Learner Engagement in 21st Century Technology Integrated Classrooms: A Case Study in Malaysia

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Abstract

The Covid-19 pandemic has been a catalyst in the integration of emerging technological and artificial intelligent (AI) tools in today's 21st century classrooms. Yet the question that begs to be answered is to what extent are our learners engaged with these emerging tools? Henceforth this study investigated students' perspectives of learner engagement in today's technology integrated learning environment. The study was conducted at a private university in Malaysia and utilized a convergent parallel research design of mixed methods. The quantitative data were collected from 100 students using a survey questionnaire and the findings were triangulated with qualitative data from interviews with six volunteer students. Learner engagement was conceptualized based on Moore's interaction framework which examines engagement strategies from three different perspectives namely, learner-to-learner, learner-to-instructor, and learner-to-content. Findings exhibited that students highly valued the importance of learner-to-instructor engagement strategies followed by learner-to-content with learner-to-learner recording the lowest score. Students viewed technology integrated learning environment with positivity by citing higher learner engagement with content and peers before class which has led to more interactive discussions leading to a productive learning achievement. The students highly valued the role of instructors in facilitating their online learning environment through regular postings, providing prompt and constructive feedback, and sending gentle reminders on assignment due dates. The findings of the study have implications for all stakeholders in higher education to further improve the implementation of technology integrated learning for better student learning engagement and productivity.

Keywords: Learner engagement, technology integrated classrooms, higher education

1. Introduction

There is no denying that the Age of Information coupled with the Covid-19 pandemic have been a catalyst to trigger the rapid advancements in emerging technologies in all aspects of human life including the field of education. Today's digital learning environments utilize a variety of emerging technologies that provide dynamic, creative, interactive spaces for the teaching and learning process. Likewise, generative artificial intelligence tools (AI, hereafter) offer various teaching and learning solutions such as robotics and machine learning (ML) which are evident in applications such as ChatGPT and Chatbots. Additionally, one can also opt for personalized mentors that offer tailored lessons with explanation and feedback. Currently, most higher education educational institutions are embracing 21st century classrooms that are technologically integrated. Such a move has transformed the way in which learners learn and how teachers teach. Besides teaching and learning, AI tools have automated various administrative processes such as enrolment, timetable scheduling and resource allocation. Alongside this, educational institutions are utilizing big data analysis and decision-making to customize learner needs and goals through personalized programs.

Roll and Wylie (2016) in discussing the evolution of AI in education analysed close to 47 papers and concluded that the evolution of AI can be viewed as an evolutionary process, focusing on current classroom practices, collaborating with teachers, and diversifying technologies and domains. In fact, the history of evolution of technology in education represents a compelling narrative of technological innovation and its profound impact on teaching and learning methodologies. The inception of AI in education can be traced back to the 1970s (Uppal, 2022) where initial attempts to integrate computational methods into educational processes laid the foundation for subsequent developments. Over the years, the landscape has witnessed a transformative journey, from early rule-based systems to contemporary sophisticated machine learning algorithms. Notably, recent statistics highlighted a substantial increase in the adoption of AI technologies in education, with most educational institutions incorporating AI-driven tools into their curricula (Rodway & Schepman, 2023). This historical trajectory not only reflects the relentless pursuit of optimizing educational practices but also underscores the evolving role of AI and gamification as an enabler of personalized and adaptive learning experiences. As we delve into the historical evolution, it becomes apparent that understanding the contextual nuances and challenges encountered during different phases is essential for shaping effective strategies in the integration of technology into educational frameworks, thereby harnessing its full potential for the benefit of learners and educators alike (Nor Azairiah Fatimah et al., 2023).

The current landscape of technology in education is marked by a dynamic interplay of diverse technologies that holds a significant potential for transforming traditional teaching and learning paradigms. In today's technology enhanced classrooms recent advancements in AI may include natural language processing, machine learning, and adaptive algorithms. Such technologies have facilitated the development of intelligent tutoring systems, personalized learning platforms, and data-driven educational analytics. All these emerging technologies offer both educators and students alike a spectrum of benefits that range from individualized learning experiences and real-time feedback mechanisms that cater to diverse learning needs (Norazah at al., 2024).

