Engineering Students' Online Learning Environment: Basis for Enhancement Program

Dr. Conrado I. Dotong & Dr. Nestor C. Camello
College of Engineering,
Lyceum of the Philippines University Batangas
cidotong@lpubatangas.edu.ph , *nccamello@lpubatangas.edu.ph*

Asia Pacific Journal of Management and Sustainable Development
Vol. 11 No. 2, pp. 48-58
September 2023
ISSN: 2782-9332 (Print)

Abstract – *This study aimed to evaluate the online learning environment of Mechanical, Industrial, and Computer engineering students of Lyceum of the Philippines in terms of the content of e-learning courses, navigation, usability, and e-learning teacher or assistant. These were assessed by seventy (70) engineering students of LPU-B during term break of AY 2020-2021 through a survey questionnaire. Descriptive analysis and one-way ANOVA showed that engineering students were positive in their online learning environment. The composite means of 3.1232 (SD=.69857) indicates that engineering students from LPUB agreed on the Content of the E-learning Course. Also, the assessment of their online learning environment in terms of navigation (3.15), usability (3.11), and eLearning teacher/assistant (3.18) are positive. When the means of BSIE, BSME, and BSCpE were compared, no significant differences in their e-learning environments were found as revealed by their respective F-value of .070, .562, 1.258, and .215 with probability values of .932, .573, .291, and .807, respectively. The findings were strengthened by the probability values (p>.05) when the Scheffe test was used. No significant difference was uncovered when males and females were compared by independent sample t-test. The results suggest that e-learning does not affect gender. Practical implications were considered through the proposed enhancement program.* ***Keywords*** *– Content, e-learning, engineering students, navigation, online classes*

Cite this article as: Dotong, C. I. (2023). Engineering Students' Online Learning Environment: Basis for Enhancement Program. *Asia Pacific Journal of Management and Sustainable Development, 11 (2), 48-58*

INTRODUCTION

The World Health Organization (WHO) declared Coronavirus disease -19 (COVID-19) a pandemic on March 11, 2020. To prevent the further spread of the deadly virus, the Philippine government implemented a lockdown on March 16, 2020. Schools were not exempted from the lockdown. As it was implemented during the second semester of AY 2020-2021, teachers were compelled to continue teaching online for the remainder of the semester. The transition from face-to-face to online classes posed challenges for both teachers and learners. This was because teachers tend to teach in the same way they were taught [1]. Teachers who are accustomed to face-to-face teaching have to undergo a significant adjustment to adapt to online teaching [2].

There is a notable difference between face-to-face classes and online classes. Students need to exert extra effort to overcome the distractions at home while attending online classes. According to reference [3], taking classes online has not been easy for students, and they want teachers to understand that not every home provides an ideal learning environment. Additionally, the transition from face-to-face to emergency remote learning and then to online courses presents numerous inherent difficulties for students' academic experiences. This situation poses a significant challenge [4].

With the assistance of advanced technology such as Messenger, Zoom, MS Teams, and Learning Management Systems (LMS), the challenges brought about by the sudden implementation of online teaching have been mitigated. Using tools like social media, video conferencing, and discussion forums, students can actively engage with teachers and their peers. However, teachers must acquire the necessary skills and knowledge to effectively utilize these technologies. Without adequate professional development on new technologies, their full potential cannot be realized [5].

One of the issues identified in the research conducted by Asgari [6], which negatively impacted online engineering education, was the lack of sufficient hands-on training among faculty members. In his dissertation, Goode [7] concluded that to ensure the quality, usability, and effectiveness of modules, developers need to undergo comprehensive training in the entire development process, as well as prepare contingency plans for future challenges.

When considering higher education, it is important to recognize that its value extends beyond financial considerations and cost savings [8]. While online classes offer numerous advantages, there are drawbacks, such as the inability to engage in hands-on activities like practical woodworking skills. Students perceive this loss of hands-on learning as unfavorable to their overall educational experience [9].

Furthermore, assessing face-to-face classes is generally easier compared to evaluating online teaching. In a survey conducted by Daher [10], students expressed skepticism about the effectiveness of online training compared to traditional in-class learning, and many still prefer the latter as the preferred mode of education delivery.

This study utilized the myLPU Satisfaction Survey, which was structured into two main parts: respondents' profiles and the online learning environments of engineering students. The study's findings have led to the development of an enhancement program to benefit the LPUB community, particularly the teaching staff, in improving their instructional delivery to students. Additionally, the research outcomes offer valuable insights that may assist other researchers engaged in similar studies.

