



# Chapter 17

## Online Learning Using Game Design: The Architecture Student Experience

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### ABSTRACT

*This chapter reviews students' online learning experiences in an architecture module: designing a game as the learning outcome. This game design approach uses constructionism theory to analyze the learning process acquired by the students. The study employs a quantitative method. An online survey was used to collect data from a batch of undergraduate architecture students enrolled in a technical module offered online. Most students reported they had a meaningful learning experience. However, the students felt that online learning did not promote successful peer interaction, which is critical for peer learning. The results from this study indicated students preferred to develop better interaction with other students, which is an essential component of learning in architecture education-peer learning. The findings revealed that this pedagogical method could improve architecture students' learning experience and engagement. The findings provide insight on online learning platforms that might change teaching and learning after the pandemic.*

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## INTRODUCTION

COVID-19 is arguably one of the most disruptive pandemics in recent years to afflict our societies and higher education. The spread of COVID-19 has forced millions of students and teachers to move their communication online. In March 2020, the Malaysian government implemented multiple measures to contain the Covid-19 pandemic, culminating in the execution of the Movement Control Order (MCO). The Movement Control Order was rolled out on 18 March 2020, requiring the closure of all businesses except those providing essential services and items. The order was enforced more strictly over time, which led to significant improvement in compliance (Tang, 2022). MCO caused significant disruption to higher education in all universities and higher education institutions. As a result, education has changed dramatically with the phenomenal rise of e-learning, whereby teaching is undertaken remotely and on digital platforms.

In the case of Private Higher Education institutions, the transition of teaching and learning from current practice to online learning is smooth and successful because all modules have practiced implementation of online learning, contributing to at least 30% of the class conduct. The problem was the student engagement when teaching and learning a module were done 100% online.

### Online Learning

Online learning or e-learning can be defined in several ways. It can be defined in terms of its associated technology used to deliver it, its delivery system, and the communication form and pattern (Sangrà et al., 2012). Online learning can happen through the internet, either asynchronously or synchronously. In both types, delivering the content of a course online will enable the students to join and follow the course regardless of geographic restrictions. However, in contrast to the asynchronous type, the synchronous type engages students in real-time face-to-face online meetings (Ibrahim et al., 2020). Other types of online learning include blended/hybrid, asynchronous/synchronous, and multi-modal. Blended/ hybrid is a combined in-class and asynchronously online delivery with a substantial portion of the course delivered online. Blended synchronous is a combination of face-to-face and synchronously online classes. Multi-modal combines synchronous and asynchronous online learning in one course (R. Mukhopadhyay & K. Mukhopadhyay, 2020).

According to Parthasarathy et al. (2009), the virtual classroom is an innovative and unique learning environment that imitates the physical classroom. Still, it is entirely independent of physical classrooms, and the teaching-learning process and evaluation are achieved through networked computers and information systems. They describe the features of virtual classrooms as integrating two/more classrooms with communication technology and making available lecture videos with the help of information technology will replace the knowledge level repetitions. Transmitting the lecture from one location to multiple locations at the same time, as well as maintaining a lecture video repository with edited lectures and discussions, will help to avoid repeating the same lecture many times in the future and will allow for more sharing of ideas among teachers and learners rather than repeating the fundamentals.

A virtual classroom environment ensures human connection, a vital element of classroom teaching that video-on-demand courses don't have and sorely miss. In a virtual classroom, teachers interact with students in real-time; students can voice their questions and interact with peers like in a regular classroom, albeit over the internet (Sam, 2020). Virtual classrooms are also synchronous as learners and teachers appear online simultaneously to facilitate immediate interactions. However, virtual classrooms also use

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pre-recorded components such as videos, presentations, and lecture slides to facilitate learning, much like physical classrooms.

Broadfoot and Bennett (2003), writing about establishing online contemporary architecture design studios, asserted that institutions must structure online design studios differently than other online courses. The online or virtual studio ideally involves a 'community' rather than isolated, one-on-one communication. It seems unique in aspiring to facilitate the creative process within a web-based environment and to deliver online education to students of a discipline based on a relatively loosely structured mode of teaching and learning. Online studios are now an increasingly attractive alternative to traditional studio teaching. They identified and collated four conditions for an effective studio being:- 1) Learning by doing must be a central concept to the studio, as the fundamental concepts of designing, 2) One-to-one dialogue between teacher and student is considered essential, 3) Collaborative context for teaching and learning is another vital element for effective design studios and 4) Process-focus is a central concept to an effective design studio. They indirectly highlight the complexity of online learning that must be addressed for architecture students' learning environment.

### **Student Learning and Engagement in Online Environment**

Many researchers advocate the online-learning environment and describe the many benefits of learning that this mode provides. According to Li and Lalani (2020), some research shows that, on average, students retain 25-60% more material when learning online compared to only 8-10% in a classroom, primarily due to the students being able to learn faster online. Online learning requires 40-60% less time than in a traditional classroom setting because students can learn at their own pace, going back and re-reading, skipping, or accelerating through concepts they choose. Golden et al. (2006) said that most researchers felt that e-learning had helped learners become more effective at creating visual presentations, presenting written work, and researching topics. More specifically, lecturers who used e-learning to support a learner-centred approach tended to consider that learners used e-learning more for independent learning and were more effective as independent learners due to e-learning. Petrides (2002) conducted a qualitative study on students' perspectives on online learning and found that they tend to think more deeply about subjects when responding in writing than verbally. Another student said online technology allowed more reflection than face-to-face classroom discussion. Vonderwell (2003) interviewed 22 students concerning their perceptions of their asynchronous online learning experiences. Some participants expressed that the asynchronous environment allowed them to write carefully about their ideas. Petrides (2002) also reported that the students found it easier to work in collaborative groups in an online course since there was no less need to rearrange everyone's schedule. In addition to flexibility with time, choices related to the learning experience were also reported as positive.

