INTERNATIONAL JOURNAL OF CREATIVE MULTIMEDIA

International Journal of Creative Multimedia

Aim and Scope

The International Journal of Creative Multimedia (IJCM) is a peer-reviewed open-access journal devoted to publish research papers in all fields of creative multimedia, including Digital Learning, Film & Animation, Media, Arts & Technology and Visual Design & Communication. It aims to provide an international forum for the exchange of ideas and findings from researchers across different cultures, and encourages research on the impact of social, cultural and technological factors on creative multimedia theory and practice. It also seeks to promote the transfer of knowledge between professionals in academia and industry by emphasising research where results are of interest or applicable to creative multimedia practices. We welcome all kinds of papers that connect academic researches with practical and industrial context in the field of creative multimedia. The scope of the IJCM is in the broad areas of Creative Multimedia following the five major thematic streams, includes but not limited to:

- Digital Learning
- Media, Arts & Technology
- Games and Virtual Reality
- Cinema and Film Studies
- Animation and Visual Effects
- Visual Design and Communication

Foreword from Digital Learning Editorial Team

Greetings from the Editors and welcome to the Special Issue on Digital Learning in the 21st century. In this Issue, we present papers from international and local researchers focusing on research papers in areas of education technology, learning analytics, e-learning, engineering, IT, business and management, creative multimedia and many other domains that seek to improve the learning process of the learner with technologies. These papers were presented in the ELITE 2019 International Conference held in Multimedia University, Cyberjaya, Malaysia on October 2, 2019, in conjunction with the 2019 IDE4TE International Exhibition on Oct 1, 2019. Themed, "Empowering Learning, Innovating Teaching Environments", this event showcased best practices of Malaysian Universities, particularly from the network of Industry Driven Education Alliance (GLU iDE4) comprising of Universiti Teknologi Petronas (UTP), Universiti Multimedia (MMU), Universiti Tenaga Nasional (UNITEN) and Universiti Kuala Lumpur (UniKL), as well as from international presenters from China, India, Bangladesh and Maldives.

The papers presented in this Special Issue centred around 5 sub-themes; 1) Innovative Pedagogies & Instructional Design, 2) New Roles of Teachers, 3) Redesigning Curriculum for Education 4.0, 4) Emerging Technologies In The Classroom, and 5) Designing Learning Spaces for 21st Century Education, and are very timely articles for readers interested in adapting technology in today's classrooms. We hope that these papers will provide further insight and contributions to the knowledge base in these fields and we hope you enjoy reading them.

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Professor Dr. Neo Mai is the Director for Academic Development for Excellence in Programmes and Teaching (ADEPT) for Multimedia University, and Professor in the Faculty of Creative Multimedia, and the Institute for Digital Education and Learning (IDEAL). Prof. Mai is the Director of the award-winning MILE Research lab and founding Chairperson form the CAMELOT (Centre for Adaptive Multimedia, Education and Learning cOntent Technologies) Research Centre. Prof. Mai's research interests are in the design of constructivist learning environments, micro-learning, team-based learning and web-based education. She was the recipient of the 2014 Excellent Researcher Award, an AKEPT Certified Trainer for Interactive Lectures (Level 1, 2, 3), an HRDF certified trainer and is certified in Team-Based Learning from the Team-Based Learning Collaborative, USA.

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Dr. Gan Chin Lay is a Senior Lecturer affiliated with the Faculty of Business, Multimedia University. Her main research interest is in learning analytics, particularly related to technology-enhanced student-centered learning environments. Her research domains include teaching and learning issues such as student engagement, and educational technology integration frameworks.

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Dr. Liew Tze Wei is a Senior Lecturer at the Faculty of Business, Multimedia University, Malaysia. He is leading the Human-Centric Technology Interaction Special Interest Group, in addition to serving as the collaboration & innovation coordinator and research & innovation committee member in the faculty. His research interests and contributions fall within learning sciences, human-computer interaction, and media psychology; with a strong focus on experimental research approach.

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Collaborative Learning Tools for Constructive Learning in Maldives

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Abstract

Collaborative student work has taken a stronghold in higher educational contexts due to the paradigm shift from instructor-centered to student-centered teaching and learning. Instructor roles have shifted towards facilitation and students have become more active in their learning, creating and sharing knowledge within their social groups. The availability of online tools enabling peer collaboration has been the main driving force behind this progress. These online collaborative learning environments have been particularly useful for geographically distributed learners with limited opportunities for face-to-face collaboration. With the evidence from literature, this has proven to be applicable to Maldives, with its unique geography of 1190 islands distributed over 20 atolls, with students across the country in executing constructive learning approaches in Maldives. However, evidence from studies are required to support on the effectiveness from student's perception, and the impacts of the tools in learning.

Keywords Constructive learning; Maldives; Collaborative learning tools; Wiki; Padlet

Introduction

Education in the 20th century, is witnessing a paradigm shift in learning especially in higher education institutions with a shift towards student-centred learning (Aguti, Walters, & Wills, 2014) as opposed to instructor-centred, stemming from the belief that knowledge is considered as a social construct which is facilitated by peer interaction, evaluation, and cooperation (Lee & Bonk, 2014). This shift is referred as collaborative learning where instructional methods encouraging learners to work together on academic tasks

are being used (Lee & Bonk, 2014). The theoretical framework of collaborative learning is reinforced by the theory of constructivism which considers students as active learners and take more responsibility for their own learning (Yueh, Huang, & Chang, 2015).

In collaborative learning, students work in groups, teaming with peers, equally searching for understanding solutions and meanings, or creating products (Yueh, Huang, & Chang, 2015). Collaborative learning also involves engaging individuals as a group member to facilitate learning, which results in the concept of sharing meanings and build group cognition supported by constructivism (Yueh, Huang, & Chang, 2015). Since instructions shift from an instructor-centred to a more learner-centred paradigm, a learner-centred personalised learning environments needs to be created in collaborative learning (Lee & Bonk, 2014).

With reference to Sigala (2007), Lee & Bonk (2014) states that learner-centred personalised learning environments have been accelerated by the advent and application of Web 2.0 technologies. This provided favourable tools for performing collaborative work where students can share, negotiate, and discuss among themselves asynchronously outside the class (Li, 2015). The collaborative learning tools include communicational tools allowing synchronous and asynchronous text, voice or video chat as well as online spaces facilitating brainstorming, document editing, and remote presentation of topics (Mallon & Bernsten, 2015). The availability of these tools further accelerates collaborative learning as a popular method of engaging students (Mallon & Bernsten, 2015).

Furthermore, collaborative learning tools available over the internet offered new ways of real collaboration which serve as a solution to the fact that physical collaboration between students is often limited by location and time constraints (Duarte et al., 2014). Due to its geography, collaboration among students in dispersed locations is a challenge faced by higher educational institutes of Maldives. Moreover, the dispersed nature raises further issues which increases the need for collaborative learning tools in implement constructive learning in Maldives. Even many industries use collaborative tools as a bridge for the interactions among multinational teams that are globally distributed (Esparragoza & Ocampo, 2015).

