Use of Interactive Multimedia e-Learning in TVET Education

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Abstract—**Malaysia is focused on the development and use of technologies among consumers. Thus, technological innovations are used in the adaptation of online learning to educate students, as well as to enhance the teaching and learning process in Technical and Vocational Education and Training (TVET) institutions. There is a need to expose students to the online learning revolution, which conceptualises using computerised systems to facilitate the learning process. However, the COVID-19 outbreak has disrupted the academic year across the country. Due to the unusual circumstances related to the pandemic, the Malaysian government has urged all academic institutions to conduct online teaching and learning. Thus, an e-Learning system, known as SpmiILP, has been designed and developed accordingly for an interactive multimedia course to encourage online interaction among students and lecturers, as well as to enhance human learning and cognitive development. In fact, these essential elements such as learning style of the students and user experience are focused on to engage them in learning effectively as well. An e-Learning System for Interactive Multimedia Course was used to develop the e-Learning system (SpmiILP). The usability test showed that the developed e-Learning system has a positive influence that provided potential contributions to (TVET) students in their learning processes.**

Keywords—e-Learning; interactive multimedia; learning style; user experience

I. INTRODUCTION

The evolution of information technology has spread worldwide in conjunction with the rapid growth of various technologies. Multimedia technology has demonstrated the great potential of evolution in learning, accessing, and manipulating information. Multimedia contributions have an enormous opportunity for educators to expand numerous learning techniques, especially e-learning. e-Learning shows the potential of digital transformation in the education system that would allow the development of new teaching and learning ecosystems. e-Learning growth was facilitated using digital tools involving interactivities that encourage online interaction between students and lecturers. e-Learning concepts encompass many multimedia technologies and the Internet that enable access to virtual learning environments. The use of information and digital technology empowers the diverse learning process by combining traditional classroom and online learning environments. Therefore, e-Learning has been massively implemented in higher education institutions based on pivotal success factors categorised as system quality, service quality, information quality, usefulness, and engagement.

The advancement of teaching and learning technologies has helped improve students' critical thinking skills. e-Learning's enormous growth, alongside technological advancement, has promoted high-quality learning techniques that fit students' preferences. The term "digitally literate" indicates the ability to perform and handle digital technologies humans use daily [1],[2]. Indeed, the quality of learning has been enhanced by advancing educational tools. Nowadays, younger generations are immersed and surrounded by technologies, with easy access to information.

The e-Learning approach supports collaborative communication that allows users to control and customise their learning environment. Satisfaction in e-Learning has enabled users to experience learning that fits their preferences and styles [3]. Multimedia elements also play a significant role in education by allowing users to experience interactive learning. Multimedia elements consisting of text, audio, animation, image, and video can trigger users to be more entertained and keener to continue learning [4]. The intensive penetration of multimedia has fuelled the demand for visualising educational materials to be more engaging and effective.

Hence, this next section of the paper will further provide detail on the related works; methodology will emphasize the five phases of analysis, design, development, implementation, and evaluation, then will summarize the results, discussion and conclusion.

II. RELATED WORKS

The massive spread of coronavirus disease or COVID-19 has become a global pandemic that forces social distancing policy. Progressive steps are taken to limit the spread of this policy in the community and influence various sectors, including education. Therefore, there is a sudden transition of learning where the institutions are required to implement online learning. Human motion restrictions force changes in our education in new aspects such as learning styles, learning platforms, accessibility, and the deliverance of information [5]. Thus, the pandemic of COVID-19 leads educators to provide learning materials through online learning. The transition from face-to-face learning to remote learning as an alternative shows the potential of e-Learning that uses an online platform. To that end, face-to-face learning has become vulnerable in most

institutions due to the COVID-19 pandemic, which results in another alternative of providing online learning for the students.

In a world with ever-evolving computing technology, e-learning has been pushing the advanced technology boundaries. e-Learning is recognised as an important part of learning in higher education institutions. The expansion of e-learning has initiated several changes in education delivery, as shown in Fig. 1 [6].

This e-learning model shows the different e-learning techniques in education that learners can employ. First, adjunct e-learning can be used in a traditional classroom that provides relative independence to learners. Second, the blended e-Learning technique can explain the delivery of course materials using traditional learning and e-Learning methods. The third technique is conducted online, devoid of traditional learning or classroom participation, because it features individualised and collaborative learning. The development of the proposed e-learning system in this research paper was focused on blended e-Learning.