The researchers acknowledge the university's multifaceted responsibilities in promoting instruction, community extension, and research as integral aspects of the institution's culture. With the shift to online teaching during the pandemic, the researcher realized the importance of understanding students' preferences to ensure effective online instruction. Evaluating the e-learning environments of students is crucial for identifying issues and challenges in its implementation, as the effectiveness of online teaching hinges on meeting the desired objectives.

OBJECTIVES OF THE STUDY

This study sought to assess the online learning environment of engineering students. Specifically, its to present the profile of the respondents in terms of their program and gender, to evaluate the quality of the online learning environments based on elements including course content, navigation ease, usability, and the role of E-learning teachers/assistants, and to determine any significant differences in these online environments when categorized according to profile variables.

MATERIALS AND METHODS

Research Design

This research used a quantitative approach, which means it gathered numerical data and used statistical methods to study phenomena. Quantitative research is a rigorous method that helps researchers analyze data objectively and draw meaningful conclusions. By using quantitative methods, this study aimed to provide a reliable understanding of the research topic and discover relationships and patterns in the data.

The shift to online learning, largely driven by the challenges of the pandemic, has become a practical substitute for individuals seeking educational advancement. Understanding the crucial role of assessing this online learning methodology, the researchers underscored the value of soliciting student opinions and attitudes regarding the deployment of an e-learning system. This includes aspects such as the development of e-learning materials, a point also stressed [11].

Participants

This research utilized total population sampling due to the small size of the population, which comprised all engineering students at LPU-B who enrolled for the term break of AY 2020-2021 and experienced online learning. Out of the 72 students enrolled during the term break, 70 actively participated in the survey.

Instrument

This research primarily utilized an online survey conducted through a Google Form to gain insights into the e-learning experiences of engineering students. The survey focused on four key aspects: the content of the e-learning course, navigation, usability, and the e-learning teacher. Online surveys, distributed through the Internet, serve as effective tools for collecting information from respondents. They offer several advantages, including ease of creation, global reach, and high response rates. These benefits are particularly valuable during urgent situations like the ongoing COVID-19 pandemic [12].

The primary data collection tool used in this research was the myLPU Satisfaction Survey questionnaire, which underwent validation by an expert to ensure its reliability. To assess the instrument's reliability, pilot testing was conducted. The results of the pilot testing revealed a Cronbach alpha value of 0.877 for the Content of the E-Learning Course and 0.892 for usability, indicating a "Good" level of reliability. Similarly, the Navigation instrument and the E-Learning Teacher/Assistants instrument both demonstrated "Excellent" reliability, with Cronbach alpha values of 0.903 and 0.902, respectively.

In Part 1 of the questionnaire, the focus was on gathering information about the respondents' profiles, including their program of study and gender. Frequency counts were used to score the responses in this section. Part 2 of the questionnaire explored the online environments experienced by engineering students. To interpret the responses, a 4-point Likert scale was utilized, with the following scale: 4 - Strongly Agree, 3 - Agree, 2 - Disagree, 1 - Strongly Disagree.

Data Gathering Procedure

This study specifically focused on engineering students who were enrolled in the term break semester of 2021. It aimed to examine the learning environment that resulted from the sudden implementation of online teaching and learning. In the first phase of the study, relevant literature was gathered from secondary sources such as books, journals, and internet references. This helped provide a comprehensive understanding of the topic.

In the second phase, a quantitative survey was conducted among all students of LPU-B College of Engineering. The questionnaires were distributed to the respondents during that challenging time through Google Forms. After two weeks, the questionnaires were retrieved to collect the necessary data for analysis.

Data Analysis

To determine the frequency of male and female respondents in the Bachelor of Science in Computer Engineering (BSCpE), Bachelor of Science in Industrial Engineering (BSIE), and Bachelor of Science in Mechanical Engineering (BSME) programs, cross-tabulation was utilized.

The online learning environment of the respondents, which encompassed the content of the e-learning course, navigation, usability, and the e-learning teacher or assistant, was evaluated using descriptive statistics.

To identify any significant differences in the responses of the participants, one-way ANOVA was employed for program-based grouping, while independent-sample t-tests were used for grouping based on sex.

Ethical Consideration

The respondents were assured that the data collected would be treated with the highest level of confidentiality and used exclusively for this study. This assurance was formalized through an informed consent form, which guaranteed their safety and security. The researcher did not disclose any personal information but instead provided information and results derived from the collected data. This approach ensured the privacy and anonymity of the participants throughout the study.

RESULTS AND DISCUSSION

In this section, the analysis and interpretation of the collected data are presented to address the specific research questions of the study. The data were classified and organized into various tables to facilitate understanding and comparison.

The survey instruments were distributed to different groups of engineering students, with forty-two (42) out of forty-four (44) students from the BSIE program, ten (10) students from the BSCpE program, and eighteen (18) students from the BSME program.

