engineering education to e-learning. In general, quantitative design is founded on scientific principles. Thus, the researchers used deductive reasoning, in which the researcher developed the study's objective, collected data to solve the

problem, and then analyzed the data. The researchers then came to conclusions to complete the study.

The Descriptive Method type of quantitative design was used by the researchers. The data were collected in the first quarter of 2022. The research project was designed to minimize potential common method bias caused by collecting data from a single source. Specifically, responses were collected from engineering students and instructors from Holy Angel University.

The data were collected electronically by sending Google forms to the respondents, which included the survey instructions as well as the necessary information for the researchers. To access the form, the respondents used their own user names and passwords that were only known to them. This was used by the researchers to ensure the confidentiality of the survey collection process. Furthermore, it was previously stated to the respondents that their individual responses would be kept confidential and used solely for research purposes.

2.2 Locale Of the Study

The study was conducted at Holy Angel University (HAU) located at Angeles City, Pampanga.

The respondents were given google forms or electronic questionnaires which they can complete in their houses or any comfortable place that the respondent will choose to. The researchers chose the place of implementation because it will give the researchers the needed information for the study since Holy Angel University has been implementing E-learning for two years.

2.3 Samples And Sampling Procedure

The researchers used non-probability sampling to generalize the sample's findings to the general population. Non-probability sampling was chosen by the researchers because it is a sampling procedure that involves the non-random selection of a sample within respondents. This type of research will also provide the researchers with an initial understanding of a small population that is the researchers' target.

The researchers will use convenience sampling in particular. Individuals who are more accessible are included in the convenience sample. In this regard, the samples were gathered from available respondents.

2.4 Respondents Of the Study

The researchers considered the students enrolled in Engineering at Holy Angel University as well as their instructors. The respondents were chosen because they have been experiencing E- learning for quite some time. Moreover, the students and instructors are part of different Engineering courses thus more possibilities may occur. In addition to this, the students and instructors are also from different places thus showing different types of perspective with regards to the topic.

2.5 Research Instrument

An electronic type questionnaire was used in gathering the data. The questionnaire is a Likert scale question type of survey. The questionnaires were given via google forms which the respondents can access using their own emails. The questionnaire has three parts. The first part is all about the information from instructors. The second part consisted items that determined experiences of the students with E learning set up. The last part consisted of questions for both the faculty and students regarding the overall evaluation on the adaptation and transition of engineering education to e-learning.

2.6 Data Gathering Procedure

The questionnaires were personally sent to the respondents by the researchers. The questionnaire is given to students in exchange for their permission to collect a sample from them. The researchers conferred and discussed the significance of the study as well as the instructions for the questionnaire introduction.

To prevent respondents from rushing to answer the questions, they were given until the end of the day to complete the forms. After each completed questionnaire, the researchers automatically collected data using Google Forms.

After completing the questionnaire, the results were tallied and tabulated. These data served as the foundation for the researchers' analysis and interpretation.

2.7 Data Analysis

The researchers analyzed the data collected from the respondents to obtain usable and useful information. All of the questionnaires were organized and separated for input into Excel by the researchers. To obtain accurate and complete data, the researchers used Microsoft Excel.

For ease of comprehension, the researchers displayed the results in the form of a table, pie chart and bar graph.

The researchers also used a Likert scale to assess the impact of organizational culture on role emergence and enactment. The Likert scale employed a five-point scale, with each point corresponding to a Likert item.

Point	Scale	Verbal Interpretation
5	4.2 – 5	Strongly Agree
4	3.4 – 4.19	Agree
3	2.6 – 3.9	Neither Agree nor Disagree
2	1.8 – 2.59	Disagree
1	1.0 – 1.79	Strongly Disagree

Formula:

$$\bar{x} = \frac{\sum WX}{N}$$

Where:

W = points

X = number of respondents per weight

N = total number of respondents

III. RESULTS AND DISCUSSION

The purpose of the study was to evaluate the effectiveness of the adaptation and transition of engineering education to e-learning

The related research questions were:

- What are the difficulties and advantages of e – learning?
- Is e-learning effective to engineering students?
- Is e-learning more beneficial to instructors?
- Can e-learning be a substitute for face-to-face learning?