This paper proposes the use of collaborative learning technological tools as a solution to the barriers in practicing constructive learning through collaboration in higher education in Maldives. Two tools; Wiki and Padlet, which are proven to be effective collaborative tools are suggested among many.

Literature Review

Constructive Learning

Constructivism is an educational theory in which students conceptualise their own ideas with the help of hands-on activity-based teaching and learning (Keengwe, Onchwari & Agamba, 2014). These activities must occur within a social context where there are possibilities for engagement or interaction among all the participants of the learning community. Constructivists learning environments are designed to incite the kind of thoughtful engagement helping students to develop effective thinking skills as well as attitudes that result in effective problem solving and critical thinking. This provokes a student-centred approach where students are expected to be active learners and take responsibilities for their own learning experience (Keengwe, Onchwari & Agamba, 2014). By talking, listening, writing, reading, and reflecting on content, ideas, issues and concerns, students construct their own meaning and helps to foster creativity (Aguti, Walters & Wills, 2014). Similarly, students are considered to create connections between facts, ideas and processes through dialogue between teacher and students, and students with their peers making learning a dynamic process and highly social initiative which requires constant development of human relationships and communication (Aguti, Walters & Wills, 2014). Thus, "constructivist pedagogy conceptualizes learning as an active and manipulative activity that encourages constructive and reflective thinking that results in creating collaboration and a conversational atmosphere" (Keengwe, Onchwari & Agamba, 2014). So, instead of transmitting knowledge, the primary role of a teacher in constructive learning is to be a facilitator who is responsible in providing a learning environment for the learners that allows collaboration through mediating, modelling and coaching. (Keengwe, Onchwari & Agamba, 2014).

Collaborative Learning Tools

"Collaborative learning tools are a set of tools used for task-specific collaborations which are associated with goal and work-oriented activities." (Cheung & Vogel, 2013) These tools provide ample number of possibilities for content creation, editing, and sharing by bringing functionalities of desktop applications to a Web Browser. The availability of online collaboration tools allows communities of common interest to share content and commentary via online participation with wikis, discussion forums, and through different file formats that can be shared or edited online (Cheung & Vogel, 2013). Among these tools includes Wiki and Padlet.

"Wiki is a type of Web 2.0 technology which enables users to work together on the web" (Hadjerrouit, 2014). Wiki helps in providing a workspace to generate ideas and share it; to construct, edit, and preserve

shared knowledge in an open environment where it can readily be accessed (Kear, Donelan, & Williams, 2014). On a Wiki, any community member can freely edit, delete, and modify content as Wikis are collaborative websites involving the collective works of multiple authors who together gain knowledge through the collaborative efforts (Yueh, Huang & Chang, 2015). Wikis have three main functions in facilitating collaboration:

(a)   Editing function: many users can create and modify articles, texts or documents.

(b)   History function: all the editing is recorded which helps in monitoring.

(c)   Discussion page: enables users to post comments and explanation enabling asynchronous learning.

"Padlet provides a free, multimedia-friendly wall which can be used to encourage real-time, whole-class participation and assessment" (Fuchs, 2014). Padlet provides similar experience of collecting ideas from whole class by writing on sticky notes and pasting those on a wall, online. It works on different devices and need not require participants to create accounts (Fuchs, 2014). In Padlet, everything happens in real time which allows everyone viewing the wall to see what is going on immediately (Atwood, 2014).

Geography of Maldives

Maldives is a low-lying island country in the Indian Ocean (Geography of Maldives, n.d.) where the islands are just 7.8 ft. above sea level (Maldives, n.d.). It is 717 km from Sri Lanka and 430 km from India and covers an area of 90000 square kilometres southwest of Sri Lanka with 1192 islands dispersed all over.

There is a lagoon or sea in between the islands making every island individual and separate from other islands. Maldives is considered and archipelago of islands – meaning chain of atolls based on geographical grouping of islands (Geography of Maldives, n.d.).

The Need for Collaborative Learning Tools in Maldives

Since 1999, Maldives has been practicing distance learning which was initiated with the aim of providing opportunities of nationwide higher education where isolation of islands was a barrier (COL - a trademark for distance education, 2016). Centre for Open Learning (COL) – a centre established for the purpose, runs under the Maldives National University (MNU), currently reaching fifteen out-reach centres all across the country, in addition to the four main campuses of MNU, and offering many courses in blended mode.

Students needs to attend any out-reach centre nearest to their island twice or thrice in a fourteen weeks long semester for their block classes. In addition, there is online-teaching carried out in between the blocks (Teaching and Learning in Blended Mode, 2016). Since COL has more than eighteen years of experience in the field, interview was conducted among all the academic staff of COL.

According to the thirteen academic staff of COL, their assessments and most of the online activities are based on individual reflection of students. Also, during block classes, students are allowed to do worksheets and tutorial exercises. Asynchronous discussion forums as well as synchronous chat sessions are set to facilitate learner-learner and learner-teacher interaction, but these discussions are very much objective based where students need to answer or present their views on specific question or scenario related to a topic. It does not provide an environment where students can build their own knowledge or apply critical thinking: a key principle of a constructive learning environment. Their main concern in practicing collaborative learning is time and location which is considered as limitation to collaboration (Duarte et al., 2014) with location being the major issue.

Academic staff of COL states that classes consists of students from different islands which is one of the reasons for not giving group projects. Students find it difficult to meet up in a physical location as islands are separated by ocean and transportation cost is high even within atolls, which is a concern raised by students even attending their block classes. Furthermore, if the weather is bad, the Meteorological Service of Maldives will give Yellow Alert stating that sea transportation is not advisable as seas will be extremely rough with wind speed expected or prevail between 20-40 miles per hour (Maldives Meteorological Service, 2015). This affects the face-to-face block classes as well. The block needs to be re-scheduled or even sometimes cancelled and even if block is arranged, students are unable to attend. According to COL, there was re-scheduling of blocks twice in the last semester. So even group activities are difficult to be arranged in block classes as some students were unable to participate. Moreover, they highlight that in block classes there are six to ten hours allocated per module and each block needs to cover 4 modules which results in a limitation of time in order to conduct collaborative activities effectively during the block classes.

"The advance of internet technology provides favourable tools for performing collaborative work" (Li, 2015). These tools allow students and instructors to interact in a non-traditional setting which is not limited by physical location, helping to design a true learning community where instructors have the opportunity to foster interaction and collaboration in both asynchronous and synchronous learning

(Gullström, 2017). Academic staff of COL also believes that it is important to move towards constructive learning allowing students to be active and learn by themselves rather than depending on instructors. In higher education and online teaching it is a key need but they claim that in Maldives, the culture of constructive learning needs to be built. The main reason of it not being practiced is the geographically dispersion of islands, and as a solution is to adopt the available collaborative learning tools. And also, they highlighted that these tools needs to be implemented in higher education which will lead to the development of constructive learning in Maldives especially when there is a demand for block mode where students frequently do not meet with one another as well as with the instructor. They further highlighted that even other faculties of MNU as well as other private institutions in Maldives offer courses in block mode (without online teaching), which further increases the necessity of collaborative learning tools to adopt constructive learning.

