An Evaluation on The Service Delivery Capacity of Engineering Educators from Selected Universities in the National Capital Region, During the COVID-19 Pandemic

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Abstract

The impact of the COVID-19 pandemic has undeniably affected the higher education sector, pushing higher education institutions to adapt to an abrupt online learning format. Engineering programs are some of those struggling to mitigate the pandemic's negative effects on the quality of education. This study evaluated the service delivery capacity of Engineering educators from selected universities in the National Capital Region, Philippines by measuring three main independent variables; namely, ICT Tools and Platforms, Training, and Perception. The study also identified Learning Management Systems and virtual laboratory software being used by respondents, and their take on the advantages and disadvantages of virtual laboratories in online Engineering education. Results of this study showed that the Training Program is the most significant independent variable in the overall service delivery capacity of Engineering Educators. Institutions have acknowledged the challenges that their faculty members are facing with regards to online teaching and have provided sufficient and appropriate training programs to equip them in the shift to online teaching. Thus, the service delivery capacity of the Engineering Educators was enhanced during the online setup.

Keywords
Service Delivery Capacity, Engineering Educators, Engineering, COVID-19 and National Capital Region.

1. Introduction

The COVID-19 pandemic has affected all areas of life, including education. As the situation worsened, the global lockdown culminated in the closure of educational institutions. The closing of schools, colleges, and universities resulted in a stressful event for educational administrations with highly limited options. With the small-time frame available to adapt to remote learning, the lockdown, and lack of inclusion in higher education, the education sector was heavily impacted, and it continues to struggle today, especially in the Philippines.

The closure of educational institutions due to the global pandemic has resulted in 1.2 billion learners worldwide with more than 28 million learners in the Philippines relying on an online mode of learning or distance education (Tria 2020). Higher Education Institutions shifted to modified forms of learning and teaching in compliance with the government's stance in resuming and continuing education despite the effect of the pandemic on the country's education system (Joaquin et al. 2020). With this, some educators managed well, while others struggled, especially those who are not used to the technology (Daumiller et al. 2021). In addition, different elements such as teaching materials, the tools used to create them, and the mechanisms used to interact with students were modified in an online teaching environment (Garcia-Alberti et al. 2021). This is due to the fact that an online teaching environment is a bigger hurdle for courses that require hands-on experience, machines, complex mathematical equations, and practical skills. In addition, although professors and students may adapt easily to technology in the 21st century, distance education still proves to be a major challenge, especially for Engineering courses. The necessary application of courses in laboratories has been a factor in the difficulty of Engineering education in an online environment (Banday 2014). In short, online learning is not a one size fits all (Ong et al. 2021).

Furthermore, Information and Communication Technology (ICT) Tools and Platforms have allowed educators to remain in touch with their students amidst the COVID-19 pandemic. It was suggested to use online platforms such as Blackboard Classroom, Google Meet, Zoom, and many other technological tools to help learners to continue with their studies. However, Arinto (2016) also emphasized that the problem with online teaching is that the online world is too broad. It has a lot of options, opportunities, and ways of doing things and this causes confusion to faculty members. This results in faculty members experimenting, grappling with different techniques, and improvising their teaching methods. Thus, Arinto (2016) stated that the training programs or workshops for online teaching should be provided to Educators that include opportunities and appropriate technical support for an individual to experiment as well as share experiences with the use of various tools and resources. Universities, now more than ever, should invest in the teaching professional development of their faculty (Rapanta et al. 2020). This raises the questions: How effective are the designs of training programs by the different institutions? In what ways can we improve these programs?

With this, the study aims to evaluate the overall service delivery capacity of Engineering Educators in selected universities in the National Capital Region measured using three independent variables or dimensions; namely, ICT Tools and Platforms, Training Programs, and Perception. With the data gathered and the provided related literature, the researchers examined the significance of each independent variable to the service delivery capacity of Engineering educators by providing data measures or subdimensions under each independent variable. In addition, the researchers identified Learning Management Systems and virtual laboratory software being used by respondents, and their take on the advantages and disadvantages of virtual laboratories in online Engineering education. Finally, the study utilized Multiple Linear Regression using Statistical Package for the Social Sciences (SPSS) in order to identify how the independent variables and their subdimensions affect the service delivery capacity of the respondents.