Table 1. Profile of the Respondents

Program	Sex	Frequency	Percentage
BSCpE	Male	8	11.43
	Female	2	2.86
BSIE	Male	28	40.0
	Female	14	20.0
BSME	Male	13	18.57
	Female	5	7.14”

Table 1 presents the profile of the respondents in terms of sex, revealing that there were more male respondents (49) compared to female respondents (21). The data indicates that the BSIE program had the highest number of enrollees, with 42 respondents, followed by BSME, while BSCpE had the lowest number of participants.

Table 2 presents the assessment of engineering students at LPUB regarding the Content of the E-learning Course. The assessment reveals a positive perception, with a composite mean of 3.1232 (SD=0.69857). This indicates that engineering students from LPUB agreed on the Content of the E-learning Course. Among the indicators of the e-learning course content, the highest-ranking indicators were the clear outlining of course completion requirements (3.20) and the appropriateness of the content to the student's level (3.19). However, the indicators related to learning activities and assessment, such as clarity and ease of following (3.01), and timely and appropriate feedback (3.00), ranked lower. All these indicators were verbally interpreted as agreement by the students.

Feedback from learning activities and assessments plays a crucial role in the educational process, providing valuable insight to both educators and learners. Effective feedback should be timely so that the learners can use it

to inform their future actions and make necessary adjustments. It should also be specific and actionable, providing clear guidance on how to improve. On the other hand, learning activities and assessments are integral components of an effective educational framework. These two elements go hand in hand to ensure that students acquire knowledge and skills and demonstrate and progress.

Table 2. Assessment of the Engineering Students on their Online Learning Environment in Terms of Content of E-Learning Course

Indicators	WM	SD	VI	Rank
1. The content is appropriate to the level of the student	3.186	.786	A	3
2. The content is accurate, up-to-date, and relevant to the course/subject at hand	3.186	.766	A	3
3. The presentation of course topics was clear	3.186	.766	A	3
4. The requirements for completion of the course were clearly outlined	3.200	.754	A	1
5. The content incorporates deep-level questions that promote critical thinking.	3.114	.753	A	5
6. The objectives and concepts of the e-learning course module are clear, and student knows exactly what the materials are all about.	3.100	.801	A	6
7. The learning activities and assessments are clear and easy to follow.	3.014	.807	A	7
8. The feedback from the learning activities and assessment is timely and appropriate	3.000	.817	A	8
Composite means	3.1232	.699	A	

Legend: 3.50-4:00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disgaree;1.00-1.49 Strongly Disagree"

Content, as highlighted by Lim [13], is a crucial element in e-learning, playing a significant role in its effectiveness. It is important to follow guidelines during the development stage to ensure clarity and effectiveness from the outset. Gilly [1] emphasized the importance of keeping e-learning content concise and engaging, considering that some students may not read lengthy materials or may lack interest. While lecturing remains a common teaching method, research by Bennet [14] suggests that it may not always be the most effective approach. To provide accurate and relevant e-learning materials, lecturers need to source information from reliable sources, as emphasized by [15].

To enhance teaching methods, e-learning content needs to be easily accessible on various devices such as smartphones, laptops, and iPads, as recommended [15]. Anderson [16] suggests that universities should require professors to submit syllabi at least a week before the start of the semester. This allows students to evaluate their courses and prepare accordingly. The syllabus serves as a vital guide for teachers in structuring their lesson plans and for students throughout the course [17].

When creating e-learning content, there is no specific rule, but it requires careful preparation and analysis before presenting it to learners, and objectives should provide sufficient detail on what is to be learned [18]. Motivation plays a crucial role in helping students meet course objectives [19]. Animation and graphics can be used to explain abstract concepts in an online learning environment, fostering imagination among students [20].

Learning objectives need to be accompanied by appropriate learning activities and assessments [21]. Clear communication of learning objectives increases the likelihood of students achieving their goals. Feedback is essential in online learning to build a partnership and trust between instructors and students [22].

E-learning offers flexibility for individuals to further their careers and gain qualifications, allowing them to fit learning around their lifestyles [23]. Allen [18] emphasizes the importance of meaningful context and activities in online learning, as they serve as gateways to learning complex skills. Building trust, social presence, collaboration, and personal contact are key factors in promoting successful engagement [24]. Teachers should adapt their teaching styles to match the learning styles of their students [18].