Architecture studies rely heavily on face-to-face interaction and collaboration in the studio. It is challenging to instill the e-learning phase that needs careful consideration of teaching and learning pedagogy, content, and mode for e-learning purposes. The study was conducted by Lane et al. (2015) to explore the differences between the student's perceptions of their learning through different modes of engagement, especially the differences between online (digital) and traditional (face-to-face) modes. The students are undertaking a Master of Architecture from a large Australian University. Generally, the students in this study held reasonably negative attitudes towards the capacity for engagement and learning opportunities from the online delivery methods in the blended learning environments. Of the online initiatives, the online discussion was rated as the least successful approach, at only 2.6, while a

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video assignment was rated 2.8 and weekly blog posts 3.3. From the perspective of learning assistance, student sentiment can best be summarized by this student, “I find live lectures easier to learn from than online content only”. Indeed, traditional methods were favored more than those conducted remotely online. There is, however, enough variation in student responses to suggest that the reasons behind this poor attitude to online learning may be many and complex; and could also relate to the nature of the existing architectural pedagogical practice.

According to Majumdar (2003), computer-supported collaborative learning is an emerging phenomenon of online education that provides a framework to bring individual learners together to achieve a shared learning goal by managing their learning processes. Online approaches have provided many tools and environments for implementing instructional techniques that address students’ independent or creative thinking. Petrides (2002) also reported that students found it easier to work in collaborative groups in an online course since there was no less need to rearrange everyone’s schedule.

According to Howland and Moore (2002), the communication between students and between students and instructors was a critical issue. The absence of face-to-face interaction between students and instructors contributed to the negative perceptions of many students. Students felt unconfident in guidance when instructor feedback was delayed. Howland and Moore’s (2002) study found that many students reported it was difficult to get clarification on assignments or coursework due to a lack of communication between students and instructors. The general perception of student communication was also negative. Other weaknesses reported by learners in their online learning experiences included a lack of a sense of online community and feelings of isolation. Vonderwell (2003) claimed that online learning participants lacked connection with the instructor, especially in “one-on-one” relationships. Woods (2002), in his study on the online communication between instructor and learner, reported that online learners reported feeling isolated from faculty and other learners in the online courses they had taken. Petride’s (2002) study on learners’ perspectives on web-based learning also reported that some participants felt a lack of immediacy in responses in the online context compared to what could typically occur in a structured face-to-face class discussion. This appears to be especially obvious in asynchronous online discussions when students must wait for others to read and respond to their postings or e-mail messages.

Technology plays a crucial role in online learning. Used to support both teaching and learning, technology infuses classrooms with digital learning tools, such as computers and handheld devices; expands course offerings, experiences, and learning materials; supports learning, builds 21st-century skills; increases student engagement and motivation; and accelerates learning. Using suitable technology can engage students in online learning, particularly in recent times. Oslen (2007) suggests integrating multiple technology features into online courses to engage students, such as multimedia, chats, simulators, role-playing activities, images, live virtual classrooms, streaming media, audio, and video. Technology can be used effectively to provide a platform to build connections, communication, and opportunity to achieve learning goals that should be functional and user-friendly (Palloff & Pratt, 2007). In another study, Kuong (2015) suggests adopting appropriate technology to plan and conduct activities for a successful online learning experience for students with different learning preferences.

Moving online is challenging but not impossible among traditional courses such as architecture that must meet accreditation requirements by boards such as National Architectural Accrediting Board (NAAB) which accredits professional degrees in architecture from institutions (Ockert, 2020). The author also urged the universities to force the accreditation board to change, as they are removed from the universities on the front lines. The architectural profession will also need to change to face this and the subsequent global crisis, climate change caused mainly by the built environment. Ockert (2020) suggests

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that the move to online learning during the pandemic offers architecture schools the opportunity to redefine the learning experience. “Great teaching can happen through any medium,” the author concludes. It will be a matter of adapting and inventing new methods and tools” and, on the negative side, “perhaps even changing out educators who cannot adapt to meet these new challenges” during this pandemic. Architecture studies, students, and lecturers were thrown into virtual classrooms by force. The lecturers now must use all the e-learning knowledge and experiences and re-think the teaching and learning of architecture students in a virtual classroom. The known technique to capture the student’s engagement and always succeed with a high level of engagement is mimicking the studio. Thus, the lecturers have chosen collaborative game design to assess learning outcomes for this module.

### **Collaborative Learning and Online Education**

Architecture teaching and learning have a high level of collaborative projects. Many studies have shown group work promotes the development of communication skills and students’ personal growth. Therefore, the social and intellectual outcomes of learning in groups are essential to architectural design education in developing skills needed for the professional industry. In collaborative learning, students work in groups of two or more to collectively seek comprehension, solutions, or meanings or to create something. Ismail and Soliman (2010) said that learning in a group promotes individual accountability toward a common team goal and success, which affect and encourage success and motivation among other group members. Akhrif et al. (2019) highlighted that the main challenge is to integrate and stimulate a learner’s participation to share knowledge, integrate each student in the learning process, and develop communication and collaborative skills within a team of learners. While Afacan (2012) concluded that the quality of learning in group work could be maximized through wanting to learn, needing to learn, learning by doing, learning through feedback, and coming to conclusions. Gunasagaran et al. (2001) reported that Architecture students prefer cooperative/collaborative learning provided that the distribution of work is fair. Their study proves that architecture students had successful learning outcomes through project-based learning. These views of researchers were done during the traditional teaching and learning approach.

Golden et al. (2006) reported similarities between lecturers’ use of e-learning and their perceptions of its impact on learners. According to them, most lecturers felt that e-learning had helped learners become more effective at creating visual presentations, presenting written work, and researching topics. Seven out of ten thought e-learning helped learners more effectively reinforce their knowledge. Half felt that learners engaged more effectively with the subject in the classroom, and nearly half felt that learner motivation had increased because of e-learning. E-learning was less widely noted to have made learners more effective in collaborating with their peers either inside or outside the classroom.

According to Majumdar (2003), teaching designers using online collaborative learning must integrate increased group work, work-based learning, and problem solving to encourage higher-order thinking. If the design of online courses incorporates the desired changes in pedagogical dimensions, the difference between training on the web and traditional methods could be profound.