Key findings on the first part of the questionnaire (Faculty Survey):

Fig. 1. Showing survey results on the challenges (e.g., lack of access or difficulty in operations) in transitioning to online instruction.

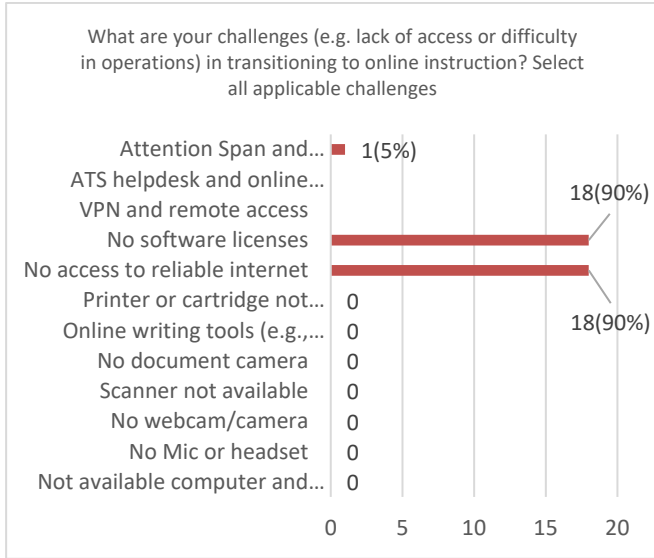


Fig. 1

Figure 1 shows that 90% of instructors had problem with their internet connection and software license. Having an issue with internet connection plays a big impact on e-learning. Slow internet connection can cause disruptions in teaching especially on a synchronous set-up.

Fig. 2. Showing survey results on all possible topics that can enhance the instructor's skills to teach in e learning (by either attending a workshop or watching a webcast).

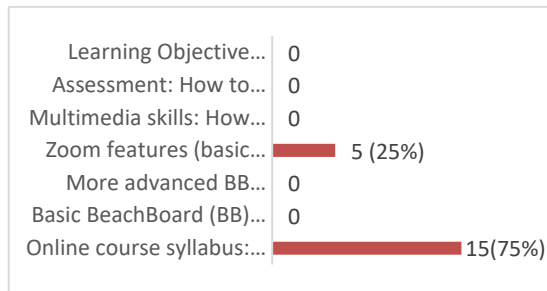


FIG. 2

Figure 2 shows that 75% of instructors chose to have an online course syllabus and 25% chose to have a workshop/ seminar on zoom features. This result shows that the instructors are still adjusting on e-learning as majority of them chose to have workshop on online course syllabus and zoom features.

Fig. 3. Showing survey result on how the instructors perceive the extent of cheating/plagiarism during the e learning.

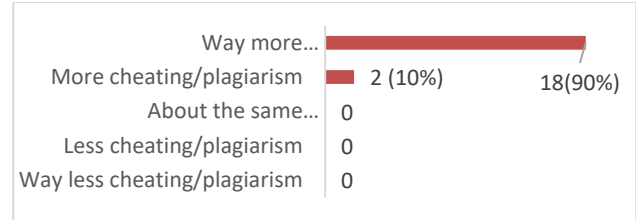


FIG. 3

Figure 3 shows that 90% of the instructors find that there are way more cheating/plagiarism during e-learning and 10% answered that there are more cheating/plagiarism. This result shows that the students can cheat easier on e-learning than face to face set-up.

Showing survey results with the following questions:

Do you think e-learning is better than face to face?



FIG. 4

Do you recommend e-learning as a platform of education even after the pandemic?

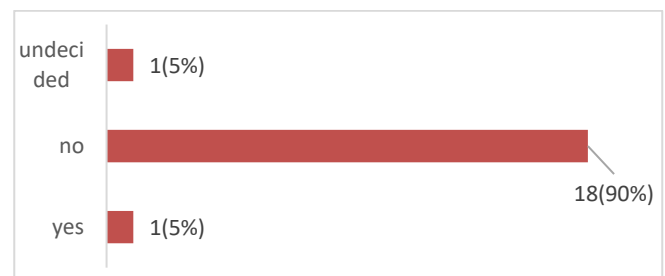


FIG. 5

Figure 4 and 5 shows 95% and 90% respectively not in favor of e-learning. These results indicate that e-learning is not yet fully supported as a permanent alternative for education by the instructors.