Hence, it is important to know the available effective tools. Being the first and earlier technology (Duarte et al., 2014), Wiki can be considered as one of the tools together with Padlet which is more recent with more attractive user interface (Heng & Marimuthu, 2012). Both have been proven to be effective collaborative learning tools.

Methodology

This paper is aimed to find a solution to the problems faced in practicing constructive learning through collaboration among higher education students in Maldives. Hence, this study involves a literature review on using technological tools as a means to full-fill the above stated purpose and proposes two tools that can be used based on the findings and analysis from the existing related literature.

Articles for the review was selected from Google Scholar; searched based on the keywords "Web 2.0 collaboration tools" and "Web tools for constructive learning". The search results were further filtered to select the papers published from 2012 to 2017. Papers detailing the applications of different technological tools for teaching and learning promoting collaboration and constructive learning and students' acceptance level of those tools were set as the selection criteria. A total of twenty papers that passed these criteria were included in the review and the frequency of the tools mentioned among the papers was considered in order to propose the two tools.

Results and Discussions

After reviewing the 20 selected papers, several tools were identified as illustrated in Table 1 below.

Table 1 Result of the review stating the tool and frequency

Tool	Number of papers mentioned
Wiki	19
Blog	16
Padlet	17
Google Docs	10
Trello	4
Podcast	8

Since Wiki and Padlet was among the highly mentioned tools in the papers reviewed and proven to be effective for collaboration which promotes constructive learning, these two tools were selected and further studied on their features and applications.

Wiki as a Collaborative Learning Tool

According to Prokofieva (2013) as mentioned by Zorko (2009), the development of wikis (example as shown in Figure 1) provided an easily editable virtual space for creation of collaborative knowledge. It allows to transform one's own knowledge into a shared digital artefact as stated by Lee & Tasi (2009). Prokofieva (2013) further states with reference to Choy & Ng (2007) that the flexibility in creation of knowledge in wiki allows users to present "data in a freer manner than existing asynchronous learning tools such as discussion forums." Furthermore, practical applications of wikis in a wide range of disciplines have been discussed by the educators. Prokofieva (2013) gives examples of such disciplines as computer science courses with reference to Bower et al. (2006), language learning with reference to Richardson (2006), and health science courses with reference to Snodgrass (2011).

Interaction is always considered as a crucial element in teaching and learning (Prokofieva, 2013) as stated by Anderson (2008). In fact, interaction is considered as a vital factor in technology-mediated education (Prokofieva, 2013). A study conducted by Prokofieva (2013) to evaluate the types of interactions of students engaged in a wiki-based collaborative project, showed that in such projects, students engage in all the three types of interactions namely; "student-content, student-instructor, and student-student" (Moore, 1989) which may not be meaningfully correlated in a traditional classroom setting (Ting, 2013).
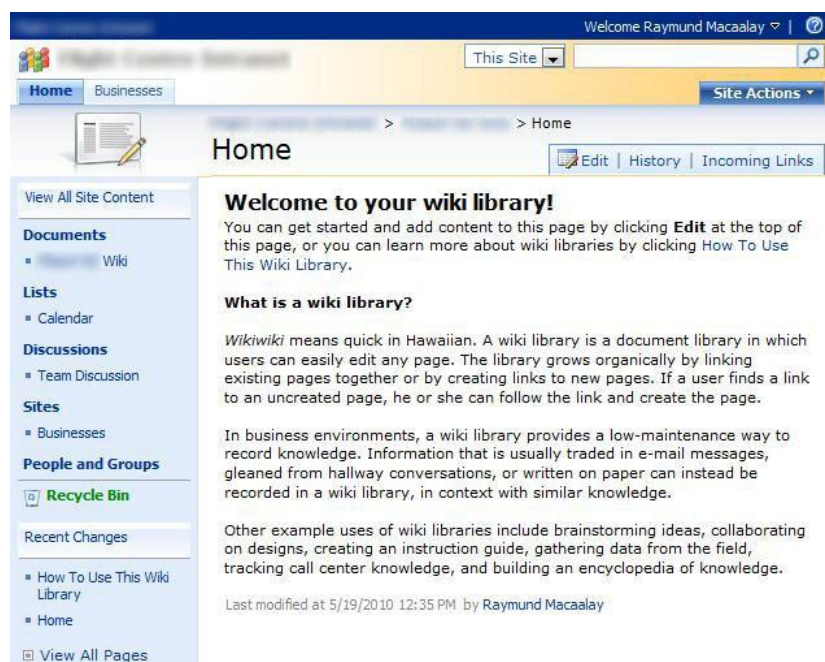
Figure 1 Macaalay (2010). Wiki Example. Retrieved from Raymund Macaalay's Dev Blog

Padlet as a Collaborative Learning Tool

Padlet (example as shown in Figure 2) "is an interactive web-based bulletin board with many uses" (Wong & Maceira, 2017). It is ideal for collaboration and poses open-ended questions for reflection and assessments (Wong & Maceira, 2017). Study conducted by Wong & Maceira (2017) by integrating Padlet as a tool to enhance active learning with increase engagement of students, presenting and creating reflections showed that there was increased engagement, creativity and reflection from the students.

Weller (2013) cited by Dewitt, Alias, & Siraj (2015) states that Padlet has been used for simple instructional tasks, as well as for more complicated tasks among the experts as it is a tool for interaction in a virtual wall. Furthermore, the findings of a survey conducted by Dewitt, Alias, & Siraj (2015) in finding out the usability of Padlet for constructing new knowledge and for collaborative learning indicated that students could learn and generate new ideas and can be used for collaborative learning.

DeWitt et al. (2015) states that deaf students face more difficulties in communication and learning problems without specific facilities to cater for their needs in higher education institutions. Hence, they suggest Padlet as a solution to bridge this gap and designed a learning module for the deaf in a higher education institution using Padlet. After the evaluation of the prototype module with data collected from

observations and interviews of four deaf students, the findings stated that Padlet is a helpful and effective tool that could be used for communication among deaf students (DeWitt et al., 2015).