### **Serious Game Design as Pedagogy**

The studio is still the dominant environment of architectural practice. It is also the dominant environment of architectural education. The term “studio” has come to refer to both a physical space in which architecture is practiced and a mode or style of educational engagement, which includes the physical

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space, the types of activities and assessment, the authentic project-based tasks, and the teacher/student relationship (Lane et al., 2015).

Architectural education is an area that has not responded quickly to opportunities afforded by new technologies used and as Computer-Aided Drawing, Simulation for energy and visual form and for designing. Studio learning through action is an investigative and creative process driven by research, exploration, experimentation, making and constructing, and critique and reflection. Design thinking is the core creative process for any designer. It is structured around a series of in-depth case studies of outstanding and expert designers at work, interwoven with overviews and analyses (Cross, 2011).

The game design analogy is a practical conceptual framework for design learning, we argue here, because of its robustness as both a theory of design-thinking and a heuristic representation through which design discourse and practice may be subjected to playful yet critical scrutiny (Scriver & Wyeld, 2003). Designing can thus be said to be game-like in at least two ways: (1) as a form of an exploratory play within and upon the rule-like bounds of convictions and conventions about the supposed object or end-product of such designing (e.g. “house”, “hospital”, “mosque”, etc.); and (2) as a further sub-set of rule-like tendencies that we might call a “style of play” or, to refer to one of our earlier definitions for “

A serious game is a game that can be used in a serious game design context, such as education. It is an applied game designed for a primary purpose other than pure entertainment. It is used to impart skills, knowledge, and attitude or to deliver information using the fun elements to engage understanding of its fields and theories: game design, learning theories, and domain content. This intrinsic approach ensures that domain content and game are naturally embedded or tied. It consists of integrating the domain content into game structure and rules, where the gameplay represents the learning content necessary for game goal achievement. As the game is interesting, the content becomes interesting. It is considered a good approach to creating a better serious game design by starting with a blank board and making the domain content the centre of the design process; it may target serious game design with more. The intrinsic game design leads to freedom in learning content design.

A study by Woodbury et al. (2001) documented a formal evaluation of their practise of gameplay in learning in early tertiary design education and reported positive effects on architecture students’ confidence and self-assessed competence with form-making. More importantly, the group containing the previously underperforming students achieved a higher overall mean score than the other group.

Using a Serious Game Design project is an innovative solution for fully online learning and student engagement in this technical module. Serious Game Design” can engage students in learning and help them understand module content through creative experimentation and design. The serious game design allows students to explore and understand information using fun and engaging elements.

## **Theory of Constructionism**

Game design and learning are grounded in constructionism. Constructionism, as a theory, refers to learning, where learners create socially meaningful artefacts (Ackerman, 2001). Constructionism highlights the importance of learning to learn and making things. Learning is necessarily situated and pragmatic. In other words, the situated nature of constructionism lets “individuals develop their ways of thinking in given situations and nonetheless remain excellent at what they do” (as cited in Papert and Harel, 1991).

Ackerman (2001) highlights 3 aspects of Papert’s constructionism. 1) In the role external aids are meant to play at higher levels of a person’s development, 2) In the types of external aids, or media, studied (Papert focuses on digital media and computer-based technologies), and 3) In the learner’s initiative in

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designing her own “objects to think with.” While Stager (2005) shared eight big ideas behind Seymour Papert’s Constructionist Learning Lab as creating contexts for productive learning: 1) learning by doing, 2) technology as a building material, 3) hard fun, 4) learning to learn, 5) taking time – the proper time for the job, 6) you can’t get it right without getting it wrong, 7) do unto ourselves what we do unto our students, and 8) we are entering a digital world where knowing about digital technology is as important. These researchers’ works are also efforts to distinguish between constructionism and constructivism theories. Constructivism and “modern” teaching methods such as group projects, discovery learning, and active tasks are not synonymous (Ben-Ari, 2001). These methods are favoured by constructivists only if they enable the students to build a viable mental model based on pre-existing knowledge. Constructivists have different ideas about how important the individual learner and the group are in building knowledge. These ideas are called radical constructivism and social constructivism, respectively.

In constructivist classrooms, there are project-based learnings, problem-generation and problem-solving approaches, and inquiry-based activities where students generate driving questions, generate potential solutions and dig into investigations. As a facilitator, educator, and co-investigator, the teacher’s role is critical. Constructivism takes advantage of the student’s natural interest in the world and how things work. Respect for their current knowledge and real-world experience motivates their participation. Their hypotheses and methods of investigation are respected and refined.

In this project, students create ‘the educational game’ to create awareness of Sustainable Development Goals (SDG) and targets among the public. Constructionist gaming approaches, namely, those approaches in which games are designed by students (rather than professionals) for learning benefits. In designing educational games, the students employ academic content knowledge skills such as sustainability to create practical games intended first and foremost for their peers/public rather than tutors. Learning in this context is a constructive process, which encompasses aspects of collaborative learning in which knowledge creation emerges through discussion and negotiation between individuals and groups.

### **Problem Statement**

Students constantly reported dissatisfaction and unpleasant experiences from their prior online learning experiences. Despite 80% of course content offered by Higher Education Institutions (HEIs) being delivered online complained about the classes they had taken. Some complaints were not engaging, lack of assistance from the instructor, and inability to follow the class (Allen & Seaman, 2003). According to Keengwe et al. (2008), technological sophistication alone does not guarantee pedagogical effectiveness. Although online education represents a different form of course delivery, it is subject to the same need for monitoring and assessment as traditional forms of instruction (Greener, 2008). Educators are concerned about the quality of student learning (Armstrong, 2011).

Additionally, Warschauer (2007) called for more research on students’ perceptions of technology in their education to understand how faculty refine their teaching pedagogy to improve the student learning experience. Kearns (2012) confirmed the lack of research in this area for investigations on the types and distribution of assessments that are used that contributed to students’ academic success in an online course” (p. 3). Kuo et al. (2013), in support of the call for more research, stated that student satisfaction, perceptions of learning experiences, and perceived value of a course should be investigated (p. 17). There is much research on online and student learning; however, limited studies have investigated the students’ learning experiences in architecture courses, particularly in the local context. Therefore, this

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study aimed to examine the students learning experience and performance in an assessment designed in an online architecture course offered entirely online.