Therefore, Industrial Training Institutes, or Institut Latihan Perindustrian (ILP), provide formal training for school leavers and industrial workers that would enable them to acquire skills for specific work fields. By upgrading their skills, they would be more focused on their work and contribute effectively to this country's development. Interactive Multimedia has been introduced to ILP students as one of the main subjects in the Information Technology (IT) course. ILP students have been using the conventional way of learning instead of focusing on the rapid growth of digital technology for teaching and learning [7]. The lack of motivation and engagement has caused them to lose interest in learning.
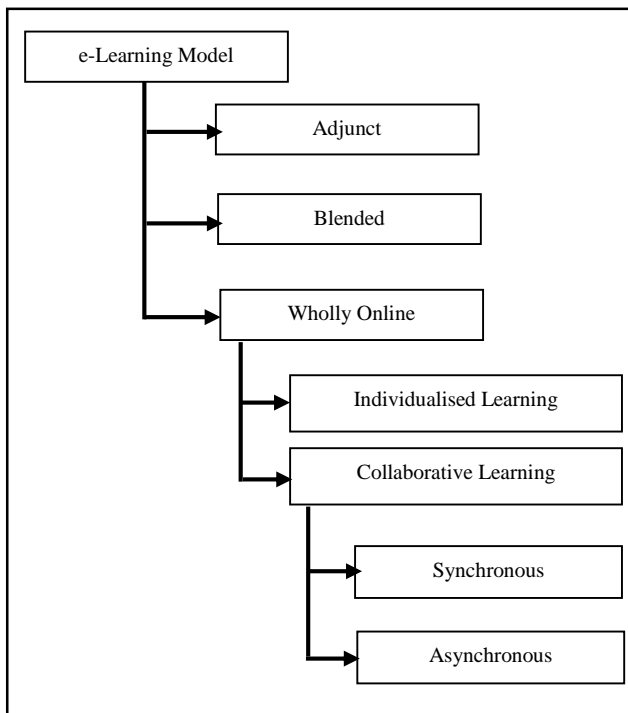

Fig. 1. e-Learning Model.

Nonetheless, the ongoing technological changes have enhanced the education system in this country with the use of digital technologies. The e-Learning system for the Interactive Multimedia subject can drive ILP students to use technology and learn effectively. e-Learning has become a learning platform with various benefits, such as being easy to use, user-friendly, interactive, and efficient for students [8].

Online learning has been introduced in ILP to expose students to different teaching and learning methods that would suit their learning styles. Some students prefer to study in groups, while some prefer to study alone. Additionally, some of the students' performances showed that they understand better through verbally explained lessons, while some might have difficulties in this environment. They might prefer learning using visual and graphical forms of the lesson to understand and improve their motivation and engagement [9],[10]. These different learning styles show that students have different capabilities in adapting to knowledge. Thus, the e-Learning system for the Interactive Multimedia subject has been developed with several functionalities, such as interactive notes, videos, and quizzes. These functionalities enable the students to complete the tasks involving problem solving and assignments. The students can improve their cognitive abilities by adopting an online platform during the pandemic COVID-19. The user interface is obtained based on the user requirements specified on the usage of multimedia elements such as animation, text, videos, and audio. Using multimedia elements helps them stay focused and have fun while learning.

The students involved in this study could complete their assessments and were evaluated right after they completed the e-Learning. It should be aligned with the users' performance and learning styles to make the e-Learning system more effective. The constantly growing research on interactive multimedia e-Learning systems has helped foster new approaches to learning. Therefore, this study has aimed to design and develop an e-Learning system for the Interactive Multimedia subject (SpmiILP) for ILP students that could improve their learning outcomes.

In the meantime, students can utilise other currently available systems, such as Moodle, as a learning management system. Moodle offers various features, such as reading materials, papers and projects, forums relating to the course, conduction of quizzes, the distribution, collection, and evaluation of assignments, keeping track of class attendance, and recording grades. Some of these features have been used to develop the e-Learning system (SpmiILP) based on the user requirements of ILP students enrolled in the Interactive Multimedia subject.