The success in the classroom is mainly defined by the quality and quantity of student participation (Fuchs, 2014). However, barriers for instance students being afraid to make mistakes, feeling shy and afraid of how the instructor or classmates might respond to an opinion prevents student participation in class (Fuchs, 2014). Hence ways need to be found out to overcome these barriers to support an inclusive classroom environment. Fuchs (2014) uses Padlet in his class as a solution. He claims that Padlet helps in overcoming some of the challenges involved in class participation and encourages whole-class collaboration and engagement.
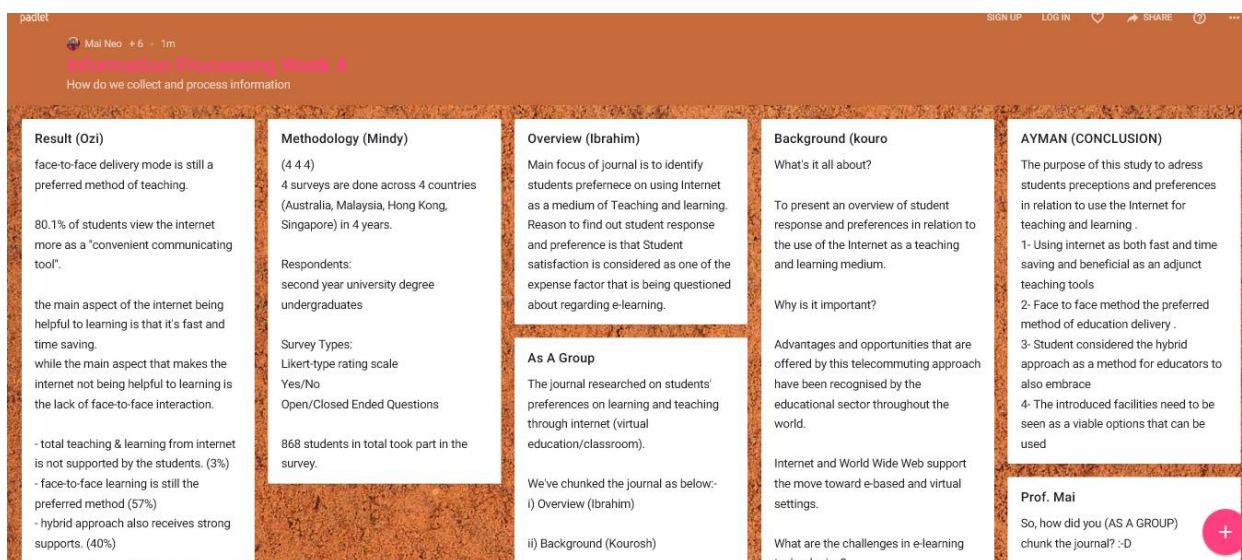
Figure 2 Mai (2017). Padlet Wall. Retrieved from Dr. Mai's Place

Besides proving Padlet as an effective collaborative tool, features like saving, copying, and pasting documents and multimedia files from the virtual wall into any other application and placing them dynamically using several techniques (Dewitt, Alias & Siraj, 2015) makes it more user-friendly. Also as stated by Weller (2013) cited by Dewitt, Alias, & Siraj (2015), it does not require special training to use the Padlet. Moreover, using Padlet, students will be able to read, create and comment on other student's responses about the classroom concepts and activities in the same way that they regularly interact with user-generated content in the form of Facebook, Twitter, and comments at the end of online articles (Wong & Maceira, 2017), further adding credit as an effective collaborative tool.

Conclusion

Traditional model of instructor-centred teaching and learning where knowledge is considered transmitted from teacher to learner is being rapidly replaced by student-centred model of learning. Students are guided and supported to construct their understanding as they learn. This is mostly being achieved via collaborative activities. To adhere to the change, Maldives also needs to adopt constructive learning model. The fact that Maldives consists of dispersed islands, together with further issues related to it, is considered as a limitation for the application of constructive learning. Due to the advancement of technology this barrier can be removed with the help of online collaborative learning tools. In fact, these tools have become a necessity in Maldives to initiate the culture of constructive learning.

Since there are a multitude of tools available, it is important to find a proven effective tool. Wiki and Padlet are among such tools which are proven to serve the characteristics of collaborative learning. However, further researches need to be carried out to find the effectiveness of the implementation of these tools. Similarly, student's response about these tools needs to be further studied.

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Authors' Bio

Ibrahim Adam is currently a lecturer at Centre for Educational Technology and Excellence, The Maldives National University. He received his Master of Multimedia (E-learning technologies) (2018) from Multimedia University, Malaysia and Bachelor of Information Technology (2012) from The Maldives National University, Maldives. For the past four years, he has been involved in providing quality education to the citizens of highly dispersed islands of Maldives through blended learning. He has been actively involved in designing, facilitating, monitoring and delivering courses in blended mode. In addition, he is an advocate for technology enabled learning and consistently look forward new ways of integrating technology to improve teaching and learning by maintaining quality through research. Moreover, he is highly engaged in training, supporting and promoting quality e-learning. Being a postgraduate award recipient, he is currently pursuing his PhD at Multimedia University, Malaysia, in the area of creative multimedia.

Appendices
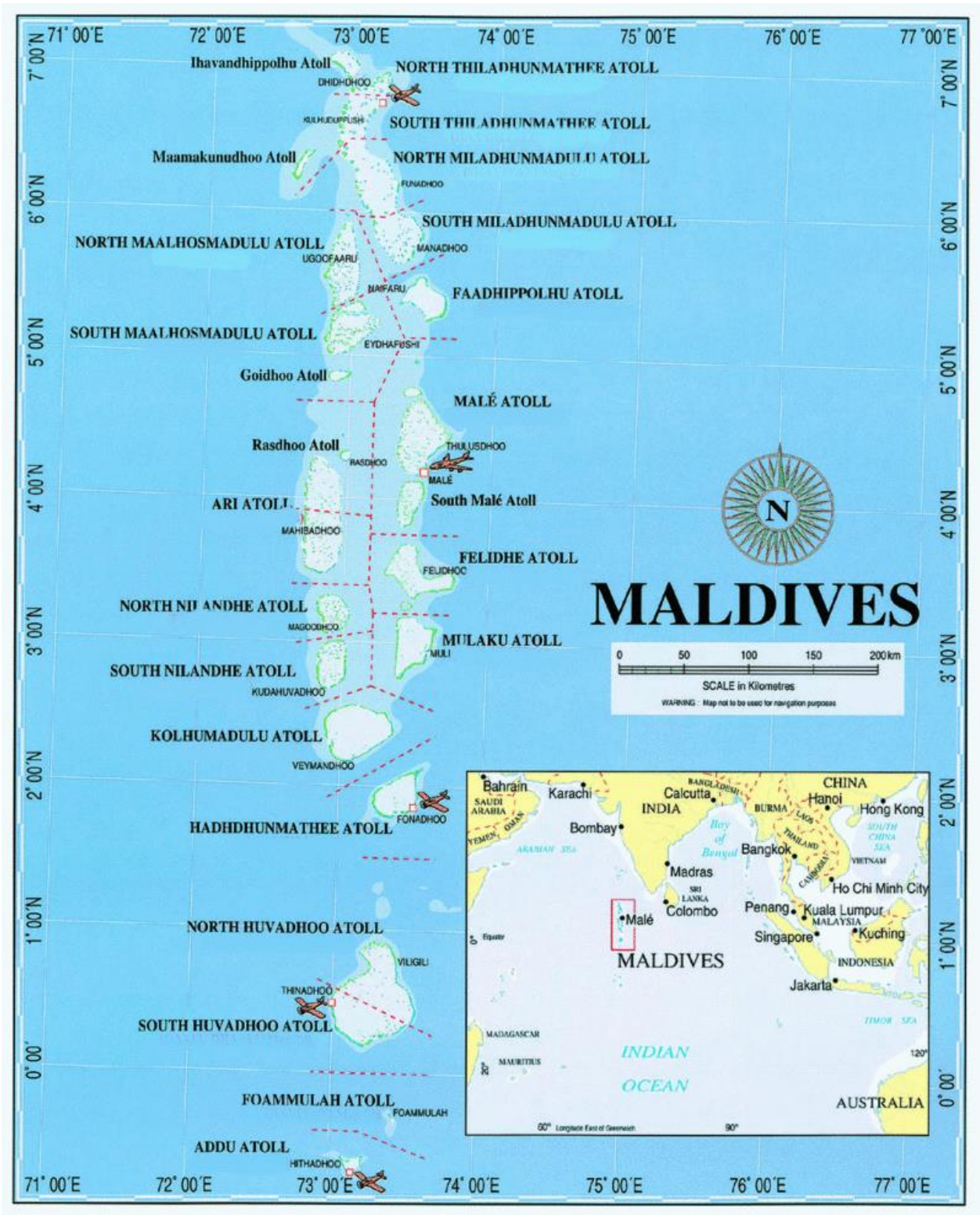
Figure 3 Maldives Map. Retrieved from: maledivenbucher.ch