### **Research Questions**

Answers to the following research questions were sought in this study.

1. What was the students overall learning experience in the online architecture module?
2. What was the students learning experience with the module's online delivery, curriculum, and assessment?
3. What was the student's experience with online learning platforms or technology?
4. How do students perceive their interactions with the instructors and other students in online courses?

### **MATERIALS AND METHODS**

This study used a quantitative method. An online survey was used to collect data from a batch of undergraduate architecture students enrolled in a technical module offered online. The survey was conducted to gather information on students' online learning experience during the MCO period due to the COVID-19 pandemic. This study does not seek to generalise the findings from the case but to provide an in-depth understanding of the students' perception in one online class.

The module content was delivered through the university-hosted online learning platforms such as Teams, Zoom, Google Drive, and the University's interactive Learning Management System (LMS), which is explicitly designed to support teaching and learning materials activities. The module included both synchronous and asynchronous online learning. The majority of the lectures in the module were pre-recorded with activities to ensure students went through the lectures. The asynchronous sessions (recorded lectures) allow students time to deliberate and reflect before asking questions during the discussion or tutorial sessions. Meanwhile, Synchronous online learning was adopted for tutorial sessions. During the tutorials (synchronous), online learning instructors and the students engaged with the course content simultaneously (but from different locations). During the tutorial sessions, the instructors interact with students using tools such as Zoom and Teams. The synchronous (live) learning was used to guide students in completing their assignments and through presentations and discussions.

### **Survey Instrument**

This quantitative study used survey questionnaires to collect data from the student population. Fraenkel et al. (2012) suggest that survey research allows researchers to summarise the findings of characteristics with different groups to evaluate respondents' beliefs and attitudes. A questionnaire was used to collect data from 67 students enrolled in a private university's online undergraduate architecture module. The questionnaire consisted of two sections. Section A contains the personal information or background of students. This section had four questions on their study level, current and prior learning engagement modes, and modules they have completed in their study. Section B of the questionnaire had a total of twenty-three (23) items to measure students' online learning experience, particularly associated with delivery, curriculum and assessment, technology or platforms used for online learning, and interaction



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with the instructors and peers during the COVID-19. In this section of the questionnaire, students were asked to indicate their level of agreement with each statement using a five-point Likert scale (1-strongly disagree and 5-strongly agree).

### **Participants**

The population sample for this study was all students who took an online architecture module. A total of 67 students enrolled in the module. The students were semester 2 students who had completed a few modules via face-to-face mode in prior semesters, including their foundation studies. Within the semester, the students were also enrolled in two (2) other online modules. However, the students were requested to consider their learning experience in the technical module in answering the survey questions.

### **Data Collection**

The online survey was conveniently shared among the students via google. Data were collected at the end of the semester for two (2) days. The instructors conducted an online briefing covering the study's purpose and the process of completing the questionnaire, such as what the students or participants were expected to do. The same information was also provided with the online survey instrument. The students completed the survey within the two days allotted.

### **Data Analysis**

The collected data were analyzed using descriptive statistics. The descriptive statistics results are presented in frequencies to understand the students' perceptions of online learning and interactions with instructors and peers. This provides insights into the online teaching and learning used in teaching a technical module in the undergraduate architecture programme during the COVID-19 pandemic in 2020.

## **FINDINGS AND DISCUSSION**

This study aimed to investigate the students' learning experience in an assessment designed for an online architecture course. The teaching and learning in this module were changed from face-to-face to entirely online due to Movement Control Order (MCO) during COVID-19. Additionally, specific assessment using serious game design was adapted to increase and improve engagement and online learning experience. Students' perceptions of online learning based on their own experiences were examined.

The findings of this study are grouped and explained according to the three (3) components of online engagement and learning experience associated with i) delivery, curriculum, and assessment (serious game design), ii) technology or platforms used, and iii) interaction with the instructors and peers.

Table 1 below shows the descriptive statistics of the student's self-reported outcomes of their online learning experience. For discussion and analysis, the scale of strongly agree (SA) and agree (A) will be summed up, likewise for the disagree (D) and strongly disagree (SD) scales. The study measured the three (3) components of online learning - i) delivery, curriculum, and assessment, ii) technology, and iii) interaction with the instructors and peers.