Despite the rapid technological advancements, the current landscape also presents challenges that require educators and policymakers to navigate the ever- evolution landscape. These challenges encompass not only the effective integration of technology in educational contexts but also call upon a comprehensive understanding of the existing technological ecosystem that has implications for teaching and learning. More importantly it also calls upon informed decision-making and ensuring the alignment of technological advancements with pedagogical goals that can boost overall educational outcomes.

With technology-integrated classrooms becoming the call of the day, a nuanced examination of the current state of teaching and learning becomes imperative and hence, the question that begs to be answered is how engaged are our students with emerging technology? Therefore, this case study aimed to examine learner engagement strategies in today's technology integrated classroom at one private institution of higher learning in Malaysia.

2. Literature Review

This review synthesizes current research on the integration of technology in classrooms, emphasizing the importance of learner engagement and interaction. It highlights the critical role that both technological tools and pedagogical strategies play in fostering a rich, interactive learning environment. The use of Moore's Interaction Theory helps clarify how these interactions can be optimized to enhance educational outcomes in the modern classroom.

2.1 Technology Integrated 21st Century Classroom

The integration of technology in 21st-century classrooms has undeniably transformed the educational landscape, offering significant benefits in terms of access to information, interactive learning, and real-time feedback. As highlighted by Ramalia and Molwele (2022), the role of digital tools in facilitating deeper engagement with content is crucial in promoting critical thinking and problem-solving skills, essential for preparing students for a technology-driven society. However, while these advantages are clear, it is important to critically examine the broader implications of technology integration in educational contexts.

While technology offers an enriched learning environment, its effectiveness hinges on how it is used. The mere presence of digital tools does not automatically guarantee enhanced learning outcomes. As Nayanika (2012) suggests, the key lies in the active use of technology to engage learners in meaningful ways, enabling them to process and construct knowledge. This implies that both the design of technology-driven lessons and the teaching strategies employed must be thoughtfully crafted to encourage genuine student engagement, rather than simply acting as supplementary tools for content delivery. Therefore, educators must be well-versed in both pedagogical strategies and technological tools to ensure that the integration is purposeful and impactful.

2.2 Learner Engagement with Technology

Learner engagement, as discussed in the literature, is a multifaceted concept that plays a critical role in influencing academic performance and the overall learning experience. Zhang (2022) suggests that engaged learners demonstrate greater motivation, better language performance, and more active interaction with peers and instructors, which collectively contribute to enhanced learning outcomes. For instance, they tend to ask questions, seek feedback, and engage in academic discourse, which further enhances their understanding of content.

Engagement can be understood through three key dimensions: behavioral, cognitive, and affective (Chapman, 2022; Mondernach, 2015). Behavioral engagement reflects active participation in academic activities, while cognitive engagement refers to the mental processes involved in learning, such as planning, monitoring, and reflection. The affective dimension captures emotional and relational aspects, focusing on students' feelings about the learning environment and their relationships with peers and instructors (Bond et al., 2020). As Anderson (2003) suggests, engagement is a precursor to interaction, and fostering engagement leads to more productive interactions in both online and traditional learning environments.

Recent research suggests that technology tools, especially AI-enhanced learning platforms, positively impact student engagement and academic performance. Boubker (2024) reports a strong correlation between AI tools and improved learning outcomes, while Kim et al., (2022) emphasize the role of technology in fostering collaborative skills and critical thinking. Moore's Interaction Theory (1993), which identifies three types of interactions—learner-to-learner, learner-to-instructor, and learner-to-content—provides a valuable framework for understanding how technology can enhance engagement in online learning environments.

2.3 Moore's Interaction Framework

Moore's Interaction Framework offers a comprehensive model for examining learner engagement across three critical interactions: learner-to-learner, learner-to-instructor, and learner-to-content. These interactions are essential for creating an engaging and supportive learning environment.