The assessment of the engineering students regarding their online learning environment, specifically in terms of navigation, has been presented in Table 3. The overall assessment is positive, with a composite mean of 3.15. Out of all the navigation indicators, the highest-ranking one is the ease of downloading content or assignments to work offline, which scored 3.29. This is closely followed by the ease of opening the e-learning course module upon logging in, which scored a 3.23. On the lower end, the smooth running of the module every time students use it scored a 3.1, and the e-learning module's allowance for students to control their pace of learning scored a 3.04. All these indicators received a verbal interpretation of 'agree'.

Table 3. Assessment of the Engineering Students on Their Online Learning Environment in Terms of Navigation

Indicators	WM	SD	VI	Rank
1. It is easy to move back and forward through a section of the course module.	3.129	.70034	A	4
2. The students can easily navigate back to the start of the course module.	3.157	.71497	A	3
3. The e-Learning module allows students to control the pace of learning.	3.043	.80642	A	7
4. The e-Learning module allows students to actively interact with the program	3.114	.75264	A	5
5. The e-learning course module is easy to open when the students log in.	3.243	.75057	A	2
6. The module runs smoothly every time the students are using it.	3.100	.78297	A	6
7.I can easily download content or assignments so that I can work offline.	3.286	.78284	A	1
Composite Means	3.153	.65997	A	

Legend: 3.50-4:00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disgaree;1.00-1.49 Strongly Disagree"

The online learning environment provides user-friendly navigation, allowing easy access to different course sections for content review. It also offers a clear option to return to the beginning of the module, facilitating revisiting of introductory material. The environment promotes a flexible learning pace, accommodating individual preferences. Interactive features engage students, enhancing their understanding. The interface is easily accessible, reducing barriers and frustrations during login. The module runs smoothly, ensuring uninterrupted learning. Additionally, students can conveniently download content for offline access, supporting continuous learning without the Internet.

To ensure a smooth learning experience, a well-designed e-learning module combines carefully crafted activities and effective assessments. E-learning allows students to control their own pace, unlike traditional classrooms. The online learning environment has user-friendly navigation, enabling easy access to course sections and the ability to return to the beginning. This flexibility promotes personalized learning. Interactive features engage students, enhancing understanding. The interface is designed for easy access, reducing login barriers. Students can download content for offline access, ensuring continuous learning without the internet.

Technological literacy and competency were found to be the least challenging aspects of online learning [25]. Considering the need for offline access to the learning management system (LMS) is crucial during the design phase of a new platform [26]. Prioritizing easy navigation and granting students the ability to control their learning pace and direction is important [18] - [21]. It is essential to carefully design e-activities to facilitate navigation and engagement in relevant tasks [1]. Rusman [27] highlights the value of self-directed and self-paced activities in asynchronous learning. Additionally, Smith [21] emphasizes the importance of consistent course design and easy access to tasks within the LMS.

Table 4 presents the assessment of engineering students regarding the usability of their online learning environment. The overall rating is positive, with a composite mean of 3.11. Among the usability indicators, the highest-ranked indicator is "screen presentation enhances learning" with a score of 3.20. This is followed by "myLPU provides students with various options to select extra information, new materials, and review previously learned materials" and "myLPU is an innovative approach to learning," both scoring 3.16. On the other hand, the indicators "using myLPU has improved my learning" and "myLPU fits my learning style" received the lowest scores of 3.06 and 2.97, respectively. Overall, these indicators were interpreted as agreement by the students.

Furthermore, the composite means of 3.1122 (SD=0.68399) suggest that the respondents generally agreed on the usability of online learning. The standard deviation, ranging from 0.71424 to 0.85077, indicates that the respondents' responses are closely aligned with the mean values of the dataset.

One of the main advantages of using myLPU for learning activities is the flexibility it provides in accessing resources and materials. With myLPU, students have the convenience of accessing learning materials at any time and from any location, allowing for personalized and convenient learning. The platform offers a wide range of resources, including multimedia content, interactive modules, and online discussions, catering to different learning styles and aiding in the comprehension of complex concepts. However, it is important to note that if users are unfamiliar with the system or do not receive adequate training, their performance may be negatively impacted. Therefore, it is crucial to provide sufficient training and support to ensure optimal utilization of the myLPU platform.

Table 4. Assessment of the Engineering Students on their Online Learning Environment in Terms of Usability

Indicators	WM	SD	VI	Rank
1. myLPU is easy to use.	3.143	.748	A	3
2. The screen presentation enhances learning (e.g., good use of graphics clear text, well layout, good use of color)	3.200	.714	A	1
3. myLPU provides the students with various options to select extra information, new materials and review previously learned materials.	3.157	.735	A	2.5
4. I am satisfied with the amount of online interaction I had with other students in the course	3.100	.764	A	4
5. Using myLPU has improved my learning.	3.057	.814	A	5
6. myLPU fits my learning style.	2.971	.851	A	6
7. myLPU is an innovative approach to learning.	3.157	.773	A	2.5
Composite Means	3.112	.684	A	

Legend: 3.50-4:00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disgaree;1.00-1.49 Strongly Disagree"

Arora [28] emphasized that a good user environment in a Learning Management System (LMS) is crucial for enhancing the user experience. The LMS should be designed to cater to the needs of different types of users. However, according to Mansor [29], no significant relationship was found between students' perceptions of online learning and their learning styles.