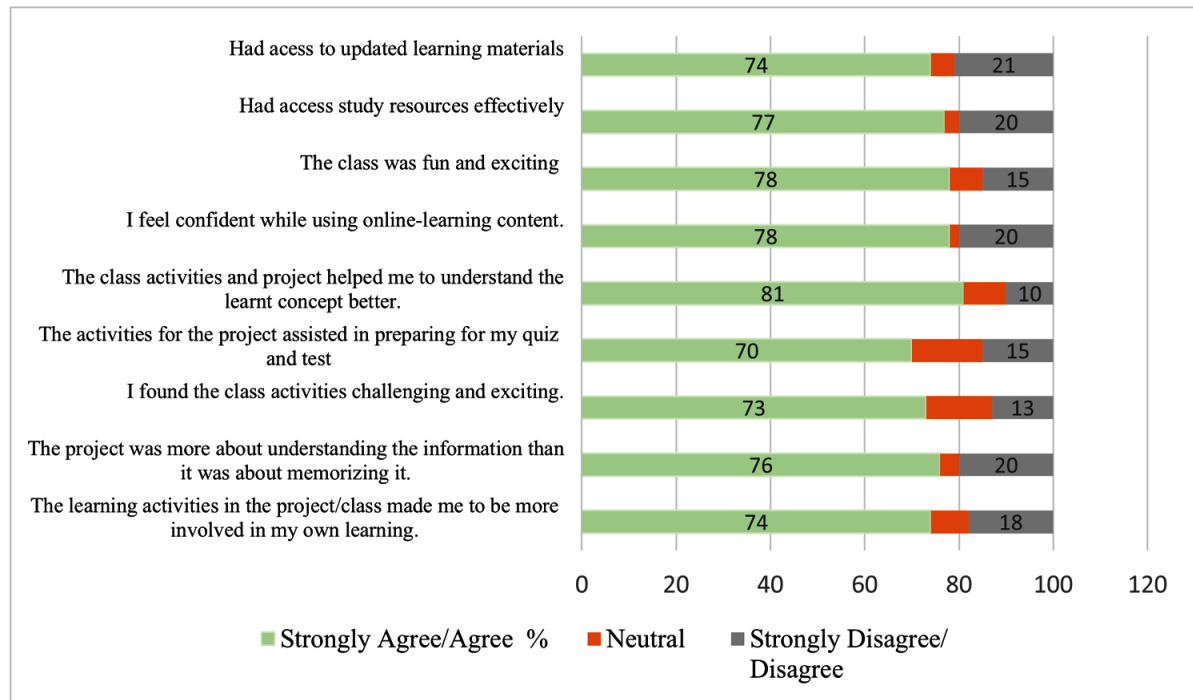
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Findings of the study reveal that the majority of the students (72%) agreed (SA/A) that overall, they had a meaningful learning experience with the module (see table 1). This result contradicts Lane et al. (2015), who suggested that the students negatively responded to online learning engagement in architecture courses. It should be noted, however, that in this study, students were not asked to compare their face-to-face learning experience with the online learning experience. Clark (2002) argues that the quality of the designed content influences the effectiveness of online learning. The author suggests that the content of e-learning should be more “meaningful, distinct, vivid, organized and personal” (p. 601) to increase students’ knowledge retention. Within the first component - delivery, curriculum, and assessment- most (81%) of the students reported that the online class activities and projects helped them understand the learned concept better (see table 2 and Figure 1). This could be due to the class and project activities requiring the students to conduct online research associated with the recorded or live lectures. Project activities required them to explore current local and global issues and goals, which can be found easily on the websites. This finding corroborates Petrides’s (2002) and Vonderwell’s (2003) studies, which suggest that online learning promotes student reflection, deeper thinking, and more involvement in their learning.

Following that, most of the students (75%) agreed with the online learning activities where they were more involved in their learning (engaging), and the project (serious game design) allowed them to understand the learned concept better without memorizing it. About 73% of the students found the class activities challenging and exciting. However, only 70% of them agreed that they understood how the activities designed for the project assisted in preparing for my quiz and test; this was the lowest scored item in this component. Some students enjoy the technique and the type of project without understanding how it relates to the module’s learning outcomes or the topics learned. Most students (78%) found the online module fun and engaging, felt confident using online-learning content, and had adequate access to the resources because most of the resources were made available on various platforms such as Moodle, Teams, and Google Drive. Most students (74%) reported that uploaded online learning materials were updated efficiently. Generally, the students were satisfied with the curriculum, delivery, and engaging project and class activities.

*Table 1. Students’ Overall Perception of Online Learning Experience*

Item	Description	Strongly Agree/Agree	Neutral	Strongly Disagree/Disagree
		%		
22	Overall, I had a meaningful learning experience with the module	72	3	25

**Online Learning Using Game Design***Figure 1. Online learning experience: Delivery, curriculum and assessment, technology, and interaction**Table 2.*

Item	Description	Strongly Agree/Agree	Neutral	Strongly Disagree/Disagree
		%		
	<i>Delivery, curriculum, and assessment (9)</i>			
1	The learning activities in the project/class made me more involved in my learning.	74	8	18
2	The project was more about understanding the information than memorising it.	76	4	20
3	I found the class activities challenging and exciting.	73	14	13
4	The activities for the project allowed me to explore and understand how ideas are connected.	70	15	15
5	The class activities and projects helped me to understand the learned concept better.	81	9	10
6	I feel confident while using online-learning content.	78	2	20
7	The class was fun and exciting	78	7	15
8	Had access study resources effectively	77	3	20
9	Had access to updated learning materials	74	5	21

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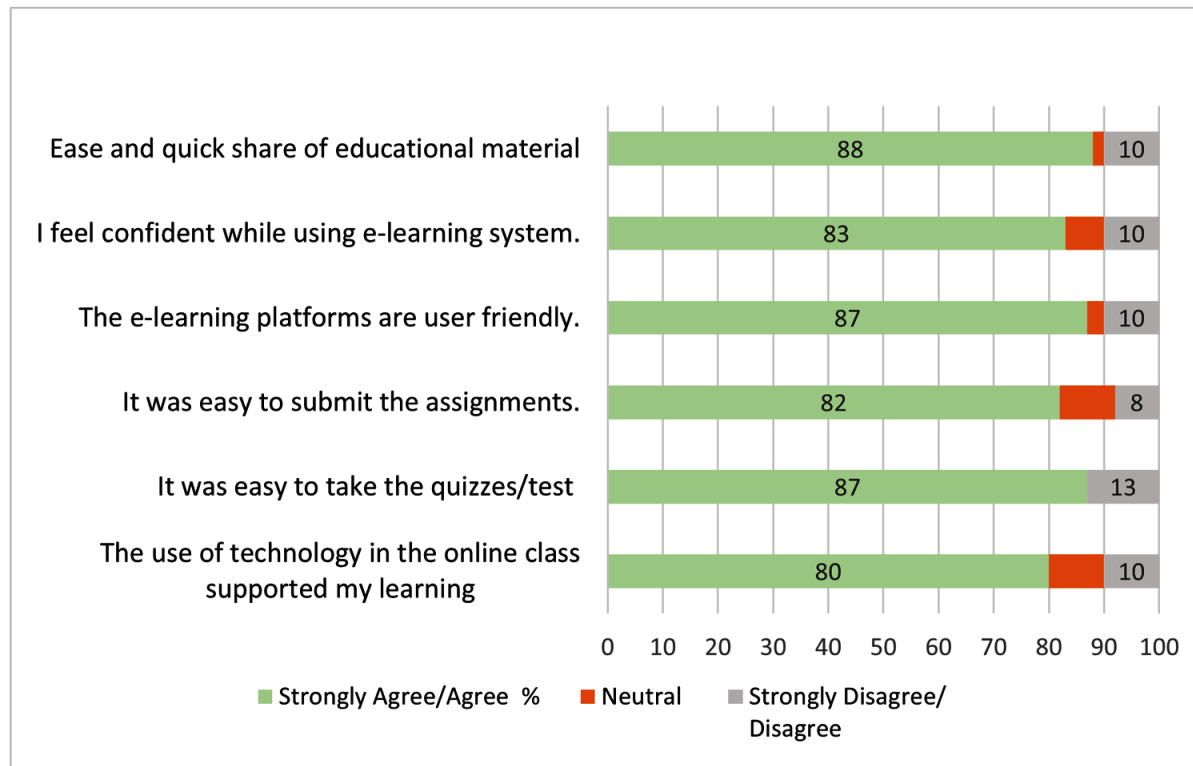
Table 2. Continued