International Journal of Creative Multimedia

Teaching Email Writing through Online Teaching Platform

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Abstract

Email communication has been widely used in tertiary education as a mean of interpersonal communication (Huang, 2011; Baghestan, Indriyanto & Asfaranjan, 2016; Robinson & Stubberud, 2012). However, the lack of understanding of proper etiquette in e-mail writing results to frustration because students fail to convey their message effectively and professionally, hence unable to receive anticipated feedback from their lecturers (Kim et al., 2016). The necessity of email writing as a subject for English as a Second Language (ESL) classroom is essential; unfortunately, this has been rarely addressed in classrooms. In addition, conventional style of teaching that is chalk and talk, only results to ineffective teaching of email writing etiquette. This is because through the advancement of technology, the designed educational system does not suit the students of today. The current students are known as digital natives who are impatient and prefer to receive instant information. They are also great at multitasking and appreciates instant gratifications. There is a need for an effective method to convey lessons on email writing etiquette to students to ensure that they are able to grasp the lesson better and are able to write effective emails. This study will shed light on the method used to teach email etiquette to first year foundation students using online teaching platform namely Blendspace, Padlet and Kahoot!. The results indicate that with these online teaching platforms, students' etiquette to email writing etiquette improve significantly. Clearly, technological infused learning along with active and collaborative learning employed by the instructor enables effective learning to take place.

Keywords Email writing; Online teaching platform; Digital natives

Introduction

Email communication has been widely used in tertiary education as a means of interpersonal communication (Huang, 2011; Baghestan, Indriyanto & Asfaranjan, 2016; Robinson & Stubberud, 2012; Merdian and Warrior, 2015). It is a useful tool of communication preferred by lecturers due to its features that require content to be more correct, detailed, and arranged (Merdian and Warrior, 2015; Baghestan, Indriyanto, Asfaranjan, 2016; Levy, 1997). As a result, there has been a significant increase in the use of email as a form of interaction in tertiary institute (Judd & Kennedy, 2010; Li, Finley, Pitts, & Guo, 2011; Littlejohn, Margaryan, & Vojt, 2010) because it is a dependable alternative interaction method for discussion about the courses with their instructors and peers (Vrocharidou & Efthymiou, 2011).

However, students' failure in conveying their messages effectively and professionally is a result of their lack of understanding of proper etiquette in e-mail writing. Consequently, students are frustrated because they are unable to receive the anticipated feedback from their lecturers (Kim et al., 2016). For this reason, it is necessary for English lecturers to provide guidance for e-mail writing etiquette, in ensuring effective communication between students and lecturers (Lancaster, 2011; Kim et al., 2016; Nguyen et al., 2015). This points out the necessity of email writing as a subject for English as a Second Language (ESL) classroom but this is rarely addressed in English as a Second Language (ESL) classroom (Stange, 2016). Although English as a Second Language (ESL) teachers realize the importance of teaching email writing etiquette, they are left at great disadvantage with lack of materials and conventional style of teaching that is chalk and talk (Puncreobutr, 2016), which only result in ineffective teaching of email writing etiquette.

The Lack in Educational System

It is important to note that over the years through the advancement of technology, the designed educational system does not suit the students today. The students in this era has changed radically. The current batch of students represents a generation that matures with the bits and bytes of the digital age. Their entire lives have been surrounded with smart devices, the World Wide Web and all the tools and devices of technology (Prensky, 2001; Sarkar et al., 2017). Notably, the average tertiary students spend more time with their computers on the World Wide Web either playing video games or watching movies and series as compared to reading. Prensky (2001) reported that digital natives lavish their spare time exceeding 10,000 hours playing video games and more than 20,000 hours watching online movies and series but they only utilize less than 5,000 hours of their lives reading. Therefore, this reflects that technologies have become an inherent part of their lives (Prensky, 2001; Samaha and Hawi 2016).

Literature review

Digital Natives

The new generation batch of students that enters our classrooms are digital natives. These digital natives possess certain attributes that varies from their predecessor generation due to their continuous exposure to digital technologies (Prensky, 2001; Tapscott 2009) that results in their brains to be wired differently. As a result, this affects their perspective and methods to learning (Prensky, 2001; Sarkar et.al 2017). Typically, the current generation of students prefer to receive instant information thus utilize most of their free time on the internet because they have access to some or all of these technologies beyond the classroom walls. Therefore, information could be accessed within the comfort of their home environment.

Moreover, our digital native students possess shorter attention span and have a penchant for multi-tasking (Sarkar et al., 2017). Digital information world (2018) reports that the average duration of human's concentration has drop from twelve seconds in the year 2000 to eight seconds today as compared to a goldfish with the concentration length of nine seconds. Therefore, information presented to these digital natives should in graphical form that is simple and easy to comprehend rather than long-winded texts (Prensky, 2001) because digital native students are unable to tolerate slow-paced environment due to their cravings for speed thus they prefer simple and easy way to digest information with activities that are done in parallel process and requires multi-tasking.

Additionally, digital native students thrive on immediate feedback, instant gratification and frequent rewards for their effort (Prensky, 2001; Sarkar et al., 2017). As a matter of fact, digital native students function best when they are networked because they show a preference for group work and connectivity to peers which explains their preference to learn through activity. Consequently, collaborative learning environments are the best learning environment for these digital native students to ensure best result in their learning processes (Prensky, 2001; Sarkar et al., 2017; Aziz, 2017, Puncreobutr, 2016).

Digital Natives and Teaching Styles

The conventional style of teaching such as lectures; lengthy PowerPoint slides and notes are obsolete while technology presents a variety of novel and fresh methods to attract these digital native students in and out of the classroom so that they become dynamic, independent, and invested learners (Prensky, 2001; Sarkar et al., 2017). Consequently, there is a need for an educational reform because the conventional educational teaching method does not address the need of these digital native learners (Prensky, 2001). A paradigm shift

from traditional education system to incorporating technology in the teaching and learning would be beneficial for these students (Prensky, 2001; Aziz, 2017, Puncreobutr, 2016).