According to Jaffer et al. (2007), it is difficult for learners to understand theory-driven courses due to limited experience and practical knowledge. Real-world experiences helped bring theory into practice to address some challenges. Future

challenges remain in identifying and conceptualizing ways that educational technologies can contribute to learning experiences, curriculum and pedagogical designs.

Key findings on the second part of the questionnaire (Student Survey):

Fig. 6. Showing the survey result for the question:

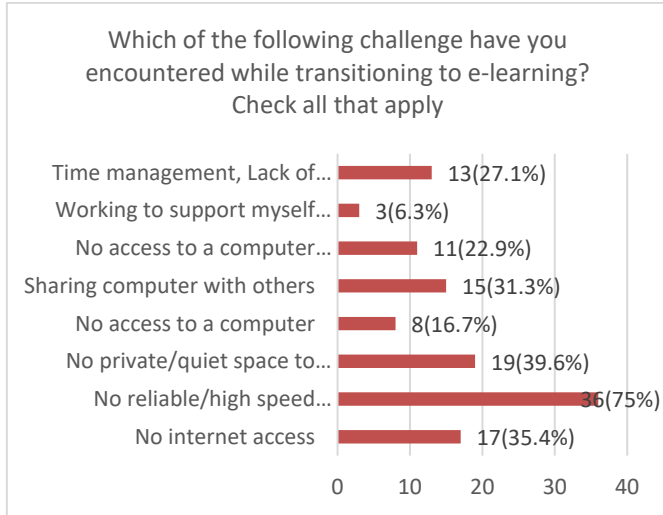


FIG. 6

Figure 6 shows that the majority of the students (75%) had problems with their internet speed followed by the private/quiet space to study with at 39.6% and having no internet connection at all at 35.4%. These results show that not all students can qualify with the e-learning set-up.

Fig.7. Showing the survey result for the question:

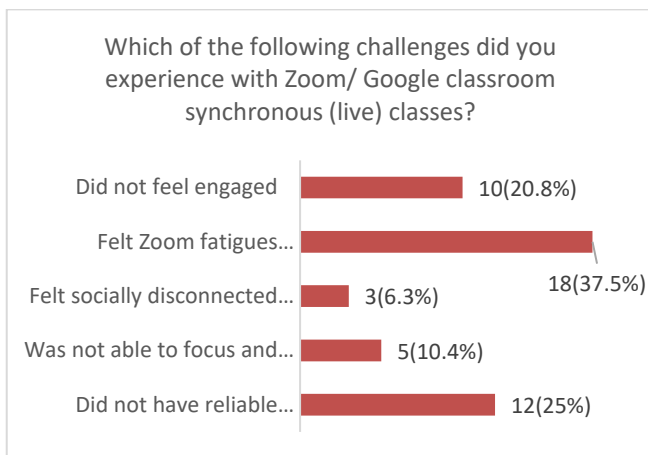


FIG. 7

Figure 7 shows that 37.5% of the students felt zoom fatigues, 25 % did not have reliable internet connection and 20.8% did not feel engaged. Not being on the same room while studying may be harder to students as they need to work harder to process non-verbal cues. Paying more attention with multiple online classes will consume more energy. Not having a reliable internet connection can also cause the students problems as e-learning cannot work without the internet.

Furthermore, given the sudden shift to online education, students may not have had access to all technical resources (e.g., stable internet connection) or support from teaching staff and peers. Given the uniqueness of the situation, it is important to build an understanding on whether and how students were able to adapt their resource-management strategies when confronted with emergency remote learning.