On the other hand, Smith [21] supports the idea that incorporating appropriate images or pictures can aid students in better comprehension and processing of the course content. However, Pozgaj et al., [11] identifies a lack of communication and interaction with fellow students as the biggest drawback of e-learning.

Similarly, a survey conducted by Iqbal [30] revealed that the main barriers to the adoption of e-learning among faculty members are the lack of training, incentives, technical support, and time to develop e-courses.

A Learning Management System (LMS) offers several advantages, including different learning opportunities, long-lasting learning, convenience, and flexibility [28]. Online learning also promotes a high level of accountability for independent learning among students [31]. In line with this, Allen [18] suggests that teachers should adjust the level of challenges in online learning to align with the readiness level of the learners.

Table 5. Assessment of the engineering students on their online learning environment in terms of E-learning Teacher/assistant

Indicators	WM	SD	VI	Rank
1. Provides orientation to students about the concepts of the e-Learning course module	3.243	.7310	A	1
2. Provides help to students encountering difficulties during the e-Learning class activity	3.171	.780	A	2.5
3. Provide guide questions to students to facilitate learning.	3.171	.780	A	2.5
4. I am satisfied with the online interaction I had with my instructor	3.129	.833	A	4
Composite means	3.179	.734	A	

Legend: 3.50-4:00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disgaree;1.00-1.49 Strongly Disagree"

Table 5 presents the assessment of engineering students on their online learning environment,

specifically focusing on the eLearning teacher/assistant aspect. The assessment indicates a positive response, with a composite mean of 3.18.

The indicators of the eLearning teacher/assistant have been ranked based on their scores, and all these indicators were verbally interpreted as agreement by the respondents. The highest-ranked indicator, with a score of 3.24, is providing orientation to students about the concepts of the e-learning course module. Following closely behind, with a score of 3.1714, are providing help to students encountering difficulties during the e-learning class activity and providing guide questions to facilitate learning. Lastly, the indicator "I am satisfied with the online interaction I had with my instructor" ranks last with a score of 3.13.

The e-learning teacher/assistant plays a crucial role in enhancing the student's online learning experience. They provide orientation sessions to help students understand the concepts of the e-learning course module, assist those who encounter difficulties during class activities, and offer guide questions to facilitate a better learning process. It is important to note that satisfaction with online interaction can be influenced by factors beyond the instructor's control, such as the quality of the online learning platform or the student's circumstances.

However, instructors who prioritize effective communication, engagement, availability, personalized support, technological proficiency, and empathy can significantly enhance satisfaction levels in online interactions. Guide questions, in this case, serve as prompts that aid students in comprehending and interacting with the material being taught. It is crucial to adapt and tailor the guide questions to suit the specific needs and abilities of the students, thereby enhancing their engagement, critical thinking, and overall learning outcomes.

Each student may face unique difficulties, so it is vital to approach challenges individually and provide tailored support accordingly. By addressing concerns and offering assistance, the eLearning teacher/assistant enables students to overcome obstacles and succeed in their e-learning activities. The students expressing their satisfaction with the online interaction they had with their instructor highlights the positive impact of effective communication and support in their learning journey.

It is commonly observed that students generally prefer classroom classes over online classes due to various challenges they face, such as a lack of motivation and a decrease in communication levels between students and their instructors [32]. However, it is worth noting that research conducted by Laguador et al., [33] has shown interesting findings specifically related to engineering students. The study found that engineering students exhibit significantly higher levels of positive attitude toward academic performance during their junior level. However, this positive attitude experiences a significant decrease after taking professional courses.

To address the issue of motivating students who encounter difficulties, one possible approach is to apply the expectancy theory [34]. The expectancy theory suggests that individuals are motivated when they believe that their efforts will lead to performance, and that performance will result in desirable outcomes. In the context of education, this theory can be applied by providing support and assistance to students when they are stuck or facing challenges. Allen[18] implemented this approach by providing hints and, in some cases, even answers to his students when they encountered difficulties. By doing so, the instructor aimed to boost students' confidence and belief that their efforts would lead to successful performance.

Smith [21] emphasizes the importance of reaching the greatest number of learners, prioritizing this goal to ensure successful online activities. Furthermore, passion and commitment to teaching are crucial for the success of online activities [1].