Certainly, there is a need for an effective method to convey lessons on email writing etiquette to students to ensure that they are able to grasp the lessons better and are able to write effective emails. An innovative method to teach and improve students email writing etiquette is by using technology. This is a new version of learning in line with the current buzzword education 4.0 and blended learning that promotes students centred learning. This method of learning changes the role of the educator from sage on the stage to guide on the side while peers become significant entities in their learning. This enforces peer teaching and learning where students learn together and from each while the instructor acts a guide or a facilitator in class. (Aziz, 2018). Consequently, learning becomes more collaborative through the digitalization of education where students become active creator and contributor of knowledge (Sarkar et al., 2017; Schuster et al., 2015; Aziz, 2017). Nonetheless, this will enhance students' knowledge in particular lessons and develop crucial competences needed for the working world (Sarkar et al., 2017; Schuster et al., 2015).

Objectives

This study aims to examine the effectiveness of the utilization of online teaching platform to teach email etiquette to first year foundation students. Therefore, the following objectives are developed to meet the aims of this study:

1. To enable students to understand the importance of e-mail writing etiquette.
2. To help students to master e-mail writing etiquette through the use of online teaching platforms.
3. To understand the effectiveness of the online teaching platforms to teach e-mail writing.

Online Teaching Platform Utilized

Realizing the need to integrate technology to adapt to the learning styles of the current generation of students, the instructor incorporated three different online teaching platform to teach email etiquette namely Blendspace, Padlet and Kahoot!.

The first online platform used to teach email writing is Blendspace. Blendspace is a learning management system that is free for lecturers to organize and annotate digital resources into bundles of interactive lessons. Multiple materials could be incorporated into Blendspace like documents, web links,

videos and images from various different resources such as Youtube, the World Wide Web or even from the instructor's own personal computers. Students can access all of these materials using an URL provided by their instructor (Fong and Por, 2014: Sarkar, 2017). In addition, Blendspace provides the opportunity for students to discuss on the materials through discussion questions posed by the instructor thus this promotes collaborative learning (Sarkar et al., 2017; Schuster et al., 2015). Consequently, it facilitates an independent learning environment where learning can occur unrestrained by time and place (Sarkar et al., 2017). Moreover, class time is repurposed for more active and experiential learning.

Meanwhile, Padlet is a free multimedia wall similar to sticky notes but provides an online experience, encourage virtual, whole class involvement and assessment (Fuchs, 2014; Ellis, 2015). Padlet is an easy tool to use and works on a variety of smart devices (Fuchs, 2014). Padlet allows opportunities for peer to peer learning and self-assessment (Fuchs, 2014) by providing access to a vast variety of responses from classmates. It promotes collaborative learning even with shy and low esteemed students because Padlet has the choice to be unnamed. Therefore, students may seem to want to contribute in the class discussion. In addition, students receive immediate individual feedback from the instructor which shows that it creates a more targeted and genuine communication between teacher and students (Fuchs, 2014; Ellis, 2015). Moreover, instructors could use students' discussions as criteria to evaluate and improve their lessons (Fuchs, 2014).

The third and final online platform used to teach email writing is Kahoot!. Kahoot! is a free social learning tool in the form of interactive game. It is a novel student-response system that focuses on student motivation and engagement (Sarkar, 2015; Dellos, 2015). Through game-like quizzes, it engages students into learning (Byrne, 2013; Cross, 2014; Thomas, 2014). Using smart devices like smart phone, tablet or laptop, students can participate to play the game by typing a unique PIN displayed on the screen and creating username for themselves. The screen also displays the questions created by the instructor together with the answers while on the students' devices, only the answers are displayed. Kahoot! do not only promote competitive spirit in the learning process but improves engagement, motivation and perceived learning (Wang et al., 2011) because it provides students with the desired instant feedback that is preferred by digital native students (Sarkar et al., 2017).

Methodology

This study was conducted on twenty-five first year foundation students in Universiti Tenaga Nasional. This study employs a qualitative research design in which observation and interviews are conducted between the lecturers and students. The students and lecturers are randomly selected for this study. There were five lecturers and five students interviewed. The research also observed the style of email writing of these students throughout the semester.

Procedure

The teaching and learning of email writing etiquette is divided into three parts that are pre-class, while-class and post-class. In the first part, which is pre-class stage, the instructor utilized Blendspace as the online learning platform. This is where micro-lectures and videos replace lecture time in class. Students are to access the material via an URL link provided by the instructor through an email sent by the instructor. In addition, students are to discuss among their peers about the etiquette to email writing prior to class via Blendspace discussion section. Students learn at their own pace at an unconstraint time and place by customizing their learning experience through self-directed knowledge acquisition (Sarkar et al., 2017). Additionally, students can experience unrestrained access to learning materials that satisfies their individual needs (Sarkar et al., 2017; Aziz, 2017). This is to promote collaborative and active learning between the students and their peers while instructors can efficiently manage their digital content teaching materials (Sarkar et al., 2017; Schuster et al., 2015). The flow of the lesson before class stage is as in Figure 1:
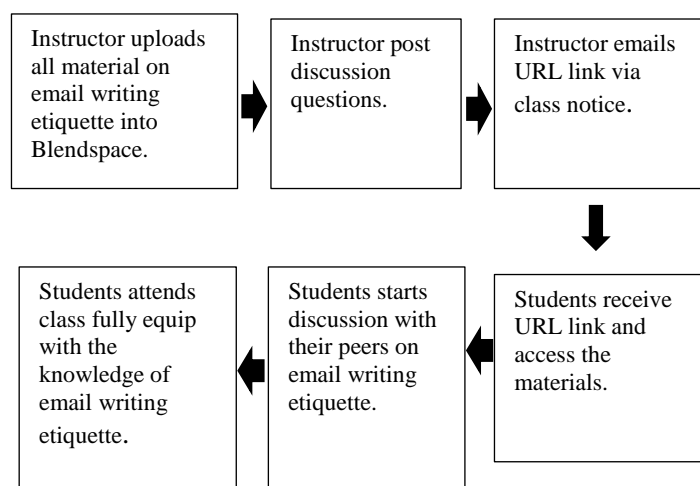

Figure 1 Pre-class Stage

The second part is the while-class part which is divided into two phase. In the first phase, active learning takes place. Students will enter class with questions and doubts about the materials that they access

in Blendspace and clarify their doubts with the instructor. The instructor acts as the facilitator in class while encouraging fruitful discussion and knowledge sharing between students and their peers. Once their doubts on email writing etiquette are cleared, the instructor divides the class into groups and provides students with sample of emails and two discussion questions for them to discuss in class. Students are to identify the poorly written emails and provide their opinions on the emails.