Learner-to-learner interaction, which promotes collaboration and peer learning, is particularly effective in enhancing engagement and satisfaction (Zainuddin, 2018). The learner-to-instructor interaction focuses on the importance of clear communication, feedback, and instructional support, all of which contribute to student motivation and success (Kumtepe et al., 2019). Lastly, the learner-to-content interaction emphasizes the integration of interactive and adaptive content, which helps to maintain learner interest and motivation (Kumar et al., 2021).

The interaction between these three elements is mutually reinforcing. For instance, as Vygotsky (1978) argues, social interaction plays a crucial role in cognitive development, making learner-to-learner engagement essential for knowledge construction. Additionally, the learner-to-instructor interaction is key to facilitating deeper understanding through guidance and feedback (Richardson & Swan, 2003), while learner-to-content interaction supports intellectual engagement with learning materials (Chen & Huang, 2023). These interactions collectively contribute to a rich learning experience that fosters critical thinking, problem-solving, and collaboration.

3. Research Methodology

The following section will outline the research methodology that was adopted to conduct this case study. It covers aspects in methodology such as research design, population and sampling, instrumentation and how data were collected and analysed.

3.1 Research Design

This was a case study set in a private institution of higher learning located in the Klang Valley, Malaysia. The University, referred to as University X in this study is one of the leading educational hubs in the region offering a wide range of programs ranging from foundation to postgraduate levels. This study utilised a case study approach as helps researchers to describe the phenomena been investigated and helps provide and multi-faceted understanding of the scenario (Fraenkel, Wallen and Hyun, 2022). In this study the phenomena that was investigated was learner engagement strategies in today's technology integrated classrooms. Moreover, this study employed an explanatory sequential mixed-methods design. According to Creswell and Creswell (2022), a convergent parallel research design involves the collection of both quantitative and qualitative data leading to a better understanding of the phenomena, thus providing greater credibility to the findings. In Phase One of the study the researchers collected the quantitative data via a survey questionnaire. Based on the initial findings, the researchers developed the interview protocol for Phase 2, which comprised semi-structured interviews. Utilizing the mixed methods, involving both quantitative and qualitative approaches, served to triangulate the collected data provided and this helped increase the validity and reliability of the study (Cohen, Manion and Morrison, 2018).

3.2 Population and Sampling

The population of this study involved all second-year undergraduate students in University X. Sophomores were chosen as they are familiar with tertiary education having gone through one year of study and the researchers felt they had a better understanding of the teaching and learning at University X. Likewise Year Three and final-year students were not involved as most of them could have gone for their internship posting or were working on their final year project(s).

The case study involved random sampling technique as it provided each respondent an equal and fair chance of been selected and is often viewed as a reliable and unbiased method of selecting respondents for a study (Frankel, Wallen & Hyun, 2022). Thus, the researchers randomly chose respondents from two Pure Sciences faculties (Engineering & Dentistry) and two social science faculties (Education & Business Studies) The final sample population after data cleaning involved a total of 100 respondents with 52% from the pure sciences and approximately 48 % from the social sciences.

The study involved two main sample population samples, referred to as Sample A and Sample B. Sample A comprised the 100 respondents who were required to respond to the Survey questionnaire. Sample B was a sub-sample of Sample A and involved a total of six volunteer students who agreed to

be interviewed. Three were from the Pure Sciences whilst another three were from the Social Sciences. They were coded as SPSA, SPSB, SPSC (S= Student, PS= Pure Science) and SSSA, SSSB, SSSC (S= Student, SS= Social Science).

3.3 Instrumentation

Data for this study involved both quantitative and qualitative instruments, namely a survey questionnaire and semi-structured interview protocol with university students.

The survey questionnaire comprised of three main sections. Section A examined the demographic profile of the respondents and investigated aspects such as gender, discipline of study and academic achievement based on their CGPA scores (Cumulative Grade Point Average). Section B examined respondents' engagement in using emerging technologies in their technology integrated classrooms. Here respondents were required to respond to items based on a six-point scale ranging from 1= strongly disagree and 6= Strongly Agree, and another scale for emerging technologies usage ranged from 1=never to 6=always. Section C sought to obtain respondents perceptions of learning engagement strategies based on Moore's framework which probed respondents' perceptions based on three aspects, namely, learner-to-learner, learner-to-content, and learner to- instructor. Here respondents were required to respond to items based on a six-point Likert scale ranging from,1=Very Unimportant and a score of 6=Very Important.