The results of the ANOVA test, which aimed to identify significant differences in the responses of the three groups of respondents regarding the Content of E-Learning Course, Navigation, Usability, and E-Learning Teacher, are presented in Table 6. The means of the responses from the three programs at LPU-B College of Engineering were compared using the Scheffe test.

Upon comparing the means of BSIE, BSME, and BSCpE, no significant differences were found in the areas of content of e-learning course, navigation, usability, and e-learning teacher, as indicated by their respective F-values of .070, .562, 1.258, and .215. The corresponding probability values were .932, .573, .291, and .807, respectively. The lack of significant differences was further supported by the probability values ($p>.05$) from the Scheffe test.

The lack of significant differences suggests that the existing e-learning materials and teaching approaches are effective across the different programs, promoting an equitable learning environment. Consistent design and development of e-learning courses, along with similar student backgrounds and a high-quality e-learning environment, may have contributed to this outcome. The relatively homogeneous sample of students in the study could have influenced the observed similarity in perceptions.

Table 6. Online Learning Environments of Engineering Students among the three Programs of LPU-B College of Engineering

Areas	F-value	Probability Value (Anova)	Significant Pair	Mean Difference	Probability Value (Scheffe)
Content of E-Learning Course	.070	.932	BSCpE vs BSIE	.093	.933
			BSCpE vs BSME	.082	.958
			BSIE vs BSME	-.011	.999
Navigation	.562	.573	BSCpE vs BSIE	0.151	0.812
			BSCpE vs BSME	0.275	0.580
			BSIE vs BSME	0.124	0.805
Usability	1.258	.291	BSCpE vs BSIE	0.189	0.742
			BSCpE vs BSME	0.269	0.322
			BSIE vs BSME	0.222	0.515
E-Learning Teacher / Assistants	.215	.807	BSCpE vs BSIE	0.119	0.902
			BSCpE vs BSME	0.000	1.000
			BSIE vs BSME	-0.119	0.851

Significant at .05 level"

As shown in Table 7, an independent-sample t-test was conducted to compare the scores or performance of the content, navigation, usability, and e-learning teachers in e-learning courses between male and female students. The content of e-learning courses showed no significant difference in the scores for male (M=3.0255, SD=.76631) and female (M=3.3512, SD=.44303) students; t(68) = -1.817, p=.074. In terms of navigation, there was no significant difference in the scores for male (M=3.0816, SD=.73482) and female (M=3.3197, SD=.40634) students; t(68)=-1.393, p=.168. Similarly, there was no significant difference in the scores for male (M=3.0350, SD=.74945) and female (M=3.2925, SD=.46615) students in usability; t(68)=-1.455, p=.150. The e-learning teacher component also showed no significant difference in the scores for male (M=3.1071, SD=.81170) and female (M=3.3452, SD=3.3452) students; t(68)=-1.247, p=.217.

As shown in Table 7, an independent-sample t-test was conducted to compare the scores or performance of the content, navigation, usability, and e-learning teachers

Table 7. Comparison of the Online Learning Environments between Male and Female Engineering Students of LPU-B College of Engineering

	Gender	N	Mean	SD	t	df	Sig (2-tailed)
Content of E-Learning Course	Male	49	3.026	.766	-1.817	68	.074
	Female	21	3.351	.443			
Navigation	Male	49	3.082	.735	-1.393	68	.168
	Female	21	3.320	.406			
Usability	Male	49	3.035	.750	-1.455	68	.150
	Female	21	3.293	.466			
E-Learning Teacher / Assistants	Male	49	3.107	.812	-1.247	68	.217
	Female	21	3.345	.490			

in e-learning courses between male and female students. The content of e-learning courses showed no significant difference in the scores for male (M=3.0255, SD=.76631) and female (M=3.3512, SD=.44303) students; t(68) = -1.817, p=.074. In terms of navigation, there was no significant difference in the scores for male (M=3.0816, SD=.73482) and female (M=3.3197, SD=.40634) students; t(68)=-1.393, p=.168. Similarly, there was no significant difference in the scores for male (M=3.0350, SD=.74945) and female (M=3.2925,

SD=.46615) students in usability; t(68)=-1.455, p=.150. The e-learning teacher component also showed no significant difference in the scores for male (M=3.1071, SD=.81170) and female (M=3.3452, SD=3.3452) students; t(68)=-1.247, p=.217.

The study's results indicate that gender does not significantly impact e-learning outcomes, suggesting that both men and women perform equally well in e-learning environments. This finding contradicts the findings of a survey conducted by Mohd et al., [35], which reported that the usability of AU e-learning courses varied by gender, with female students having a slight advantage.