Item	Description	Strongly Agree/ Agree	Neutral	Strongly Disagree/ Disagree
		%		
	<b><i>Technology or platforms used (7)</i></b>			
10	Ease and quick share of educational material	77	6	17
11	The use of technology in the online class supported my learning	80	10	10
12	It was easy to take the quizzes/test	87	0	13
13	It was easy to submit the assignments.	82	10	8
14	The e-learning platforms are user-friendly.	87	3	10
15	I feel confident while using the e-learning system.	83	7	10
16	Ease and quick share of educational material	88	2	10
	<b><i>Interaction with the instructors and peers. (5)</i></b>			
17	I was able to work within a group and intergroup with my peers	72	7	21
18	I was able to communicate and discuss my lessons with my tutor	78	7	15
19	It was easy to participate in group discussions.	72	3	25
20	The instructor facilitated discussions in the course.	80	3	17
21	Improved collaboration and interactivity among students	66	2	32
22	Overall, I had a meaningful learning experience with the course.	72	3	25

The study findings to research question 3 – students' experience with online learning platforms or technology revealed that the majority of the students (above 80%) had a very positive learning experience with the technology component of online learning (see figure 2). This high level of agreement could be because the module used various platforms such as Zoom, Teams Moodle, Whatsapp, Google Forms, and Google drive in delivering and assessing the curriculum. The students also explored technology associated with game design to develop manual and digital game designs. The various technologies adapted in the module facilitated the communication and interaction among lecturers and students and students with students. This conquers Oslen's (2007) suggestion to integrate multiple technology features into online courses to engage students, such as multimedia, chats, simulators, role-playing activities, images, live virtual classrooms, streaming media, audio, and video, etc. However, it is important to note that technology should be functional and user-friendly to provide a platform to build connections, communication, and opportunity to achieve learning goals (Palloff & Pratt, 2007). Among all the items measured under this component, the ease of use of technology to share educational materials was agreed (SA/A) with the most significant number of students (88%), who also agreed (SA/A) that the technologies used were user-friendly, allowing them to submit their work and take their test online easily. The varied technologies employed in the online module allowed users (students) to explore their preferred technology. This conquers Kuong's (2015) suggestion to use appropriate technology to plan and conduct activities for a successful online learning experience for students with different learning preferences.

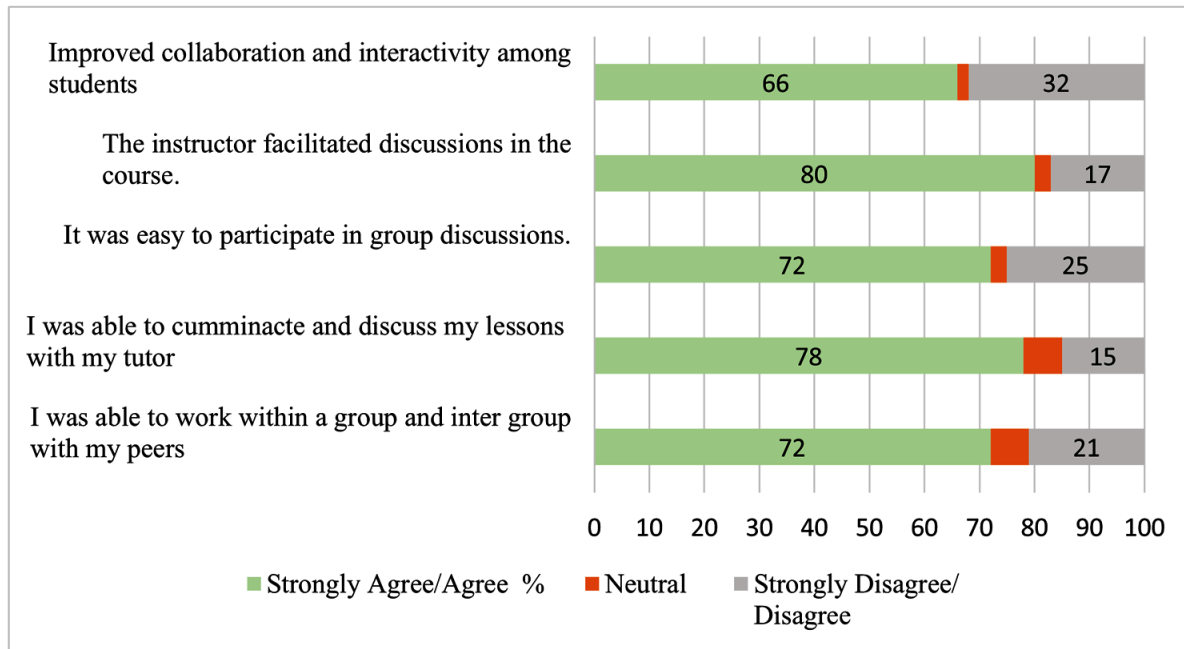
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Figure 2. Students' online learning experience with the technologies used.