Overall, the primary objective of this study is to evaluate the service delivery capacity of Engineering educators in the National Capital Region during the pandemic to provide institutions and Engineering educators insight about the challenges Engineering educators are currently facing today, and show areas they could improve to enhance service delivery capacity for remote learning, especially since the end of the pandemic is still unforeseen.

2. Literature Review

It is apparent that the switch to remote learning brought numerous challenges and drawbacks, requiring teachers and students to adapt to a variety of digital tools and platforms. This is due to the urgent and unexpected request for traditional face-to-face courses to be taught online (Rapanta et al. 2020). With this, Higher Education Institutions are doing their best to find the most convenient platforms and tools that would help students receive a maximum learning experience, and aid faculty members with their difficulties in an online environment. According to Dhawan (2020), with the help of online teaching modes, we can sermonize large students at any time and in any part of the world. However, there are problems and challenges associated with the sudden shift to online teaching (Ong et al. 2021).

A study by Kostopoulos et al. (2015) has defined service delivery in a services management context, as the infrastructure (job design, skills, etc.), structure (facilities, equipment, etc.), and the process of delivering a specific service in order to produce a specific desired effect. Similarly, a study by Westhuizen (2014) defined "service delivery" as a measure of how well the service level of a respective industry has been achieved or how well it matches customers' expectations. Thus, service delivery could be determined by customer's assessments, and service delivery in the academic context would measure the customer's satisfaction with the service of higher education institutions.

Despite the several ICT tools and platforms that could aid teaching in an online setting, the mere presence of computer technology hardware does not necessarily lead to student progress. The shift to an online environment highlights the value of digital literacy skills or technological proficiency during these times (Daumiller et al. 2021). Engineering education is founded on science and mathematics. Traditionally, Engineering education has been content-centered, hands-on, design-oriented, and centered on the development of critical thinking or problem solving-skills (Asgari et al. 2020). Laboratories and machines play an important role in applying and demonstrating principles and theories in Engineering education (Kandamby 2019). The necessary application of courses in laboratories has been a factor in the difficulty of Engineering education in an online environment (Banday et al. 2014). Operating laboratory courses in distance learning denies the students of valuable hands-on exposure to equipment and facilities necessary for a maximum learning experience. Therefore Gamage et al. (2020) suggest that universities and colleges must review how they deliver laboratory-based practical experiments before the pandemic, and how they are currently introducing students to laboratory-based experiments through online delivery in the COVID-19 period. In this way, universities and colleges could redesign the approach that will be taken in the post-COVID-19 period with alignment to the expected learning outcomes.

Furthermore, two primary challenges that were summarized in online learning during the pandemic were identified by García-Alberti et al. (2020). The challenges were the digital divide and the lack of inclusion in higher education, which heavily relates to a developing country like the Philippines. Obstacles brought by this shift include logistical challenges such as lack of access to hardware, software, and necessary tools for online instruction. In a study by Asgari et al. (2020), faculty members tried to proctor exams using on-cam and on-mic methods, however, the student survey indicated that the use of cameras and microphones may raise equity concerns for those who do not have access to cameras and cannot afford it, and privacy concerns for monitoring students' private space. Professors also raised the problem of internet connectivity and instability in a study by Chua et al. (2020) and Mishra et al. (2020).

In comparison, a study by Altbach and De Wit (2020) stated that for higher education institutions around the world to be competitive again, evidence of faculty preparedness in terms of professionalism is necessary. Universities should invest in teachers' professional development of their faculty; for them to be updated on effective pedagogical methods with or without the use of online technologies. It was suggested by Asgari et al. (2020) that training workshops for faculty members should be organized and provided by their respective institutions in order for their faculty members to further familiarize themselves with the use of necessary online technology and tools. Similarly, Chua et al. (2020) found that faculty members in their study requested an orientation or training in using the E-Learning classrooms because even if the professors could adapt to the new E-Learning environment, lack of training was a major drawback for them. Evidently, in a study by Leslie (2019), a framework for an online teaching professional development course for faculty in higher education that has gone through one pilot with faculty has impacted students and faculty positively. After faculty applied the Trifecta of Student Engagement framework to courses taught, faculty saw an improvement in student engagement, satisfaction, learning, and achievement.