Based on the scores obtained, it can be inferred that both girls and boys have achieved equality when taught through online learning environments. Therefore, it is crucial to provide students with the opportunity to learn through an online classroom, where they can actively engage with the content and have the space to share learning objects [20].

REFERENCES

[1] Gilly, S. (2004). E-tivities: The Key to Active Online Learning. © Gilly Salmon, 2002. Routledge Falmer. This edition was published in the Taylor & Francis e-Library, 2004, in London and New York. Retrieved from: https://books.google.com.ph/books/Qe6QAgAAQBAJ

[2] Landicho, C.J.B. (2021). Changes, Challenges, and Opportunities in Teaching Senior High School Earth Science amidst the COVID-19 Pandemic. *Journal of Learning and Teaching in Digital Age*, 6(1), 55-57. Retrieved from https://files.eric.ed.gov/fulltext/EJ1285388.pdf

[3] Chen, T. (2020). A College Student's Viral Tweet About the Stress Of Online School Shows How Education Is Being Impacted By The Coronavirus. BuzzFeed News. Retrieved from: https://www.buzzfeednews.com/article/tanyachen/students-say-theyre-struggling-with-online-classes-in.

[4] Stewart, W., & Lowenthal, P. (2021). Experiences and perceptions of exchange students learning online during the COVID-19 pandemic in the Republic of Korea: An exploratory descriptive study. *Asian Journal of Distance Education*, 16(1), 119-140. Retrieved from https://files.eric.ed.gov/fulltext/EJ1303713.pdf

[5] Johnson, A. M., Jacovina, M. E., Russell, D. E., & Soto, C. M. (2016). Challenges and Solutions when Using Technologies in the Classroom. In S. A. Crossley & D. S. McNamara (Eds.), Adaptive educational technologies for literacy instruction (pp. 13-29). New York: Taylor & Francis. Retrieved from https://files.eric.ed.gov/fulltext/ED577147.pdf

[6] Asgari, S., Trajkovic, J., Rahmani, M., Zhang, W., Lo, R. C., & Sciortino, A. (2021). An observational study of engineering online education during the COVID-19 pandemic. *PLOS ONE*, 16(4), e0250041. https://doi.org/10.1371/journal.pone.0250041

[7] Goode, C. M. (2003). Evaluating the Quality, Usability, and Potential Effectiveness of Online Learning Modules: A Case Study of Teaching with Technology Grant Recipients at the University of Tennessee, Knoxville (Doctoral dissertation). University of Tennessee. Retrieved from https://trace.tennessee.edu/utk_graddiss/4291

[8] Piletic, P. (2018). Lower Costs Are Making More Students Prefer Online Education. eLearning Industry. Retrieved from https://elearningindustry.com/students-prefer-online-education-lower-costs-making.

[9] Johnson, J. E., & Barr, N. B. (2021). Moving Hands-On Mechanical Engineering Environments Online: Course Redesigns and Student Perspectives. Online Learning, 25(1), 209-219. ERIC Number: EJ1287139. Retrieved from https://eric.ed.gov/?id=EJ1287139

[10] Daher, C. A. (2020). Transitioning to Online Training: Assessment of Students' Perceptions and Needs. Al Nahda. Retrieved from: https://www.alnahda.org/files/research_programs/37.pdf.

[11] Pozgaj, Z., & Knezevic, B. (2007). E-Learning: Survey on students' opinions. 2007 29th International Conference on Information Technology Interfaces (pp. 381-386). IEEE Xplore. https://doi.org/10.1109/ITI.2007.4283800

[12] Andrade, C. (2020). The Limitations of Online Surveys. *Indian Journal of Psychological Medicine*, 42(6), 575-576. https://doi.org/10.1177/0253717620957496

[13] Lim, A. (2021). The Ideal Process of Creating eLearning Content. eLearning Industry. Retrieved from https://elearningindustry.com/the-ideal-process-of-creating-elearning-content

[14] Bennett, C. (2019). Methods for presenting subject matter. ThoughtCo. Retrieved from https://www.thoughtco.com/methods-for-presenting-subject-matter-8411

[15] Cooper, S. (2016). 5 strategies to improve your online teaching. eLearning Industry. Retrieved from https://elearningIndustry.com/5-strategies-improve-your-online-teaching.