Fig. 8. Showing survey results for the question:

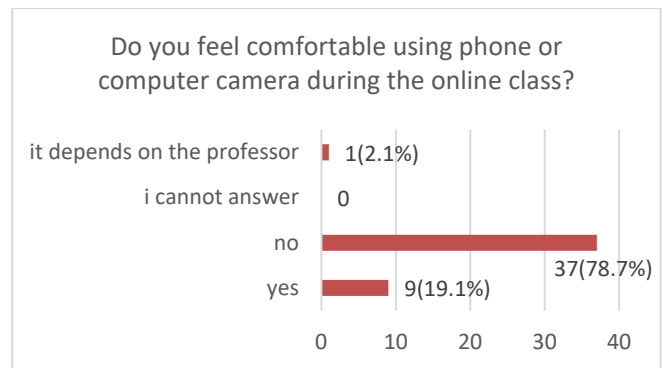


FIG. 8

Figure 8 shows that 78.7% of the students don't feel comfortable showing their faces on a cellphone/computer camera. According to The Conversation students may have an increase in anxiety and stress, "Online, students are often expected by their teachers to look at the screen for the entire class and stay focused on the video feeds of their classmates. This can result in feelings of prolonged eye contact, which can feel threatening and uncomfortable.

Feeling as though everyone is watching can be distracting as students focus on how they may appear to others. This discomfort is enhanced by the fact that the faces on the screen are often large and appear very close. This can trigger the body's "flight or fight" response, leaving students feeling on edge and impairing their concentration.

Fig. 9. Showing survey results for the question:

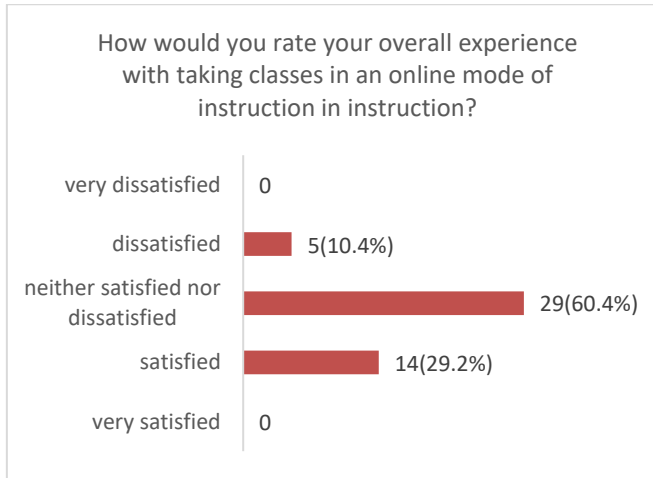


FIG. 9

Figure 9 shows that 60.4% of the students are neither satisfied nor dissatisfied, 29.2% are satisfied and 10.4 % are dissatisfied.

Fig. 10. Showing survey results for the question:

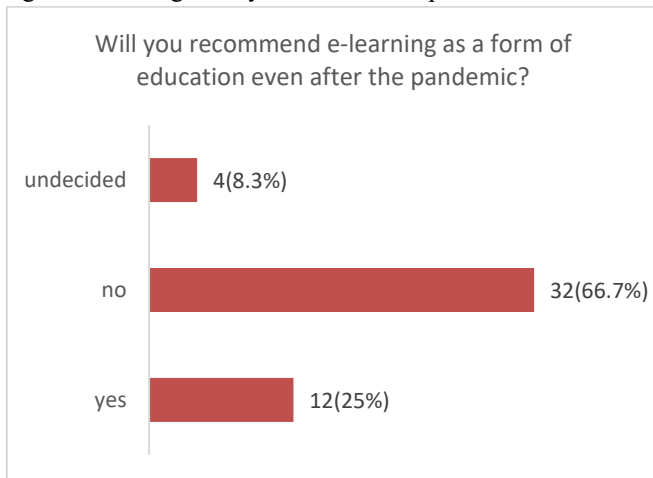


FIG. 10

Figure 10 shows that 66.7% of the students are not in favor of e-learning even after pandemic, 25% are in favor and 8.3% are undecided. This result shows that majority of students still prefer the traditional face to face platform of education.

Table 1. Key findings on the third part of the questionnaire (Likert Scale)

Descriptive Statistics					
	N	Minimum	Maximum	Mean	SD
ITEM 1	65	2	5	3.6615	2.706118
ITEM 2	66	1	5	3.5303	2.987347
ITEM 3	66	2	5	3.4697	2.97464
ITEM 4	67	1	5	3.4925	2.878121
ITEM 5	65	2	5	3.9077	2.0226
ITEM 6	67	2	5	3.5075	2.844214
ITEM 7	66	2	5	3.5455	3.035148
ITEM 8	67	2	4	2.6567	2.259309
ITEM 9	65	2	5	3.5077	3.017895
ITEM 10	67	2	5	3.5672	3.046897

Table 1

Descriptive statistics was used for the survey data, accumulated per group, and clustered into organizational categories per factor. All the gathered survey data were used and non-had been disregarded.