Finally, Daumiller et al. (2021) stated that in principle, online teaching has the capacity to become as effective as face-to-face teaching. However, multiple requisites need to be ensured. Aside from technological and contextual factors, personal, especially motivational factors of faculty also play an important role, particularly their goals and attitudes towards this sudden change. They found these constructs to be intertwined with their burnout or engagement in the face of the pandemic, as well as their students' evaluations of teaching quality in terms of learning. Similarly, a study by Arinto (2016) stated that given the right motivations, attitudes, and support towards this sudden change, faculty may better handle such transitions and be equipped to acknowledge and perceive unexpected challenges such as the COVID-19 pandemic as opportunities instead of vexations. In parallel with this, a study by Scherer et al. (2021) also stated that perceived support and self-efficacy may not necessarily go hand in hand—specifically, good institutional support may not compensate for little confidence in teaching online. Both aspects may have to be addressed in order to support educators in the online setting. Thus, Moralista and Oducado (2020) recommended that the faculty members should continuously be supported by their respective institutions in their road to fully understanding and expanding the opportunities in an online environment.

In summary, using various methods and tools can make online teaching effective according to the aforementioned studies, but online teaching is not always successful because different factors such as intensive training, sufficient ICT tools, and devices, and personal perception and experiences of educators must be put into consideration. Other significant challenges identified were the digital divide and the lack of inclusion in higher education, which heavily relates to a developing country like the Philippines.

Over time, E-learning platforms and the treatment plan for virtual learning are constantly evolving. The effects of the pandemic on the educational system create fear and worry especially in practical or hands-on courses like Engineering, resulting in the challenge of maximizing the quality of Engineering learning in an online environment. As the Philippines continues to fight the COVID-19 pandemic, universities continue to adapt and modify the educational system, and Engineering professors continue to utilize as much technology available or needed with a common goal: to continue providing quality education and mold top-notch engineers in the field.

3. Methods

3.1 Framework

In the first phase of the study, the independent variables or dimensions, ICT Tools and Platforms, Training Programs, and Perception were analyzed to measure the Overall Service Delivery Capacity of Engineering Educators. Together with this, sub-dimensions were also analyzed and clustered under respective dimensions to serve as data measures for the independent variables of the study.

Before the data analysis, the reliability of the survey instrument was measured using Cronbach's Alpha through the software, SPSS. Results showed a Cronbach's Alpha value of 0.789 for questions ICT Tools and Platforms; 0.817 for questions under Training Program; and 0.836 for questions under Perception after removing two questions from the data. Multiple Linear Regression was then utilized in SPSS to assess the strength of the relationship between the independent variables and service delivery capacity, and between sub-dimensions and their respective independent variables. The second section of the survey questionnaire, on the other hand, contained open-ended and multiple-choice questions for the researchers to identify the platforms that Engineering Educators used in their lectures and laboratories in their respective institutions, and for the respondents to provide in-depth insights into the advantages and disadvantages of virtual laboratories, specifically in the Engineering field. Shown in Figure 1 is the conceptual framework of the study.