The survey questionnaire was validated by a panel of two experts, one experienced senior lecturer teaching research methodology to postgraduate students and a professor with more than thirty years of experience in mixed-methods research. The reliability of the questionnaire utilized Cronbach's Alpha value for all the items, and the results indicated 0.983 which indicated an "Excellent" level of reliability for the research questionnaire (Cho & Kim, 2014).

The second instrument used were semi-structured interviews with six students – three from the pure sciences whilst another three were from the social sciences. The interviews were conducted face-to-face, and audio taped with prior consent from the six participants. The interviews were transcribed and sent to participants for member checking before they were analysed.

3.4 Data Collection and Analysis

The data was collected over a period of one month. The survey questionnaire was administered via a Google Form, and the respondents were coded as follows: RPS1(R=respondent, PS = Pure Science) and RSS1 (R=respondent, SS = Social Science). The qualitative data was collected via semi-structured interviews after obtaining initial quantitative findings from the survey questionnaire.

The quantitative data collected was analysed employing SPSS Version 23 whilst the trustworthiness of the qualitative research findings examined aspects such as credibility, confirmability, and dependability. The qualitative data were analysed involving thematic analysis involving both inductive and deductive data analysis utilizing Braun and Clarke (2006) framework of thematic analysis. The interviews were recorded and transcribed automatically and after the member-checking process, the transcriptions were analysed via the NVivo (Version 12) software to identify the emerging themes.

Finally, the data collection and data analysis process were conducted keeping in mind ethical considerations. First and foremost, permission was obtained from University X and informed consent was obtained from all respondents. The anonymity of respondents was addressed as each respondent was assigned a number/pseudonym. The third aspect addressed was the issue of confidentiality as respondents were informed that all personal information will not be revealed when publishing the findings of the study. Likewise, transparency was maintained whereby honesty and integrity were strictly adhered to and the researchers ensured authentic data was collected and analysed accurately. Finally, all data collected were stored in a password encrypted laptop (Fraenkel, Wallen & Hyun, 2022).

4. Results

This study was guided by the following research questions:

1. What are students' overall perceptions of emerging technology tools employed in their learning process?
2. How do students perceive learner engagement in the technology integrated classrooms?
3. How do students perceive learner-to-learner engagement, learner-to-content engagement, and learner-to-instructor engagement?
4. Is there a significant relationship between learner-to-learner engagement, learner-to-content engagement, and learner-to-instructor engagement?

4.1 Demographic Profile of the Respondents

Based on the data presented in Table 1, it can be seen that more than half of the student respondents were females (59%) and a majority were from the pure sciences (52 %). Their academic scores ranged from a low of 2.5 to a high of above 3.5 with most of them possessing a CGPA score between 3.1 and 3.5

Table 1

Demographic profile of respondents

Items	Number	Percentage
Gender		
Male	41	41.0
Female	59	59.0
Total	100	100
Discipline of Study		
Humanities and Social Science	48	48.0
Science and Technology	52	52.0
Total	100	100
CGPA		
2.6 – 3.0	34	34.0
3.1 -3.5	35	35.0
> 3.5	31	31.0
Total	100	100

4.2 Respondents' Perceptions of Technology Tools Employed in Learning

Respondents were asked to identify some common and frequently used technology tools in their learning process. Their responses displayed in Table 2 below indicated that the most frequently employed emerging technology applications were live streaming of lessons, recorded video lectures and hybrid learning platforms. This group of students pointed out that they were involved in both asynchronous and synchronous learning. Some common technological tools that they utilised were game-based learning, open education resources and MOOCs. Most of them also indicated their involvement in mobile learning but they seldom delved into the use of virtual reality, augmented reality, immersive classrooms, and other machine learning solutions. Most of the respondents also felt that technology tools such as robotics and drones were beyond their reach and their lecturers hardly employed these emerging technologies in their classroom.