By going through the emails, students learn collaboratively and experientially by exchanging ideas and opinion about the style and format of the email sample. This method engages students into the learning process that results to knowledge about email writing etiquette obtained through the transformation of experience in reading the email sample (Kolb, 1984). At the end of the discussion, students present their opinions and arguments about the email sample to the instructor. The instructor then gauge from the students the correct format and etiquette to write an email, thus developing an email template with the students.

In order to evaluate students' understanding and familiarity with email etiquette, the instructor uses the second online platform, Padlet. This is the second phase of the active learning in class. The instructor creates a Padlet wall and designs a situation for the students to practice writing email using the correct format and etiquette. An URL link is provided for the students to access the practice. Students access the link through their smart devices such as smart phones, tablets or laptops in class. Students' contribution to the wall occurs in real-time which enables their peers to view their answers. The instructor encourages students to comment on each other's answers because students learn best from their peers (Aziz, 2017). Consequently, this method promotes peer learning as students are granted with immediate access to peer feedback through comment response in Padlet (Fuchs, 2014). In addition, students also receive immediate individual feedback from the instructor on their email etiquette writing practice. If students were unable to write the email according to the correct format and etiquette, they are required to edit their responses. The availability of immediate feedback is one of the criterions of digital native students. According to Thompson (2013), the presence of immediate feedback could increase their motivation and interest in the learning environment that could improve learning and result to effective and efficient teaching and learning of email writing etiquette. The flow of the lesson during class stage is as in Figure 2 and Figure 3:
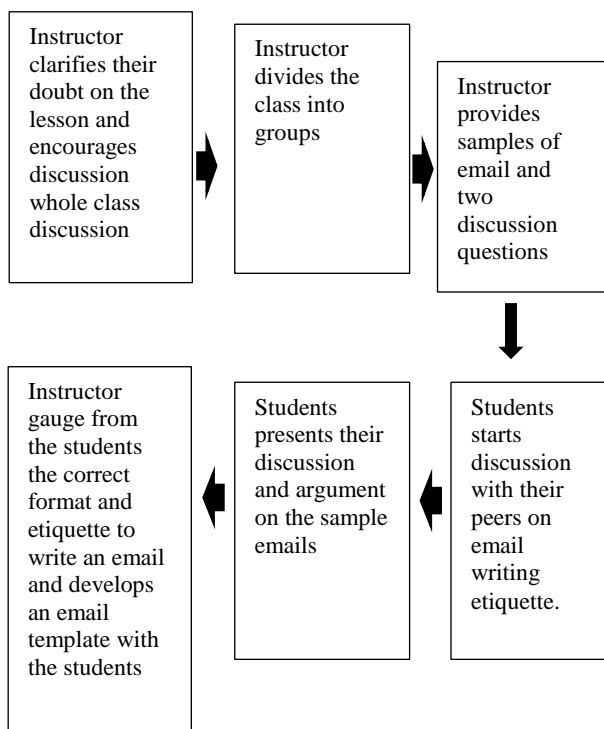
```
┌─────────────┐      ┌─────────────┐      ┌─────────────┐
│ Instructor  │      │ Instructor  │      │ Instructor  │
│ clarifies   │      │ divides the │      │ provides    │
│ their       │  ▶   │ class into  │  ▶   │ samples of  │
│ doubt on    │      │ groups      │      │ email and   │
│ the lesson  │      │             │      │ two         │
│ and         │      │             │      │ discussion  │
│ encourages  │      │             │      │ questions   │
│ discussion  │      │             │      │             │
│ whole class │      │             │      │             │
│ discussion  │      │             │      │             │
└─────────────┘      └─────────────┘      └─────────────┘
                                                 │
                                                 ▼
┌─────────────┐      ┌─────────────┐      ┌─────────────┐
│ Instructor  │      │ Students    │      │ Students    │
│ gauge from  │      │ presents    │      │ starts      │
│ the students│      │ their       │      │ discussion  │
│ the correct │  ◀   │ discussion  │  ◀   │ with their  │
│ format and  │      │ and argument│      │ peers on    │
│ etiquette to│      │ on the      │      │ email       │
│ write an    │      │ sample      │      │ writing     │
│ email and   │      │ emails      │      │ etiquette.  │
│ develops an │      │             │      │             │
│ email       │      │             │      │             │
│ template    │      │             │      │             │
│ with the    │      │             │      │             │
│ students    │      │             │      │             │
└─────────────┘      └─────────────┘      └─────────────┘
```

Figure 2 While-class Stage (Phase 1)

```
┌─────────────┐      ┌─────────────┐      ┌─────────────┐
│ Instructor  │      │ Instructor  │      │ Students    │
│ designs     │      │ provides an │      │ access the  │
│ email       │  ▶   │ URL link for│  ▶   │ practice    │
│ practice on │      │ the practice│      │ using their │
│ Padlet      │      │             │      │ smart       │
│             │      │             │      │ devices     │
└─────────────┘      └─────────────┘      └─────────────┘
                                                 │
                                                 ▼
┌─────────────┐      ┌─────────────┐      ┌─────────────┐
│ Instructor  │      │ Instructor  │      │ Students    │
│ provides    │      │ encourages  │      │ contributes │
│ feedback on │  ◀   │ peer to peer│  ◀   │ to the      │
│ their email │      │ comment     │      │ Padlet wall │
│ writing     │      │             │      │             │
│ format and  │      │             │      │             │
│ etiquette   │      │             │      │             │
└─────────────┘      └─────────────┘      └─────────────┘
```
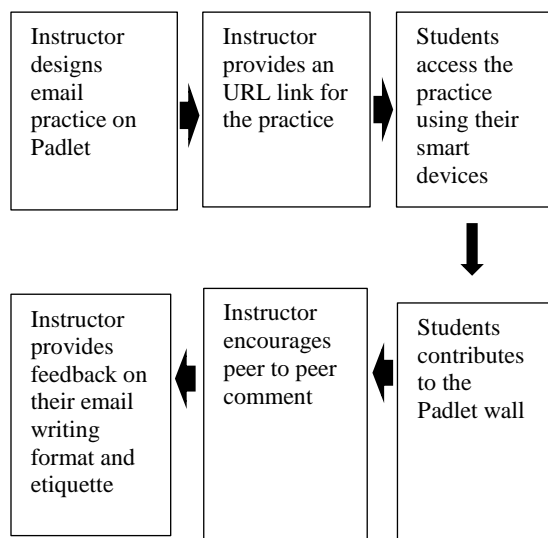
Figure 3 While-class Stage (Phase 2)