The SpmiILP was adapted to fit the needs of individual learners. For example, it offers students the flexibility of time and place to access the huge amount of information in the system, eliminates the barriers that could potentially hinder student participation in the classroom, and it enables the students to study at their own pace and speed [6], [7],[11]. As a result, they can be satisfied with their performance and decrease their stress level. Since every student's learning style must be taken into consideration, this paper presents the design

and development of an e-Learning system that is focused on the user requirements of ILP students.

III. METHOD

This study was conducted in five phases: analysis, design, development, implementation, and evaluation. Each phase is explained in detail in the following sections.

A. Analysis Phase

This phase involved analysing user requirements obtained from the users, as shown in Table I. Previous studies have highlighted the learning styles of undergraduate students, multimedia elements, user interaction, user experience, usability, and types of technology used [7], [8], [9], [11], [12], [13]. Identifying user requirements of a system has helped strengthen their understanding of the learning process.

The user requirements listed in Table I have been acquired to develop an e-Learning system for the Interactive Multimedia subject. Instead of focusing on interface designs, this e-learning system was developed to meet students' requirements with functional features that could engage and motivate them in their learning process. ILP students mostly prefer learning using different forms of visual and graphic learning tools, including animation, text, video, and audio. The tasks given to the students were in the form of online learning by providing quizzes and assessments. The implementation of online learning has enhanced the use of technologies among these students that they can use to obtain unlimited access to information.

B. Design Phase

This phase involved utilising the outputs obtained from the analysis of user requirements. The selection of activities must be suitable for ILP students to improve their learning performance. This system has adapted multimedia elements that showed greater potential and have gained popularity among the students. Fig. 2 shows a model of the e-Learning system for Interactive Multimedia subject (SpmiILP). This model consists of user specifications and software content.

TABLE I. USER REQUIREMENTS OF ILP STUDENTS

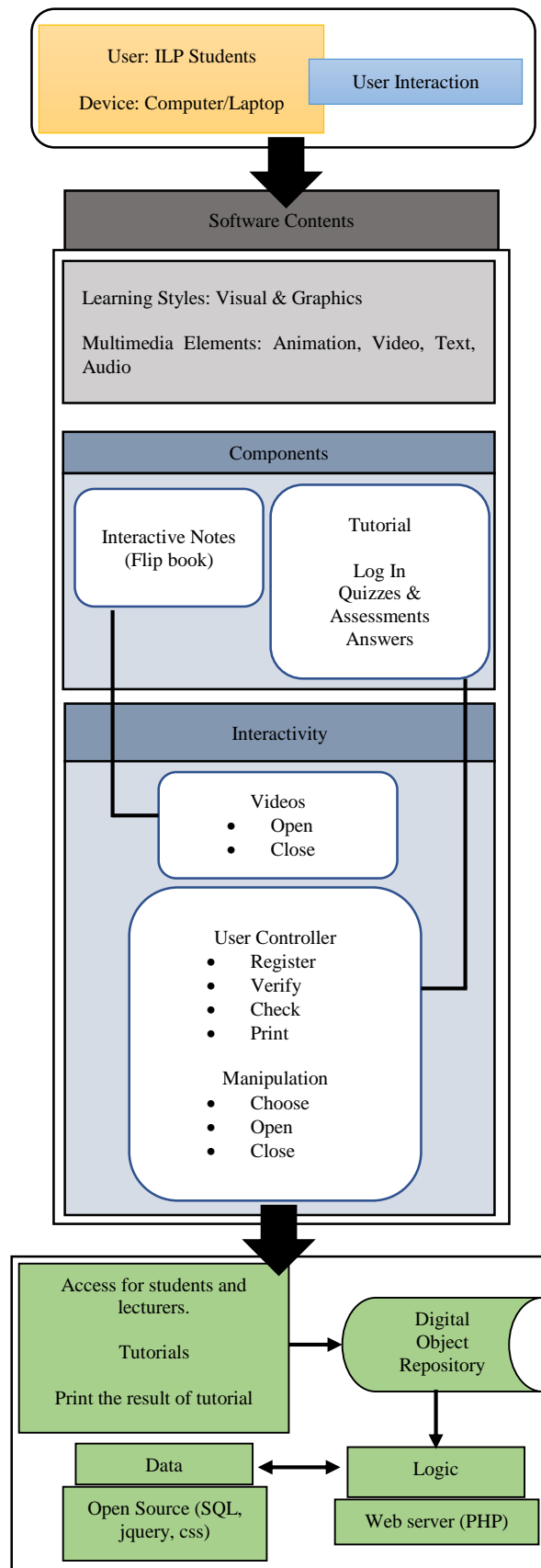| User Requirements |
| --- |
| 1. Device Used: Computer/Laptop |
| 2. User Interaction |
| 3. Learning Styles: Visual & Graphics |
| 4. Multimedia Elements: Animation, Text, Video, Audio |
| 5. Usability: Effectiveness |
| 6. User Experience: Engagement, motivation |
| 7. Activities: Quizzes & Assessments |