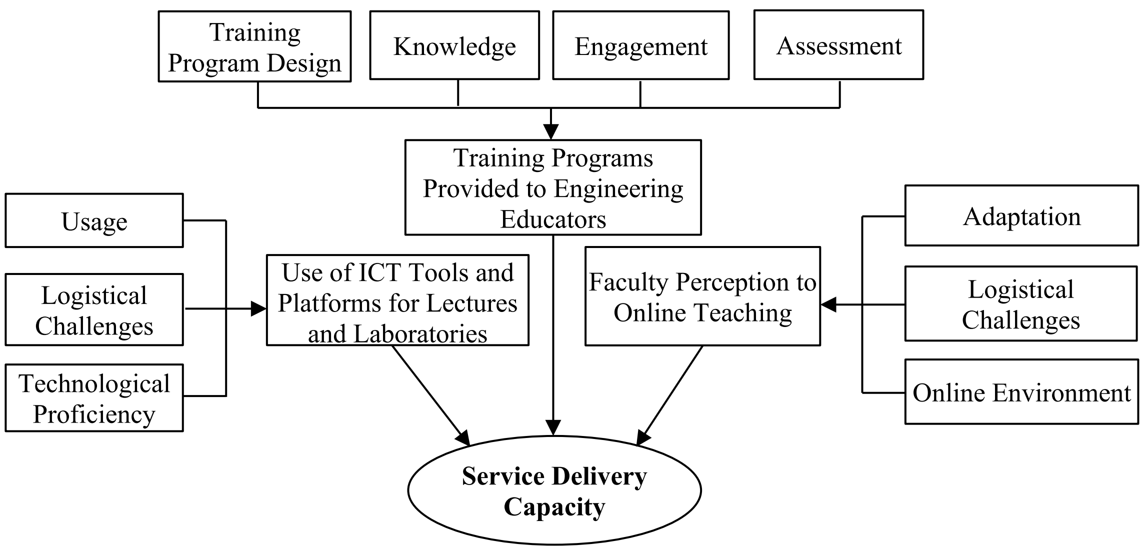

Figure 1. Conceptual Framework of the Evaluation on the Service Delivery Capacity of Engineering Educators

3.2 Dimensions and Subdimensions

Table 1. Definitions of Dimensions and Subdimensions

Information and Communications Technology (ICT) Tools and Platforms	Training Programs	Perception
Digital infrastructures such as laptops, software programs, social media, webcams, digital libraries and eBooks, the internet, etc. that assist educators in remote learning.	Online programs, seminars, and/or courses offered to educators by their respective universities with regards to the shift to online education.	Personal experiences and/or perspective of educators with remote teaching.
Subdimensions		

a.) **Usage:** The number of times Engineering educators use ICT tools and platforms. b.) **Logistical Challenges:** The challenges Engineering educators experience in terms of resources (e.g., lack of gadgets, slow internet connection.) c.) **Technological Proficiency:** The challenges Engineering educators experience in terms of technological proficiency; level of mastery in using technology.	a.) **Training Program Design:** The effectiveness of the training program design in guiding the educators. b.) **Knowledge:** The knowledge the educators have with regards to the basic and advanced skills needed in remote learning c.) **Engagement:** How active the educators were in participating in the programs offered by their respective universities d.) **Assessment:** The overall rating of the educators with regards to the training program.	a.) **Adaptation:** How the educators adapted/are adapting to the shift to remote teaching in an online environment. b.) **Motivation:** The general desire or drive of educators to accomplish tasks. c.) **Online Environment:** The challenges and/or sentiments of educators with regards to teaching in an online environment

As shown in Table 1, Information and Communications Technology (ICT) Tools and Platforms were defined. ICT Tools and Platforms for Engineering had two main uses: for lectures and laboratories. For lectures, various Learning Management Systems (LMS) were used for Engineering Educators to conduct their classes virtually, post their lectures and assignments, and track their students' progress. To analyze the dimension ICT Tools and Platforms, three subdimensions were measured, namely: Usage, Logistical Challenges, and Technological Proficiency. These three subdimensions provided findings regarding whether Engineering Educators maximized the use of different ICT Tools and Platforms before and during the COVID-19 pandemic, if Engineering Educators had the resources to conduct online teaching effectively, and if Engineering Educators had sufficient skills and knowledge in using different ICT Tools and Platforms necessary for online teaching.

Under the dimension Training Programs, the subdimensions that were measured were Training Program Design, Knowledge, Engagement, and Assessment. Training Program Design was taken into consideration since Engineering Programs do not solely focus on lecture components, rather, they focus more on laboratory components wherein the application of theoretical knowledge from lecture components is necessary. Thus, the design of the training programs should be aligned with the program demands where Engineering Educators should be capable of delivering the course objectives and outcomes. The Knowledge of Engineering Educators with regards to the necessary skills needed in online teaching was measured as well to see whether they have improved with the aid of training programs. Moreover, the Engagement of Engineering Educators in training programs provided by their respective institutions was taken into consideration to see if their participation helped improve their service delivery capacity.

Finally, as for the dimension Perception, the subdimensions that were measured were Adaptation, Motivation, and Online Environment. The three subdimensions were some of the factors that affected the acceptance of Engineering Educators in shifting to online teaching during the COVID-19 pandemic. The abrupt shift to distance education has resulted in Engineering Educators being obligated to adapt to the demands of online teaching. Despite distance education providing advantages, it still imposes issues and challenges to educators such as academic dishonesty and emotional support among students.