Table.2. Showing the survey results with the following questions concludes a mean of 3.9077 which falls on the scale of 3.4 – 4.19 that interprets the Respondents Agreement.

	N	Min.	Max.	Mean	SD
Manage time effectively	65	2	5	3.9077	2.0226

Table 2

Table 2 shows the advantage of e-learning wherein it shows that e-learning can be beneficial to both the students and instructors as they can have a flexible time and good time management.

Table.3. Showing the survey results with the following questions concludes a mean of 2.65677 which falls on the lower end scale of 2.6 – 3.9 that interprets the Respondents neither agree nor disagree.

	N	Min.	Max.	Mean	SD
Focus on school work when faced with distractions	67	2	4	2.6567	2.2593

Table 3

Table 3 shows that having no access for a quiet or private place when studying can cause the students and instructors some distractions.

Compared to regular online education, the change to emergency remote learning during COVID-19 was not voluntary, which may have had a negative influence on students' study motivation (Hsu et al., 2019).

The researchers were guided by two major questions: the effectiveness of e-learning on engineering education; the challenges that were encountered by both the students and instructors on e-learning platform. The results of this study showed three major findings. First the main problem of e-learning is the absence of reliable and fast internet connection. Second the high perception of instructors with regards to the cheating/plagiarism of students. Lastly, reported unfavorably on e-learning by the respondents.

IV. CONCLUSION

This research is composed of four specific questions. These questions are as follows; (1) What are the difficulties and advantages of e – learning? (2) Is e-learning effective to engineering students? (3) Is e-learning more beneficial to instructors? (4) Can e-learning be a substitute for face-to-face learning? This part of the research includes conclusions to the said specific questions.

In the first specific question which is; What are the difficulties and advantages of e – learning? mostly, respondents answered their difficulty with the internet connection and the licenses of the software. In the study of Statista website in November 2021, the average download speed of a fixed internet connection in the Philippines was 46.44 Mbps in November 2021. On the other hand, the average mobile internet connection speed was 18.68 Mbps. But the always hindrance and main problem with e-learning is poor internet connection.

Then, the second question is; Is e-learning effective to engineering students? From the data gathered by the researchers, 95% are disagreed that e-learning better than face to face classes. Additionally, 90% of them do not recommend e-learning even after the pandemic. This only showed the value of having classes and engaging with school works via face-to-face manner. In the statement of Benjamin Franklin, “tell me and I forget, teach me and I remember and involve me and I learn. This would mean the value of personal participation of the students. At the Western Cape Universities, Mlithwa (2006) noted the eLearning potential to unfold as a true socio-technical network was not fully realized and the technical aspect was not

engaged at a socio-technical agency basis. The technology and organizational transformations relationship is minimal. The frequency of media use in Science, Engineering and Health disciplines was higher (Brown et al., 2008).

For instance, “Is e-learning more beneficial to instructors?”; is the third specific question. E-learning can be beneficial to both the students and instructors as they can have a flexible time and good time management as what the study concluded. But the access to a quiet and conducive place is the most common problem of the instructors. Specifically, during this election period, campaign jingles with a high volume can cause distractions to online classes.

Lastly, can e-learning be a substitute for face-to-face learning is the last specific question. 60.4% of the both instructors and teachers are neither satisfied nor dissatisfied. It is just understandable because these online classes are just given focused because of the pandemic that the world is experiencing. A certain program can surely be attested for more than 3 years after its implementation. This would be the best way to test the effectiveness of the program.

Therefore, in the research title Evaluation on The Adaptation and Transition of Engineering Education To e-Learning, generally speaking, both instructors and students found difficulties and advantages. But majority of them do not think that e-learning is better with face-to-face classes. They will always prefer to have face to face classes because the respondents believe that is more effective and efficient.

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