Fig. 2. Model of the e-Learning System for Interactive Multimedia Course (SpmiILP).

The target users of this system were the ILP students, who interactively used current technology, such as computers or laptops. The software contents of this system consisted of different learning styles: visual and graphical learning tools; multimedia elements, such as animation, video, text, and audio; and other components, such as interactive notes (Flipbook) and tutorials. This flipbook consisted of several learning materials, such as notes, videos, and animation that can enhance the learning experience using technology. The interaction between the users and the system occurred through buttons; for example, videos were provided with open and close buttons. Meanwhile, accessing the tutorials with functionalities that consisted of login, quizzes, assessments, and answers has enabled the users to choose, open, close, register, verify, check, and print the results using these buttons. PHP MySQL was the database system for SpmiILP, and HTML was used for the interface design template to develop this e-learning system.

Fig. 3 depicts the hierarchy of the e-learning system's interface design, which includes login, user ID, password, notes, upload notes, list of notes, students, registration, list of students, and quizzes.

C. Development Phase

Fig. 4 shows the interface design for the SpmiILP that ILP students use to access and study the Interactive Multimedia subject. This is the main page for student registration, and this interface consists of the main page, student registration, upload notes, interactive notes, quizzes, and results. Before logging in, the students need to obtain their user ID and password by filling in their details, such as matric number (NDP), name, gender, session, and phone number. These details are compulsory for registration, where the ID and password are set up the same as the NDP for the students. The main page of this e-Learning system consists of the main menu, notes, students' names, lists of quiz categories, quiz sections, and results.

Fig. 5 shows the feature for uploading notes in the e-learning system. This page can be accessed by both the lecturers and the students. The lecturers can upload their visual and graphical notes for teaching and learning. Instead of learning by reading notes consisting only of texts, this method could help students engage more in the learning process.
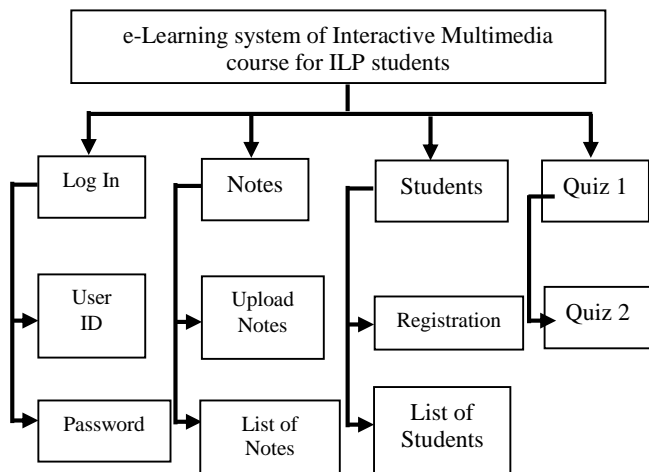
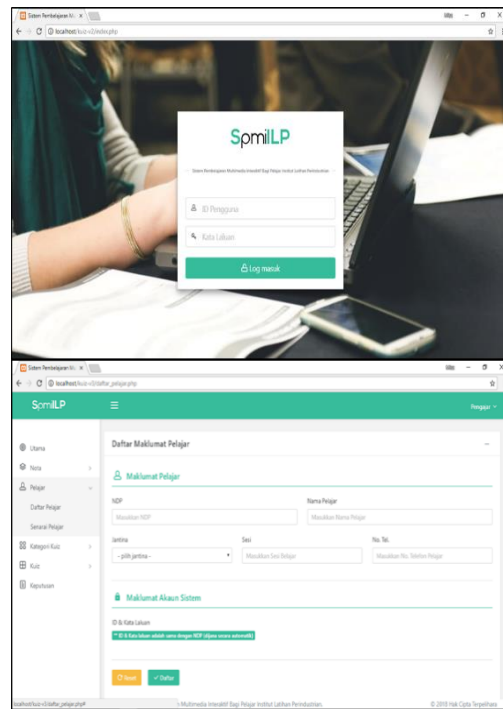

Fig. 4. Students' Registration.