4. Data Collection

To evaluate the service delivery capacity of Engineering Educators, the researchers performed an online survey through Google Forms. The first section of the survey contained 4-Point Likert Scale questions under each sub-dimension. The Likert Scale degrees that were used were degree of agreement, degree of satisfaction, and degree of frequency. Each of the sub-dimensions were identified from related literature to measure one of the three independent variables, namely, ICT Tools and Platforms, Training Programs, and Perception. The second section of the survey contained multiple-choice questions regarding what laboratory software and Learning Management System/s the respondents use and, and open-ended questions regarding the advantages and disadvantages of virtual laboratories during the health crisis.

The study focused on Engineering educators from private universities in National Capital, Philippines who are working from home and are employed full-time or part-time and are currently teaching Engineering courses fully online. This study was conducted in private universities in the National Capital Region, Philippines that offer Engineering courses. The dissemination of the survey was through email to Engineering educators from other universities and through online social platforms. The researchers gathered a total of 56 respondents. This study did not require experimentation.

5. Results and Discussion

5.1 Service Delivery Capacity and ICT Tools & Platforms

Table 2. Service Delivery Capacity and ICT Tools and Platforms

	Unstandardized B	**Coefficients** Std. Error	**Standardized Coefficients** Beta	**t**	**Sig.**
Usage	.059	.154	.050	.382	.704
Logistical Challenges	.013	.154	.013	.087	.931
Technological Proficiency	- .495	.166	- .446	-2.989	.004

As shown in Table 2, among the sub-dimensions under the independent variable, ICT Tools and Platforms, the technological proficiency of Engineering Educators with the use of different ICT tools and platforms for online teaching is the most and is highly significant with a relatively low p-value (sig.) of 0.004. In addition, it has a negative coefficient of -0.495, which suggests that the Engineering Educators who took part in this study are well-equipped with the technical knowledge and skills needed for online teaching, following its definition shown in Table 1. They also did not have challenges with the use of their respective Learning Management System for online teaching. Lastly, they are equipped with knowledge in using platforms for disseminating instructions and responding to queries of their students through social media and emails. With the sufficient knowledge and skills, they have, Engineering Educators could easily encourage participation and utilize different features for online classes.

Table 3. Usage of ICT Tools and Platforms Before and During the Pandemic

	Before COVID-19 Pandemic	**During COVID-19 Pandemic**
Mean	2.8393	3.6429

In addition, the Usage of different platforms for online teaching was taken into consideration. The detailed definition of usage which was used in assessing this section is shown in Table 1. Shown in Table 3 is the comparison of the respondents' usage of ICT tools and platforms before and during the pandemic. The mean usage of ICT tools and platforms before and during the pandemic is close, which means that even before the shift to online teaching, different ICT tools and platforms were already being used by the Engineering Educators. This has enabled Engineering Educators to be equipped with sufficient experiences and knowledge in using different tools for online teaching. This claim may be supported by the local study by Chua et al. (2020), where it was found that the universities who have fully utilized the approaches with the use of different tools and platforms online several years ago would benefit from the online teaching situation.

5.2 Service Delivery Capacity and Training Programs

Table 4. Service Delivery Capacity and Training Programs

	Unstandardized B	**Coefficients** Std. Error	**Standardized Coefficients** Beta	**t**	**Sig.**
Training Program Design	.263	.203	.224	1.296	.201
Knowledge	.353	.200	.222	1.763	.084
Engagement	.179	.182	.149	.983	.330
Assessment	.135	.188	.130	.72	.475

As shown in Table 4, among the sub-dimensions under the independent variable, Training Programs, the knowledge with regards to the basic and advanced skills needed in remote learning is the most and is only slightly significant with a p-value (sig.) of 0.084. In addition, it has a positive coefficient of 0.353, which suggests that the Engineering Educators believe that they are fully equipped with the basic and advanced skills in using cloud-based communication applications such as Zoom, Google Meet, Microsoft Teams, etc. They are also equipped with skills in using different multimedia platforms such as using and creating lectures using Microsoft Office applications. Finally, they believe that the learning materials provided in the training program (videos, presentations, articles, etc.) were useful and informative. To improve the training programs, institutions may look further into its design to achieve an effective and efficient learning environment for the Engineering Educators. This may help enhance their knowledge in better ways to approach online learning and become more equipped with basic and advanced skills needed in online learning. Factors such as time, environment, and technological facilities and capabilities should be considered by institutions to improve the training programs.