Compared to the first two (2) components, a lower percentage agreed (SA/A) that online learning facilitated their interaction or collaboration (see figure 3). The items in this component measured how the students perceived their interactions with peers and instructors. The study findings show that the students (78% and 80%) had better interaction with the instructors than their peers (72%). Only about 66% of the students agreed (SA/A) that the online learning mode improved student collaboration and interactivity. The results on student-instructor interaction contradicted Howland and Moore (2002) and Vonderwell (2003), who suggested a lack of interaction with instructors reported by students. However, the lack of student interaction with their peers is congruent with Woods (2002) and Petrides (2002), who reported similar dissatisfaction among students in the online learning environment. The student interacts with the instructors during the scheduled time, which explains the difference in the level of agreement. Any interaction beyond class hours is limited, mainly through text messages (Whatsapp). However, the student not only has to interact with their peers during class hours but also outside of class hours to complete their group assignments.

In some cases, some students may not be able to participate actively and contribute through online platforms. This shows to ensure students' interaction with their peers is improved and effective, the instructor can consider including peer interaction or collaboration using break-out rooms during class hours. Conrad and Donaldson (2011) pointed out that one should not "assume that learners know how to interact online and how to become more responsible for their online learning" (p. x). Instructors are responsible for facilitating learners' development of necessary skills to engage with the content and fellow students. It is suggested to engage in learning using activities (Kuong, 2015).

**Online Learning Using Game Design***Figure 3. Students' online learning experience: Interaction with the instructors and peers.***CONCLUSION**

The study was implemented as an assessment of a particular private University's undergraduate student satisfaction in architecture education online learning of a technical module that adopted a serious game design project. Therefore, results from this study are not generalizable to all students in architecture education or other courses.

The study revealed that most students reported they had a meaningful learning experience. The students appreciated the technology and how it eased their learning, particularly in accessing the learning materials, completing their tests or quiz, and submitting their assessments. The variety of technologies and online study materials used supported their online learning. However, the students felt that online learning did not promote successful peer interaction, which is very useful for peer learning. In online learning, students preferred peer interaction, collaboration, and instructor support (Tu & McIssac, 2002). The results from this study indicated students preferred to develop better interaction with other students, which is an essential component of learning in architecture education.

Based on the results of this study, the shortcomings of online learning at the undergraduate level, particularly in the context of interaction or collaboration among peers (student to student). Those students who reported high satisfaction with the delivery, curriculum, assessment, and technology also reported that online learning did not accommodate and promote peer interaction. The data suggests that this is due to the impersonal nature of the architecture programme itself.

However, this shows that there is scope for improvement. As each student has different needs and constraints, it is necessary to view how the online learning environment can be made to support peer interaction. Scholars in the field of online teaching have proposed some possible solutions to the above issues. Brindley et al. (2009) advocate fostering learner relationships and a sense of community to

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encourage students to form early relationships with their peers to build on these relationships in group work and improve interaction and collaboration. To accomplish this, the authors recommend that instructors model, discuss, and reinforce key elements to forming successful learning communities, such as informality, familiarity, honesty, openness, passion, dialogue, rapport, empathy, trust, authenticity, disclosure, humor, and diversity of opinions (as cited in Chapman et al. 2005). It is also suggested to engage students in online learning using group activities that require them to work together to complete the activities. Therefore, the goal is to plan and implement appropriate activities to provide students with a successful online learning experience. The study suggests that future studies may explore potential solutions to issues identified with new features to promote interaction and foster learning in the course.

## **REFERENCES**

- Ackermann, E. (2001). Piaget's constructivism, Papert's constructionism: What's the difference. *Future of Learning Group Publication*, 5(3), 438.
- Afacan, Y. (2012). Investigating the effects of group working in studying interior architecture. *Procedia: Social and Behavioral Sciences*, 51, 506–511. doi:10.1016/j.sbspro.2012.08.197
- Akhrif, O., Benfares, C., El Idrissi, Y. E. B., & Hmina, N. (2019). Smart collaborative learning: A recommended building team approach. *International Journal of Smart Security Technologies*, 6(2), 52–66. doi:10.4018/IJSST.2019070103
- Allen, I. E., & Seaman, J. (2013). *Changing course: Ten years of tracking online education in the United State*. Pearson.
- Armstrong, D. (2011). Students' perceptions of online learning and instructional tools: A qualitative study of undergraduate students' use of online tools. *The Turkish Online Journal of Educational Technology*, 10(3), 222–226.
- Ben-Ari, M. (2001). Constructivism in computer science education. *Journal of Computers in Mathematics and Science Teaching*, 20(1), 45–73.
- Brindley, J. E., Blaschke, L. M., & Walti, C. (2009). Creating effective collaborative learning groups in an online environment. *International Review of Research in Open and Distributed Learning*, 10(3). Advance online publication. doi:10.19173/irrodl.v10i3.675
- Broadfoot, O., & Bennett, R. (2003). Design studios: online. In *Apple University consortium academic and developers conference proceedings 2003* (pp. 9-21). Academic Press.
- Clark, D. (2002). Psychological myths in e-learning. *Medical Teacher*, 24(6), 598–604. doi:10.1080/0142159021000063916 PMID:12623452
- Conrad, R., & Donaldson, J. (2011). *Engaging the Online Learner: Activities and Resources for Creative Instruction (Jossey-Bass guides to online teaching and learning)*. Jossey Bass Inc.
- Cross, N. (2011). *Design thinking: Understanding how designers think and work*. Berg. doi:10.5040/9781474293884