Fig. 5. Features in the e-Learning System (Uploading Notes and Interactive Notes).

Fig. 3. Hierarchy of the e-Learning System Interface Design.

Fig. 6 shows the interface for the quizzes section. In this section, the lecturers can update the students' quizzes list. The quizzes section aimed to evaluate students' understanding of the subject they were learning. It can also provide lecturers with insights into students' progress. After the lecturers have finalised the quizzes, the students can answer them within the estimated time.

Fig. 7 shows the interface for quiz results. The students can check their marks after completing their quiz sessions. They would be evaluated based on their performance in answering the quizzes. The lecturers can access this page, and the students can view their grades. This feature showed the user interaction among the students through this platform. Therefore, the lecturers could use this platform to impart to their students a great deal of knowledge.

D. Implementation and Evaluation Phase

The usability of the SpmiILP was evaluated among ILP students using questionnaires. There were 24 respondents from the Interactive Multimedia class in this usability evaluation. Data are obtained from a questionnaire after respondents use the application. The questionnaires consisted of Section A and Section B, where Section A was focused on the respondents' background, as shown in Table II. Meanwhile, Section B focused on three dimensions of the usability evaluation: efficiency, functionalities, and effectiveness. Respondents' responses were based on agreement on all items based on a 5-point Likert scale; namely, 1 = strongly disagree, 2 = disagree, 3 = slightly agree, 4 = agree, and 5 = strongly agree. The usability of this system was analysed using answers scales of 4 and 5 points to get the percentage using Microsoft Excel.
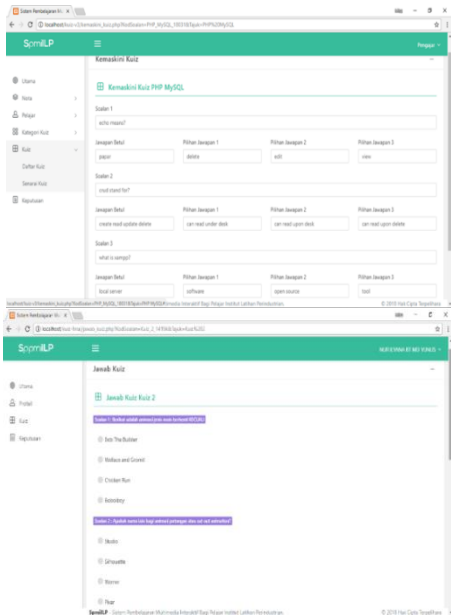

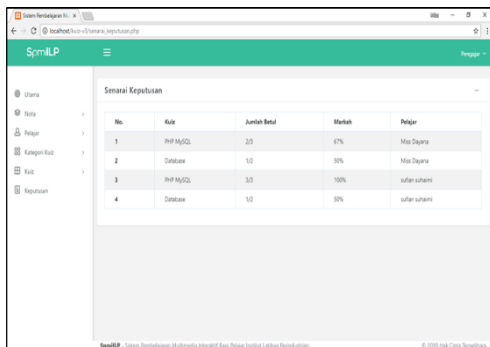Fig. 6. Features in the e-Learning System (Quizzes Section).

Fig. 7. Features in the e-Learning System (Results).

Table II shows the respondents' background in gender, age, race, education, and application usage in teaching and learning. Based on the collected data, 91% of the respondents had not used the system or other applications during the learning process. This result was troublesome because the development of technologies in Malaysia is growing rapidly, whereby the evolvement of technological innovation can enhance the teaching and learning process. Yet, these respondents have failed to take this opportunity. Therefore, there is a need to develop online learning systems or applications that could enhance the effectiveness of e-Learning and increase students' motivations. By providing the online learning platform to TVET students, they can use it to improve their communication with their educators instead of only focusing on conventional learning.