In parallel with this is a study by Leslie (2019) found that in their professional development course for faculty, prior taking the course, the faculty indicated that they were unfamiliar with technological tools. After taking the course, survey results indicated that every faculty member had the opportunity to learn some new teaching tools that they were unfamiliar with.

5.3 Service Delivery Capacity and Perception

Table 5. Service Delivery Capacity and Perception of Respondents

	Unstandardized B	**Coefficients** Std. Error	**Standardized Coefficients** Beta	**t**	**Sig.**
Adaptation	-.663	.153	-.711	-4.319	.000
Motivation	.222	.124	.308	1.791	.079
Online Environment	-.060	.107	-.077	-.563	.576

As shown in Table 5, among the sub-dimensions of the independent variable, Perception, the adaptation of Engineering Educators towards online teaching is the most and is highly significant with a relatively low p-value (sig.) of 0.000. In addition, it has a negative coefficient of -0.663, which suggests that the Engineering educators did not have a hard time establishing communication with their students and beating the deadlines and requirements set by their school administrators. They also did not have difficulties with time management in conducting classes, monitoring responses and student progress, and other online class issues. As discussed in Table 1, the definition of adaptation is how Engineering Educators have adapted to the shift to remote learning in an online environment, and results revealed that Engineering Educators have adapted positively to remote learning in an online environment. In almost two years of school closure, Engineering educators have adapted and are still continuously adapting to online teaching. Hence, the service delivery capacity of the Engineering educators were enhanced. In parallel with this, Mardiana (2020) stated that educators' adaptability to online teaching is strong given that they have enough teaching experience, training, and knowledge in the use of technologies and social media.

Table 5 also shows that the sub-dimension, motivation, which was defined in Table 1 as the general desire or drive of Engineering Educators to accomplish tasks, is only slightly significant compared to adaptation with a p-value (sig.) of 0.079. In addition, it has a positive coefficient of 0.222, which suggests that the Engineering Educators are somehow having challenges motivating themselves with the sudden shift from face-to-face to online class and are somehow having a hard time managing the stress caused by community quarantine at home and in between online classes demands. This is in parallel with the study of Daumiller et al. (2021) which stated that in principle, online teaching has the capacity to become as effective as face-to-face teaching. However, multiple requisites need to be ensured. Their findings highlight that aside from technological and contextual factors, personal, especially motivational factors of faculty also play an important role, particularly their goals and attitudes towards this sudden change. Similarly, a study by Arinto (2016) stated that given the right motivations, attitudes, and support towards this sudden change, faculty may better handle such transitions and be equipped to acknowledge and perceive unexpected challenges such as the COVID-19 pandemic as opportunities instead of vexations.

5.4 Service Delivery Capacity vs. ICT Tools & Platforms, Training Programs, and Perception

Table 6. Service Delivery Capacity and ICT Tools & Platforms, Training Programs, and Perception

	Unstandardized B	**Coefficients** Std. Error	**Standardized Coefficients** Beta	**t**	**Sig.**
ICT Tools and Platforms	-.253	.202	-.155	-1.253	.216
Training Programs	-798	.189	.499	4.230	.000

Perception	-.158	.126	-.166	-1.257	.214

As shown in Table 6, among the three independent variables, Training Program is the most and is highly significant with a relatively low p-value (sig.) of 0.000. Training Program was defined in Table 1 as the effectiveness of the training program designed provided to Engineering educators by their respective institution. This means that the design of the training program covered all the demands required in teaching Engineering education. In addition, Training Program has a high positive coefficient of 0.798, which suggests that the service delivery capacity of the Engineering Educators was enhanced due to the training programs they received from their respective institutions. The survey results show that the Engineering Educators who participated were satisfied with the training programs. Therefore, the training programs provided were well-fit, effective, and have paid off, and universities have invested and were able to conduct several effective and continuous training programs for Engineering Educators. This is due to the fact that many educators demanded institutions to provide training programs, as said in a study by Chua et al. (2020), it is found that most professors in a particular university from the Philippines requested an orientation or training in using the E-Learning classrooms. The researchers can therefore conclude that institutions have acknowledged the challenges that their faculty members are facing with regards to online teaching and have provided sufficient training programs for them.