Interview sessions with six volunteers corroborated the above findings. In terms of online platforms, all the interviewees expressed that they were most familiar with Blackboard as this was official online platform utilised in University X. Likewise, they also expressed a high self-confidence level in utilising Microsoft Teams, and Microsoft OneDrive. They also expressed their familiarity with

the use of Google Sheets, Google slides and Google Forms. More importantly, all six interviewees acknowledged that mobile devices like laptops and smartphones, smartwatches etc. were like 'godsent' and they could not imagine a world without them. Respondent SPSB further added that '*today all our mobile devices like our Smartphones help us in so many ways that I would be lost without it even for a minute*!"

When queried as to what they utilised these mobile devices for, the following were some of the main responses: making calls, group meetings, video conferencing, video recording, internet browsing, watching movies, listening to lectures, webinars, and gaming. This group of six also stressed that WhatsApp is one of the main messaging applications that they used when communicating among themselves. Respondent SSSB highlighted that "WhatsApp is popular among most of us because it is free, and it is also cheaper than texting." Respondents SPSC added that

> *it is the platform where we can share and access many things like photos, our notes, our documents, etc. and I think we use it because all students have WhatsApp, and I think for many of us it is also an information sharing platform at times during group projects.*

Table 2

Emerging Technologies Used in the Online Distance Learning (n=79)

Emerging Technologies	**Mean**	**SD**
Live streaming / Streaming of live lessons.	4.54	1.466
Accessing recorded lessons	4.63	1.379
Networked professional learning	4.10	1.473
Hybrid learning	4.39	1.409
Asynchronous learning and teaching	4.03	1.485
Learning games/Game-based learning	3.48	1.724
Mobile learning	4.08	1.500
Open education resources	4.43	1.337
MOOCs	3.51	1.510
Virtual Reality (definition)	3.39	1.652
Augmented Reality (definition)	3.38	1.689
Machine learning	3.32	1.844
Immersive classroom	3.56	1.599
5G and extended connectivity	3.34	1.887
Robotics	2.87	1.835
Drones	2.84	1.836

Scale: 1=Never, 2=Rarely, 3=Seldom, 4=Sometimes, 5= Often, 6=Always

The interviewees also cited that the three most popular social networks that they were on included Facebook, Twitter and Instagram and recently some of them have embarked onto Tik Tok. They added that these social platforms "*not only help us keep in contact with our friends and I think for some of us it has become a stress-reliever during a full day of classes*" (Respondent SSSA).

Respondents were asked some of the technological tools that their lecturers used in the teaching and learning process. All of them unanimously cited the LMS- Blackboard, Microsoft Teams and Google Docs. Students also pointed out that some classes were equipped with interactive smartboards and "*this is really cool especially when we get a chance to present using the interactive Smartboard and it enhances our group presentations"* (Respondent SSSB). Another popular choice among lecturers is also the sharing of YouTube Videos and learning online via the Zoom platform. In terms of game-based learning, student respondents expressed that their lecturers often utilised Kahoot and Quizziz.

Respondents from the science and engineering disciplines highlighted that some lecturers have moved on to 3D technologies such as unidimensional and 3D technologies such as augmented and virtual realities but Respondent SPSA said that "*I have heard of holographic displays and I have not seen that in our classroom as yet, and I hope we can experience it soon in our university. . . it will make learning more fun and interesting*." Respondents SPB from the Engineering Department said that '*a few of my engineering and ICT lecturers are very techno-savvy and good in technology use and they include visual 3D computer-generated images of bridges and other buildings... it is much better than looking at static one-dimensional models. . . 3D models allow us to look at models from all angles, and this helps us better understand the topic*." To this Respondent SSSC, a pre-service teacher shared that her educational technology lecturer had introduced them to the world of Metaverse and for her it is 'gamechanger' as a future educationist. She stressed that '*in our class we can enter an immersive classroom of the future where we can express our individuality by embodying in our own avatars. . . I like this ability to be more creative, and I think it creates a wonderful engaging leaning environment*."