**Online Learning Using Game Design**

- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (Vol. 7). McGraw-hill.
- Golden, S., McCrone, T., Walker, M., & Rudd, P. (2006). Impact of e-learning in further education: Survey of scale and breadth. *National Foundation for Educational Research: Research Report, 745*, 1–91.
- Greener, S. L. (2008). Self-aware and self-directed: Student conceptions of blended learning. *Journal of Online Learning and Teaching, 4*(2), 243–253.
- Gunasagaran, S., Mari, T. S., Kuppusamy, S., Srirangam, S., & Mohamed, M. R. (2021). Partnership of Learning Construction Through Model Making: Case Study or Designing? In *Transforming Curriculum Through Teacher-Learner Partnerships* (pp. 285-305). IGI Global.
- Howland, J. L., & Moore, J. L. (2002). Student perceptions as distance learners in Internet-based courses. *Distance Education, 23*(2), 183–195. doi:10.1080/0158791022000009196
- Ibrahim, A. F., Attia, A. S., Asma’M, B., & Ali, H. H. (2021). Evaluation of the online teaching of architectural design and basic design courses case study: College of Architecture at JUST, Jordan. *Ain Shams Engineering Journal, 12*(2), 2345–2353. doi:10.1016/j.asej.2020.10.006
- Ismail, A. M., & Soliman, M. H. (2010). Integrating multi-grade collaborative learning pedagogy into design studios. *Archnet-IJAR: International Journal of Architectural Research, 4*(2/3), 201.
- Kearns, L. R. (2012). Student assessment in online learning: Challenges and effective practices. *Journal of Online Learning and Teaching, 8*(3), 198–208.
- Keengwe, J., Onchwari, G., & Wachira, P. (2008). Computer technology integration and student learning: Barriers and promise. *Journal of Science Education and Technology, 17*(6), 560–565. doi:10.1007/10956-008-9123-5
- Kuo, Y. C., Walker, A. E., Belland, B. R., & Schroder, K. E. (2013). A predictive study of student satisfaction in online education programs. *International Review of Research in Open and Distributed Learning, 14*(1), 16–39. doi:10.19173/irrodl.v14i1.1338
- Kuong, H. C. (2015). Enhancing online learning experience: From learners’ perspective. *Procedia: Social and Behavioral Sciences, 191*, 1002–1005. doi:10.1016/j.sbspro.2015.04.403
- Lane, M., Osborne, L., & Crowther, P. (2015). A blended learning approach to the teaching of professional practice in architecture. *Education Sciences, 5*(2), 166–178. doi:10.3390/educsci5020166
- Li, C., & Lalani, F. (2020). *The COVID-19 pandemic has changed education forever. This is how*. World Economic Forum. Retrieved 29 August 2021, from <https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/>
- Majumdar, S. (2003). Pedagogical Framework for Online Learning. *Vocational Training: European Journal, 28*, 21–30.
- Mukhopadhyay, B. R., & Mukhopadhyay, B. K. (2020). *COVID-19 and ‘zoom’ for remote teaching: Enhancing student engagement*. The Sentinel, Post-Editorial.



### **Online Learning Using Game Design**

Ockert, D. (2020). *What Coronavirus Can Teach Architecture Schools About Virtual Learning*. ArchDaily. Retrieved 14 March 2021, from <https://www.archdaily.com/938784/what-coronavirus-can-teach-architecture-schools-about-virtual-learning>

Olsen, H. M. B. (2007). *Considerations for delivery of online professional development for childcare professionals* [Doctoral dissertation]. University of Northern Iowa.

Palloff, R. M., & Pratt, K. (2007). *Building online learning communities: Effective strategies for the virtual classroom*. John Wiley & Sons.

Parthasarathy, M., Ananthasayanam, R., & Ravi, R. (2009). Virtual Classroom: Architecture and Its Future in Educational Institutions. *Journal of Science Education and Technology*, 4(3), 34–40.

Petrides, L. A. (2002). Web-based technologies for distributed (or distance) learning: Creating learning-centered educational experiences in the higher education classroom. *International Journal of Instructional Media*, 29(1), 69.

Sam, A. (2020). *What Is A Virtual Classroom And Why Is It The Future Of Online Learning?* <https://elearningindustry.com/virtual-classroom-why-future-online-learning>

Sangrà, A., Vlachopoulos, D., & Cabrera, N. (2012). Building an inclusive definition of e-learning: An approach to the conceptual framework. *International Review of Research in Open and Distributed Learning*, 13(2), 145–159. doi:10.19173/irrodl.v13i2.1161

Scriver, P., & Wyeld, T. (2003). Exploring Architectural Discourse and Form through Game-like On-Line Learning Strategies. *International Journal of Design Computing*.

Stager, G. (2005, August). Papertian constructionism and the design of productive contexts for learning. In Proc. of EuroLogo (pp. 43-53). Academic Press.

Tang, K. H. D. (2022). Movement control as an effective measure against Covid-19 spread in Malaysia: An overview. *Journal of Public Health*, 30(3), 583–586. doi:10.1007/10389-020-01316-w PMID:32837842

Tu, C. H., & McIsaac, M. (2002). The relationship of social presence and interaction in online classes. *American Journal of Distance Education*, 16(3), 131–150. doi:10.1207/S15389286AJDE1603\_2

Vonderwell, S. (2003). An examination of asynchronous communication experiences and perspectives of students in an online course: A case study. *The Internet and Higher Education*, 6(1), 77–90. doi:10.1016/S1096-7516(02)00164-1

Warschauer, M. (2006). *Laptops and literacy: Learning in the wireless classroom*. Teachers College Press.

Woodbury, R. F., Shannon, S. J., & Radford, A. D. (2001). Games in early design education. In *Computer aided architectural design futures 2001* (pp. 201–214). Springer. doi:10.1007/978-94-010-0868-6\_16

Woods, R. H. Jr. (2002). How much communication is enough in online courses? Exploring the relationship between frequency of instructor-initiated personal email and learners' perceptions of and participation in online learning. *International Journal of Instructional Media*, 29(4), 377.

## *Online Learning Using Game Design*

### **KEY TERMS AND DEFINITIONS**

**Architecture Programme:** A multidisciplinary field of studies that encompasses the creative, scientific, and technical aspects of the process of designing the built environment for human habitation.

**Collaborative Learning:** An educational approach involving joint intellectual effort where students work in groups of two or more, mutually searching for understanding, solutions, or meanings, or creating a product.

**Constructionism:** A learning theory, where learners create socially meaningful artefacts, highlights the importance of learning to learn and making things.

**Movement Control Order:** Restrictions on movement, assembly, and international travel and the closure of business, industry, government, and educational institutions to curb disease spread.

**Online Learning:** A learning method of education whereby students learn in a fully virtual environment using the technology to deliver it. It happens through the internet, either asynchronously or synchronously.

**Serious Game Design:** An applied game designed for a primary purpose other than pure entertainment used to impart skills, knowledge, and attitude or to deliver information using fun elements to engage understanding of its fields and theories.

**Student Engagement:** The degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation they must learn and progress in their education.