5.5 Advantages and Disadvantages of Virtual Laboratories

It is worth noting that the researchers have gathered their respondents from private institutions only due to the pandemic constraints in the country, which is not a holistic representation of the experiences of Engineering Educators in the National Capital Region. In private institutions, the capacity in adapting to the demands or resources needed in online teaching is sufficient. Private institutions have more resources, funding, and methods in which they could aid their faculty members and stakeholders. Thus, Engineering Educators from private and public institutions may have varying experiences with the use of virtual laboratories.

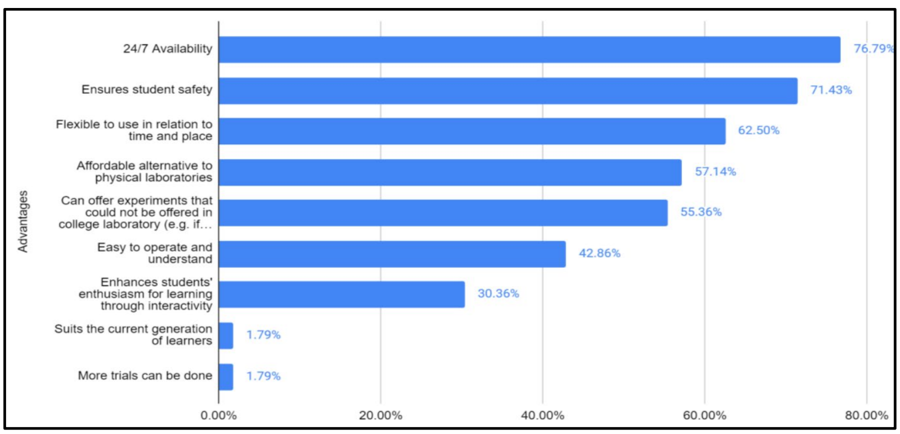

Figure 2. Advantages of Virtual Laboratories

Figure 2 shows that the top three advantages of virtual laboratories according to the respondents are: (1) They have 24/7 availability; (2) They ensure student safety; and (3) They are flexible to use in relation to time and place. Additionally, one respondent stated that there is software that can function almost the same as the actual equipment, and another respondent stated that virtual labs are good for simulation purposes only, but it does not help with psychomotor skills. Although knowledge-based courses work well in an online setting, skill-based courses are not developed as much virtually. Thus, respondents believe that students are not as enthusiastic about learning online compared to face-to-face interaction with machines and equipment. It can be used as an alternative, but not as a replacement.