From the discussion above it can be seen that the though some early technological tools such as laptops, computers, LMS, YouTube video sharing are still been utilized, the teaching and learning environment in University X is beginning to change as instructors are beginning to share more emerging technologies tools such as 3D computer -generated models and providing students the experience of learning via immersive classrooms by using metaverse avatars.

4.3 Respondents' Perceptions of Learner Engagement with Technology

Research Question Two in the study examined the student respondents' perceptions of their engagement with technology and the results exhibited in Table 3 indicated that the respondents were overall positively engaged with emerging technologies in their technology integrated classrooms that were held online.

Table 3

Learner Engagement with Technology

	How do you perceive the engagement experience between instructors, students, and content in using emerging technologies in the technology integrated classroom?	**Mean**	**Median**
1	I have better engagement experience with the content.	5.04	.980
2	I make an effort to go through the content before class.	5.03	1.097
3	I have better engagement experience with other students.	4.89	1.098
4	I participate actively in discussions during an online class.	5.01	.980
5	I have a better engagement experience with the instructors.	4.73	1.151
6	I am comfortable asking questions to the instructors during online classes and through instant messaging.	4.66	1.131
7	I receive appropriate feedback on questions posed to the instructor.	4.65	1.166
8	Overall, my engagement in the classroom has been enhanced.	4.54	1.357
Total		4.53	1.049

Scale: 1=Strongly Disagree, 2=Disagree, 3=Somewhat Disagree, 4=Somewhat Agree, 5=Agree, 6=Strongly Agree

Exploring further the results indicated that respondents felt comfortable with online technology integrated lessons, and they were deeply engaged with the content (M=5.4), and they made effort to go through the content before attending class (M=5.03, SD=.09). Likewise, they also participated actively in classroom discussions (M=5.01, SD=.98) and engaged well with both peers (M=4.89, SD=.09), and with their instructors (M=4.73, SD=.15). Respondents felt that they were more comfortable asking

questions in technology integrated classrooms held online as instant messaging was quick as they obtained instant and appropriate feedback from instructors (M=4.65, SD=.35)

Though most of these findings were corroborated during the interview sessions, there were a few mixed responses from some interview participants. For instance, Respondent SPSA from the Faculty of Dentistry articulated that "*I prefer face-to-face classes as we get to see the actual patient and understand the issue better. . . I do not understand well when three dimensional figures are presented online – it is nothing like the real thing*" Likewise Respondent SSSC from the business faculty had this to add, "*Yes, I agree technology has helped us in many ways in our studies…all information is easily available on the Net and today with ChatGPT we can easily complete our assignments. . . but I think I still prefer face-to-face interaction with my friends and the lecturer, maybe I am a social being and I like talking and discussing my lessons with my instructor and peers*." However, there was one respondent (SSSA) voiced her concern as follows:

> *In my opinion with so many technology gadgets in our technology integrated classrooms, I think we are losing the human touch …but I understand the world of education is change and there are some good tools like ChatGPT to help us, this is good.*

4.4 Respondents' Perceptions of Learner Engagement Factors

Research Question Three examined the respondents' overall perceptions of learner engagement with technology regarding the following learner engagement factors: learner-to-learner engagement, learner-to-content engagement, and learner-to-instructor engagement. Table 4 below shows the overall results based on Moore's framework on the three main constructs of learner engagement. Respondents were required to respond based on a six-point Likert scale where a score of 1= very unimportant whilst a score of 6 indicated very important.

Table 4

Learner Engagement based on Moore's Framework

How important do you perceive this online engagement strategies in technology integrated online classrooms	**Mean**	**Median**
Learner to Learner	4.02	.930
Learner to Content	4.19	.859
Learner to Instructor	4.22	.821
Total	4.53	.870

Scale: 1=Very Unimportant, 6=Very Important

The results exhibited that respondents viewed all the three factors as "important" with learner to instructor been identified as the most highly valued factor (M=4.22, SD=.821) followed by learner to content (M=4.19, SD=.859), and learner to learner (M=4.02, SD=.930).