Fig. 8 shows the percentage of all items in the efficiency dimension. More than 70% of respondents answered using scales 4 and scale 5. The highest percentage was 91% of respondents who agreed with using text, graphics, audio, and videos in the system, which would engage them to learn more. This agrees with another study that reported that multimedia elements attracted the respondents to explore more of the e-Learning system (Nauman et al., 2020). Meanwhile, the lowest percentage was 77% of respondents who agreed with the notes provided. Based on the questionnaire, several problems were found, such as the bland design of the interactive notes and the size of letters that have caused difficulties in reading the notes.

TABLE II. SECTION OF QUESTIONNAIRES (BACKGROUND OF RESPONDENTS)

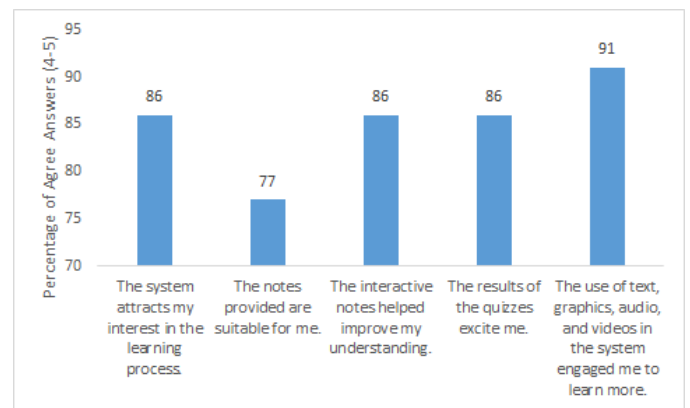| Details of Respondents	Backgrounds	Total Percentage of Respondents (%)
Gender	Man Woman	77.3 22.7
Age	18 – 20 years	100
Race	Malay Indian	95.5 4.5
Education	Certificate	100
Have/Have not used system/application in the process of teaching and learning	Yes No	9 91

Fig. 8. Efficiency Data Distribution for the e-Learning System.

Fig. 9 shows that the percentage of all items in the functionality dimension is more than 60%. The highest percentage was 91% (the system was useful for the respondents), and the lowest was 68% (the system was functional, as expected). Therefore, system functionality is the primary determinant supporting students' learning satisfaction. The ability of the system to meet users' requirements has contributed to the overall satisfaction with the system's usefulness [3].

Fig. 10 shows that the percentage of all items in the effectiveness dimension is more than 50%. The highest percentage was 91% (this system is easy to use), and the lowest percentage was 55% (I do not notice any inconsistencies when using this system). Feedback from the respondents showed that inconsistencies occur because of the unstable LAN internet network provided at ILP Kuala Langat.

Overall, the newly developed e-Learning system has helped improve students' performances in the learning process using technology. This system can be used for teaching, whereby the lecturers can upload interactive notes and evaluate the student's performance online. Using multimedia elements and interactive notes have engaged the ILP students in learning.

Fig. 9. Functionality Data Distribution for the e-Learning System.

Fig. 10. Effectiveness Data Distribution for the e-Learning System.

IV. DISCUSSION

Developing technologies as essential skills development and learning tools have proved that e-Learning is an effective learning method. The demand for adopting technology-based education, such as e-Learning, has shown an increase in a similar usage, enabling communication with the educators [14], [15]. Instead of only focusing on teaching, combining conventional and technology-based education could improve students' interests. This is because some students could face difficulties articulating their thoughts and would keep the problems to themselves. Through online learning, the educators could help these students figure out their problems [16].

The e-Learning system is an alternative learning system that the students can access online. Due to the advancement of technology, students would easily access the learning materials. The e-Learning system was developed and presented on the platform of mobile devices. Based on the preliminary study, 91% of respondents had not used the online learning system for their teaching and learning process. This has led to several problems, such as the one-way communication between the lecturer and students. The students could also lose their focus during a learning session, and the learning styles can affect their performances [7], [17]. There is a small number of studies conducted on TVET students. Students from the Z generation, or digital native generation, must change their interaction with high technology devices. The e-Learning system emphasises learning activities, social communication, activity control, notifications, file storage, and data security to help the students experience engagement and learnability from the teaching and learning process.