[16] Anderson, K. (2020). Students should have access to course syllabi before classes begin. Retrieved from https://www.gwhatchet.com/2020/01/30/students-should-have-access-to-course-syllabi-before-classes-begin/

[17] Riviere, J., Picard, D., & Coble, R. (2014). Syllabus Design. Vanderbilt University Center for Teaching. Retrieved from https://cft.vanderbilt.edu/guides-sub-pages/syllabus-design/

[18] Allen, M.W. (2007). Designing successful e-learning: Forget what you know about instructional design and do something interesting. San Francisco, CA: Pfeiffer. Retrieved from https://download.e-bookshelf.de/download/0000/5874/46/L-G-0000587446-0002384977.pdf.

[19] Kendra, C. K. (2023). Motivation: The Driving Force Behind Our Actions. Verywell Mind. Behavioral Psychology. Retrieved from https://www.verywellmind.com/what-is-motivation-2795378

[20] Baig, M. A. (2011). A Critical Study of the Effectiveness of Online Learning on Students' Achievement. *i-manager's Journal of Educational Technology*, 7(4), January - March 2011. Retrieved from https://files.eric.ed.gov/fulltext/EJ1102153.pdf

[21] Smith, R. M. (2014). Conquering the Content (2nd ed.). Jossey-Bass. An imprint of Wiley. Retrieved from https://vdoc.pub/download/conquering-the-content-14g6825i6vrg

[22] Fu, J. (2019). Providing Helpful and Effective Feedback to Your Online Student. University of Houston. Retrieved from https://tinyurl.com/c5t4fr99

[23] Chitra, A.P., & Raj, M.A. (2018). E-Learning. *Journal of Applied and Advanced Research*, 3(S1), 11. https://doi.org/10.21839/jaar.2018.v3iS1.158.

[24] Swanson, A., Davis, B., Parks, O., Atkinson, S., Forde, B., & Choi, K. (2015). Student Engagement, E-Connectivity, and Creating Relationships in the Online Classroom: Emerging Themes. *International Journal of Instructional Technology and Distance Learning*, 12(1). Retrieved from https://itdl.org/Journal/Jan_15/Jan15.pdf

[25] Barrot, J.S., Llenares, I.I., & del Rosario, L.S. (2021). Students' online learning challenges during the pandemic and how they cope with them: The case of the Philippines. Education and Information Technologies, 26, 7321-7338. https://doi.org/10.1007/s10639-021-10589-x.

[26] O'Connor, M. (2020). Using your LMS for offline learning. Synergy Learning. Retrieved from https://synergy-learning.com/blog/using-your-lms-offline-learning/.

[27] Rusman, M. (2016). The Development of an E-Learning-Based Learning Service for MKDP Curriculum and Learning at the Indonesia University of Education. *Journal of Education and Practice*, 7(31). Retrieved from https://files.eric.ed.gov/fulltext/EJ1122549.pdf

[28] Arora, D. (2018). Learning Management System (LMS) Using C#, ASP.Net and SQL SERVER (Master's thesis). Culminating Projects in Computer Science and Information Technology, 25. Retrieved from https://repository.stcloudstate.edu/csit_etds/25

[29] Mansor, M. S. A., & Ismail, A. (2012). Learning styles and perception of engineering students towards online learning. *Procedia-Social and Behavioral Sciences*, 69, 669-674. https://doi.org/10.1016/j.sbspro.2012.11.459

[30] Iqbal, S. (2011). Learning Management Systems (LMS): Inside Matters. Information Management and Business Review, 3(4), 206-216. DOI: 10.22610/imbr.v3i4.935. Retrieved from https://ojs.amhinternational.com/index.php/imbr/article/view/935

[31] Sit, J., Chung, W., Chow, M., & Wong, T. (2005). Experiences of online learning: Students' perspective. Nurse Education Today, 25(2), 140-147. https://doi.org/10.1016/j.nedt.2004.11.004

[32] Alawamleh, M., Al-Twait, L. M., & Al-Saht, G. R. (2020). The effect of online learning on communication between instructors and students during Covid-19 pandemic. Asian Education and Development Studies. https://doi.org/10.1108/AEDS-06-2020-0131

[33] Laguador, J.M., & Dotong, C.I. (2020). Engineering Students' Challenging Learning Environments and Their Changing Attitude towards Academic Performance. European *Journal of*

Educational Research, 9(3), 1127-1140. Retrieved from https://eric.ed.gov/?id=EJ1262419

[34] Spacey, J. (2020). 7 Examples of Expectancy Theory. Simplicable. Retrieved from https://simplicable.com/en/expectancy-theory

[35] Mohd. E.E, Al-Qatawneh, S., Al-Ramahi, N., & Alsalhi, N. (2019). The Perspective of Students and Faculty Members on the Efficiency and Usability of E-Learning Courses at Ajman University: A Case Study. *Journal of Technology and Science Education*, 9(3). Retrieved from https://www.jotse.org/index.php/jotse/article/view/590/424.