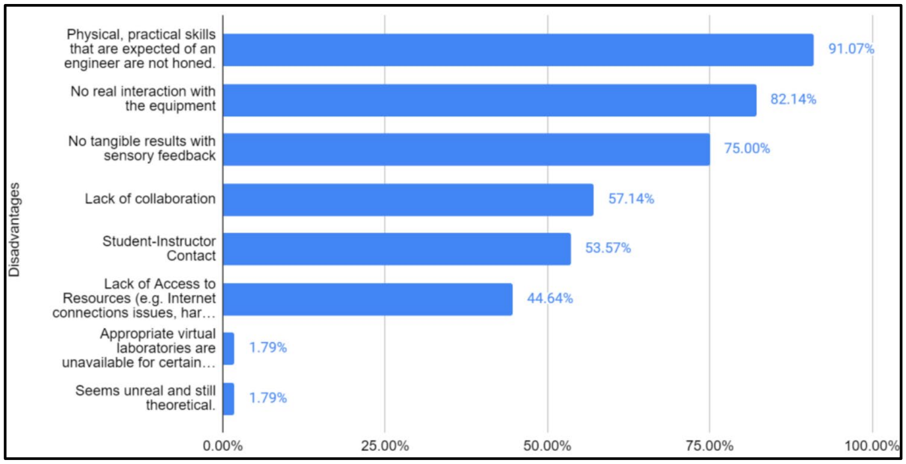

Figure 3. Disadvantages of Virtual Laboratories

Figure 3 shows that the top three disadvantages of virtual laboratories according to the respondents are: (1) Physical, practical skills that are expected of an engineer are not honed in virtual laboratories; (2) There is no real interaction with equipment; and (3) There are no tangible results with sensory feedback. Lack of proper skill-based experience is really a big disadvantage for virtual labs. Respondents believe that although virtual labs have high potential and advantages, other Engineering programs could suffer in this setup. One respondent stated that courses like Surveying and Testing from Civil Engineering programs will suffer in virtual labs. Thus, virtual labs do not fit all programs and courses. Even though virtual labs are the best alternative, students could miss certain sources of error when doing experiments virtually because of this lack of collaboration and interaction with their instructors. One respondent stated that it can simulate different systems to further enhance the learning of students, however, it gives ideal results which might lessen the students' curiosity as to why something might have happened, or how to avoid encountering certain problems in the future. Because of these ideal results, students may refrain from asking more questions to their peers and instructors. In addition, some respondents also stated that they have problems regarding internet connection, and one respondent stated that their program, Mechanical Engineering, prefers limited face-to-face because they do not have access to virtual labs. With this, some of their faculty members did onsite recorded experimentation videos last school year to use in their laboratory courses.

5.6 Learning Management Systems and Software Laboratory Platforms

The results of the survey questionnaire have shown that 87.50% of the Engineering Educators who participated in this study are using Blackboard Ultra as their learning management system. ZOOM is also the most used video conferencing software with 82.14%, while 37.50% of the respondents said they used Google Meet for video conferencing. In addition, 7.14% of the respondents on the other hand use Canvas as their platform in assigning tasks to the students. Other options like Blackboard Classic, Teams, and Google Classroom are the least used Learning Management Systems.

Furthermore, Microsoft Office products are used as a virtual laboratory by 67.86% of respondents. On the other hand, 23.21% of respondents claimed they utilize MATLAB as their main laboratory platform. Moreover, 16.07% of the respondents utilize AutoCAD, which is mostly used to develop plans for buildings. SPSS is used by 12.50% of the respondents. Finally, 5.56% of respondents claimed they utilize Mindtap, Lingo, or LTspice to carry out their virtual laboratory operations.

5.7 Summary of Results and Discussion

Table 7. Summary of Multiple Linear Regression

	ICT Tools and Platforms	Training Programs	Perception
sig.	.216	.000	.214

	Usage	Logistical Challenges	Technological Proficiency	Design	Knowledge	Engagement	Assessment	Adaptation	Motivation	Online Environment
sig.	.704	.931	.004	.201	.084	.330	.475	.000	.079	.576

Shown in Table 7: the Technological Proficiency is the most significant sub-dimension under ICT Tools & Platforms with a p-value of 0.004; Knowledge is the most significant sub-dimension under Training Programs with a p-value of 0.084; and Adaptation is the most significant sub-dimension with a p-value of 0.000, followed by Motivation with a p-value of 0.079, under Perception.

Overall, the Training Program has the biggest impact on the service delivery capacity of the Engineering Educators, and its most significant sub-dimension is Knowledge. This suggests that to ensure the success of the training programs, Engineering educators must gain ample knowledge needed in online learning, where they could experiment with new things, explore creative alternatives, and reflect on their own practices. In parallel with this is a study by Adnan et al. (2017), which stated that different techniques, teaching methods, and activities should be used in delivering the training programs effectively.

6. Conclusion

This study was able to deduced that the Training Program is the most significant variable for the service delivery capacity of Engineering Educators. It is evident that training programs for educators are a vital approach in maintaining good quality education in an online setting. Institutions must invest in training programs that would give Engineering educators the necessary skills, tools, and knowledge needed in an online setup. Furthermore, although virtual laboratories have great potential and advantages, there is still much to learn and improve in implementing these effectively. Although some software can function the same as actual equipment, there are still courses that cannot replace hands-on experience. Both physical and virtual have advantages, and this can be seen as room for improvement in our educational setting. Access to better resources, enhanced course design, better budget, and more research must be garnered in order for virtual laboratories to become more promising in the future.

The results of this study paves way for more opportunities and discussions since training programs for faculty members in an online setup during the pandemic have not been explored as much in the related literature, especially in the local context. Virtual laboratories and ICT Tools and Platforms fit for Engineering are also not explored as much in the local context, which can be viewed as potential for further advancement in the educational setting and room for improvement for HEIs, especially in the Philippines.

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