The intensive penetration of digital technology into everyday life has fuelled a new demand in teaching and learning. The educational materials were transformed from conventional learning's functional capabilities into online learning. Adopting online learning, in line with digital technology, can affect the student's learning styles. Their capabilities to learn through online learning have improved their motivation, whereby they could stop being worried or anxious to talk freely with the lecturers. Online learning has helped them learn effectively, whereby the combination of students' learning styles, such as active, visual, and audio, has caused them to be more engaged in the learning process [18].

Consequently, online learning has provided flexibility and mobility because the learning process does not remain at a fixed location and is accessible everywhere. Therefore, the growing outbreak of COVID-19 has forced all academic institutions to adopt online learning. All classes and examinations were cancelled; thus, the sudden shift away from learning has affected the students and lecturers [19]. In response to the significant demand for online learning, institutions of higher learning across Malaysia have provided online platforms to conduct classes and examinations. This shift showed that digital technology would help the users improve their learning motivation. In terms of teaching and learning, the Malaysian education system has changed with the remarkable rise of e-Learning undertaken remotely via digital platforms.
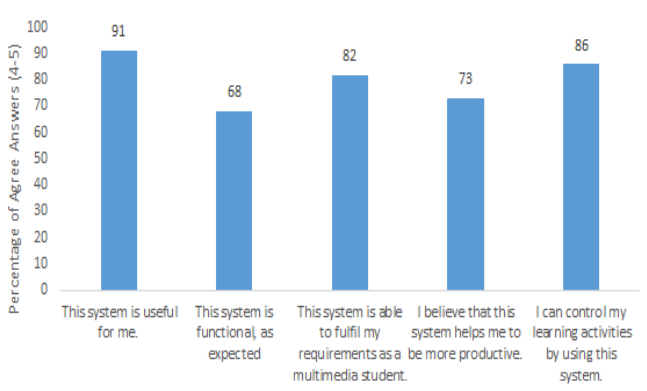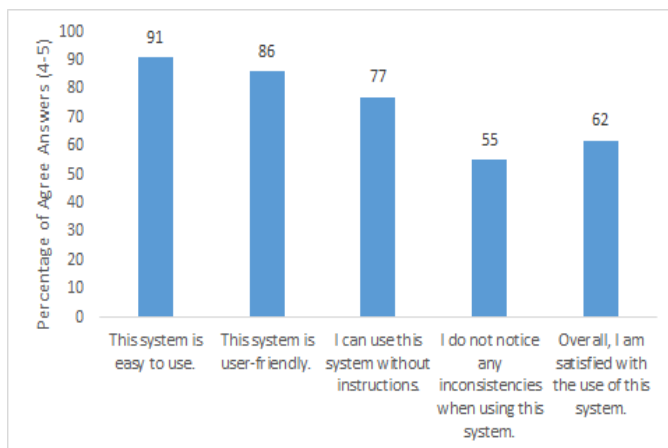
In conclusion, the e-learning system for the Interactive Multimedia subject for ILP students has enhanced their performances, motivation, and learning engagement. Different learning styles have caused them to explore various learning methods and improve communication between the lecturers and students. The developed e-learning system has shown the effectiveness and efficiency of this platform and provided functionalities that have enabled the students to access the system easily. The adaptation of the e-learning system has allowed the students to access information at anytime and anywhere. Therefore, e-learning has enhanced the abilities of students to foster the development of digital technology skills. However, the challenges faced in implementing teaching and learning still require the support of educational institutions. Embedding technologies in the classroom help in enhancing teaching and facilitating learning. Broadly, the potential to widen the access and the advancement quality of education need the adoption of technologies that will remain as challenges not only for students but educators as well.

V. CONCLUSION

The use of technology for teaching and learning has helped improve the quality of the student's performances. The rapid growth of digital technology has allowed educators to utilise various teaching techniques based on the different learning styles among students. Hence, developing the e-learning system for the Interactive Multimedia subject has improved ILP students' engagement in the learning process. The students have adapted well to the functionality and interface design of the system. Several learning techniques have encouraged the students to explore the usage of technology and improve their skills. The developed e-learning system can display teaching and learning materials through computerised digital technology. The system's main features included uploading notes, interactive notes, and quizzes for students and lecturers.

This study has found that the e-learning system has benefited the users in learning interactive multimedia subjects. The rapid growth of online learning methods was due to the advancement of learning technologies and students' needs. With the advancement of the teaching and learning method, the students showed their skills and great potential in mastering other learning methods instead of focusing on conventional learning.

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