Regarding the learner-to instructor factor, most of the respondents indicated that the following engagement strategies as very important. First, they highly valued instructors who post clear and concise grading rubrics for all assignments. This was also articulated by Respondent SSSC from the Faculty of Education who stressed that "*if we all get clear rubrics for our assignment; we can do the assignment well as we will know which sections carry the highest marks*." Another two engagement strategies highly valued by respondents was the fact that their instructors create a forum/chat group for students to contact the instructor with questions about the course and the instructors post a "due date checklist" at the end of each instructional unit. Here Respondent SPSB highlighted that it was important '*that all lecturers create a forum or chat group as this will help students to contact the lecturer if we have any problem with our lessons. I think lecturers who have WhatsApp groups with their students are often well liked by the students as we can get immediate answers to our questions and problems in learning*." To this participant SSSB from the Faculty of Education stressed that "*it is good if instructors send us gentle reminders on the due date of our assignments because we take so many courses and sometimes, we forget the due date for some assignments.*" Respondent SPSC added that, "*I like if our lecturers can*

post some tips and materials to help us with our assignments." Another highly valued engagement strategy voiced by other respondents was that discussions in technology-integrated lessons should be better structured with guiding questions and/or prompts to deepen their understanding of the content. Other engagement strategies that respondents viewed as important were that instructors should provide feedback and present content using various technology mediums such as audio, video, and visuals. Respondents also valued instructors' postings and sending regular announcement or emails on latest information.

The second important engagement factor that respondents viewed as important was the learner-to-content factor. Here respondents highlighted that technology integrated classrooms and lessons allowed students to interact with content in more than one format (e.g., text, video, interactive games, and simulations). For example, Respondent SPSB from the Faculty of Engineering highlighted that "*I love the use of emerging technologies in our teaching and learning process. . . Today we can get to see buildings and models from all angles, and this is something text cannot help us. I can now go and visit models and buildings all over the globe and technology today helps me better understand my subject.*" Likewise, respondents also stressed that with various formats of content available online they have the option to resource and explore each topic in greater depth. Another engagement strategy valued by respondents with regards to content was the fact that students can now use self-tests to evaluate their own understanding of a topic. This was well articulated by Respondent SSSA who stressed that '*with technology today I can attempt online tests before my examination, and this helps me better prepare for my examination at the end of the semester. I can also self-evaluate myself on each topic in the course."* Respondents also highly valued technology that provided content online and allowed them to work on realistic scenarios to apply content in aspects such as case studies reports and presentations.

In terms of learner-to-learner engagement strategies, respondents highly valued their ability to work collaboratively using online communication tools to complete group projects and reports. This was reiterated by Respondent SPSB during the interview session as she stressed that '*with technology today we have opportunities to meet online and discuss our group work, and this helps us a lot as we do not have to go and meet on campus*.' They also interact with their peers through presentations both asynchronously and synchronously with the many available technological tools and learning management systems (LMS). Additionally, students also had the option to post audio and video files in threaded discussions instead of only written responses. Respondent SSSA stated that with technology integrated classrooms and lessons she was also able to discuss and moderate her own discussion assignments. She further added that technology has also given students "*the choice in selecting and sharing relevant materials and articles that can help stimulate better discussion among group members… and this helps everyone to better in doing their assignments.*" Nonetheless some respondents (SPSC and SSSB) felt that interaction between learners and content was not very successful as some students are 'unwilling to share' whilst some are passive and do not 'contribute to the group discussion.'

4.5 Relationship Among Learner Engagement Factors

Research Question Four examined the relationship among the three learner engagement factors, namely learner-to-learner engagement, learner-to-content engagement, and learner-to-instructor engagement. The results are presented in Table 5.

Table 5

Relationship between learner-to-learner engagement, learner-to-content engagement, and learner-to-instructor engagement

		LLE	LIE	LCE
LLE	Pearson Correlation	1	.803**	.830**
	Sig. (2-tailed)		.000	.000
	N	100	100	100
LIE	Pearson Correlation	.803**	1	.812**
	Sig. (2-tailed)	.000		.000
	N	100	100	100

LCE	Pearson Correlation	.830**	.812**	1
	Sig. (2-tailed)	.000	.000	
	N	100	100	100

LLE= learner-to-learner engagement; LIE= learner-to-instructor engagement; LSE= learner-to-content engagement
**. Correlation is significant at the 0.01 level (2-tailed).

Based on the findings in Table 5, the result showed a strong, positive and very significant relationship between learner-to-learner engagement with learner-to-instructor engagement (r=.803**, p=0.000). Meanwhile, the relationship between learner-to-learner engagement with learner-to-instructor engagement (r=.830**, p=0.000) was also strong and very significant. Other than that, a strong and very significant relationship was also found between learner-to-instructor engagement with learner-to-content engagement (r=.812**, p=0.000).

5. Discussion

The findings of this study revealed that students overall held a positive perception of emerging technologies in their technology-integrated classrooms that were held online. Similarly, a study conducted by Kulal and Nayak (2020) revealed that students are comfortable with online classes integrating technology. However, they do not believe that it can replace traditional face-to-face teaching. In addition, their findings also highlighted that technical issues are one of the main challenges in effectively conducting technology integrated online classes.

Besides that, further analysis indicated that students somewhat agree that they have a better engagement experience with the content, participate actively in discussions during an online class, and engage better with both peers and instructors in their technology-integrated class. In a similar vein, Schindler et al., (2017) emphasized that students agree that technology-integrated online classes allow them to participate in higher-order thinking, enhance communication, engage in collaborative problem-solving activities and discussions, critically reflect on content, and expand digital competencies. Additionally, in terms of the learner engagement factors, the students felt that all the factors (learner-to-learner, learner-to-content and learner-to-instructor) were important though a majority felt that the emotional and social ability to interact face-to-face with instructors and peers was equally important. Likewise, Hollister et al., (2022) reiterated that the lack of peer connection and technological issues seem to be critical problems for students during online learning and could contribute to students' issues with engagement.

In this study, it was also revealed that the learner-to-instructor factor was rated as the most highly valued factor. Martin and Bolliger (2018) found in their mixed methods study that students particularly felt that timely instructor feedback was the most important and it should be detailed, personalized, and constructive. Moreover, in the online technology integrated class, several students needed the instructor to be responsive and supportive, thus demonstrating the importance of the learner-to-instructor relationship.

In terms of the relationship among the learner engagement factors, it was revealed that there was a strong and significant relationship between learner-to-learner engagement with learner-to-instructor engagement, as well as learner-to-learner engagement with learner-to-instructor engagement, and learner-to-instructor engagement with learner-to-content engagement.

6. Conclusion

The findings of this study have both theoretical and practical contributions. Theoretically, the findings of this study have indicated the strong and very significant relationship between the three main components of learner engagement, namely learner-instructor, learner-content, and learner-learner interaction. More importantly, the findings have reiterated that though technology-integrated classrooms are the near future, learners still highly value learner-instructor engagement over learner-content and learner-learner engagement. This finding underscores the facilitative role that the instructors play despite the rapid advancements in technology and generative AI tools that are readily

available to our learners at their fingertips. The guidance, motivation, the human touch and the socio-affective domain that instructors bring to the teaching and learning equation cannot be underestimated in all learning environments including today's technology-integrated classrooms (Chin et al., 2023).

So, with artificial intelligence (AI), virtual reality (VR) and augmented reality (AR) alongside other wireless technology devices knocking on our classroom doors, instructors today need to be knowledgeable and well-equipped with latest technological educational tools whilst maintaining the human touch and understanding the psychological well-being of the students. Besides that, they also need to embrace more innovative and engaging teaching methodologies to sustain learner engagement in the ever-evolving technology-integrated learning environments.

7. Co-Author Contribution

The first, third, fourth and sixth co-authors were responsible for writing the literature review, research methodology, and findings of the study. The second and fifth co-authors were responsible for putting the paper together, enhancing the writing, and overseeing its overall flow and coherence. All authors were responsible for data collection, analyses, and proofreading of the article.

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