The third and the last part of teaching email etiquette is the post-class stage. This stage occurs in the next class before the instructor starts a new lesson. In this stage, the instructor utilises Kahoot! as the online learning platform. Kahoot! Is utilised as a revision for the lesson email writing etiquette. The

instructor creates a set of ten multiple choice questions for the students. The students will be asked to access into Kahoot! using their smart devices and enter in the PIN and user name. The questions and answers will be shown on the projected screen while only answers to the questions are displayed on the students' device in the form of symbols and colours. Students are to choose the correct answer within a time limit of twenty seconds. The use of Kahoot! could reinforce email writing etiquette lesson by developing students' competitive nature thus they gain valuable learning experience. Kahoot! tap into their intrinsic motivation, encourages curiosity among students especially when a question is incorrectly answered which allows for more discussion between the students, their peers and the instructor. The immediate feedback from Kahoot! enables students to evaluate their understanding on the lesson. This is because feedback is critical in the learning process especially for digital natives as it is their preferred learning style (Dellos, 2015). Consequently, Kahoot! promotes a fun learning environment and tests students in the learning process (Icard, 2014). Furthermore, Kahoot! provides opportunity for instructor to identify areas of weakness in content and delivery so that the lesson on email writing etiquette could be better improved. The flow of the lesson after class stage is as in Figure 4:
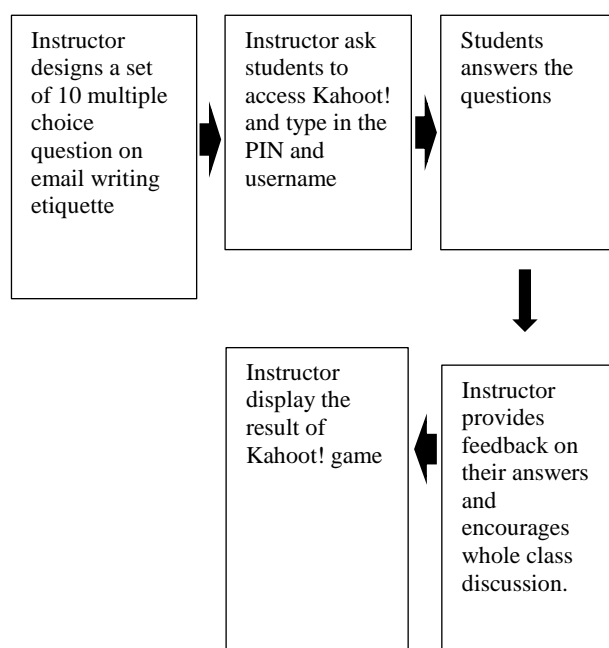

Figure 4 After Class Stage

Results

Students' and Lecturers' Feedback on Email Writing

The outcome of using these three online teaching platforms Blendspace, Padlet and Kahoot! improved the student's etiquette to email writing. Clearly, technological infused learning employed by the instructor

enables effective learning to take place Sarkar et al. (2017) claims that the paradigm shift employed by educators to integrate technology in their teaching is appropriate to the cognitive learning pattern of digital native students. Prensky (2001) explains that the current generation of students are different from their predecessors, thus educators need to reform their methodology and style of teaching to fulfil the requirements of these students to ensure that learning is made effective. Therefore, the use of these three teaching platforms show that effective learning has taken place. Students are seen to be participative in class through collaborative learning as they control their learning and the instructor acts as a guide to help them in areas that are unclear or doubtful and encourage meaningful discussion among their peers.

Consequently, the active, experiential and collaborative learning environment created by the instructor enables students to write better emails. This could be seen from the following excerpt of emails:

Email Excerpt 1

Tue 6/30/2015 12:17 PM
Syed Amirul Fikri <syedjr97@gmail.com>
Absent English ENNF 103 class

To   Alicia a/p Philip

Dear Miss Alicia,

I, Syed Amirul Fikri bin Syed Ahmad Mustaffa, student ID, AP 94543, from Section 07 would like to say sorry for not attending English ENNF 103 class on 29th June 2015 from 1 pm to 4 pm. I had an accident on the same day around 11.20 am near the CIMB bank Abu Bakar Baginda. In that case, I have to skip your class to have my treatment and made a police report. Therefore, I cannot seat for the English test. Later, I will give you my medical certificate. I am sorry again because I delay my email to you as I felt weak yesterday. Other than that, I will try my best to learn from my friends for what I had missing in yesterday's class.

Thank you.

Syed Amirul Fikri (AP 94543)

Email Excerpt 2

Wed 12/13/2017 5:10 PM
Abdul Qayyum <ayum375@gmail.com>
Permission For Not Attending English Class

o   Alicia a/p Philip

🛈 You replied to this message on 12/18/2017 8:45 AM.

IMG-20171213-WA0005.jpg
66 KB

Dear Mdm,

I am Abdul Qayyum bin Mohd Sabri PC96662 section 2 ENNF103. I want to ask permission for not attending English class at 3 to 6pm 14/12/2017 due to my representative in hockey tournament that will be held in USM this weekend. Here I inserted a document from USK, UNITEN. Hope to hear from you soon.

Thank you

Your faithfully,
Abdul Qayyum b Mohd Sabri
PC96662
Section 2 ENNF103

Email Except 3

From: jasmin irisha <jasminirisha99@gmail.com>
Sent: Monday, November 19, 2018 11:04 AM
To: Eszleen Bt Sies <Eszleen@uniten.edu.my>
Subject: Special semester subject

Good afternoon Madam,

Greetings

My name is Jasmin Irisha binti Suhaimi, id AK97186, and a student in foundation of computer science. The reason for this email is because I would like to make an appointment with you regarding the special semester subject. I would like to make the appointment on Thursday at 11 a.m. if possible. Please email me if the appointment time is not suitable for you and the appropriate time to make an appointment with you.

Thank you for your time Madam and have a nice day.

Sincerely,
Jasmin Irisha binti Suhaimi
ID AK97186

Email Excerpt 4

Mon 5/6/2019 12:54 AM
Shatesh Raj <shatesh.raj@gmail.com>
Absent to class
To   Alicia a/p Philip

Good evening Ms. Alicia,
    I'm sorry to say that I won't be able to attend class tomorrow and the day after as well due to my family having the 36th and 37th day prayers for my late grandmother. I will try my best to make it to class but it will be a bit late because the prayers will be for a short while and depends on traffic.

Thank you.

Regards,
Shatesh Raj
AK97235
ENNF1003

Email Excerpt 5

Fri 5/24/2019 9:52 AM
Nurul Alysha <uni.alysha@gmail.com>
Regarding MUET Textbook
To   Alicia a/p Philip
You replied to this message on 5/24/2019 3:20 PM.

Dear Miss Alicia Philip,

Good morning.
I am Nurul Alysha (ID : AK97440) and I am currently in your ENNF103 class of Section 01. The reason I am writing this email is to ask you whether is it alright for me to use Ace Ahead MUET 10th Edition as my textbook rather than the 11th Edition? This is because my senior is giving it to me since she has graduated last month.

Thank you.

Sincerely,
Nurul Alysha,
AK97440.

These excerpts of emails inform that students are now able to write good email with the right format and etiquette. Students have the ability to convey messages effectively and professionally after receiving replies from their instructors and lecturers. There are also less complains from the instructors as email messages are clear and concise with the right tone and formatting. The emails are now not laden with grammar errors. The following are the feedback from the instructors:

Instructor 1

My students write good email with proper email etiquette unlike the previous semester students. Their emails are so bad I don't even want to reply.

Instructor 2

There are improvements in email writing etiquette among foundation students. I am glad that now the emails make sense and I know what I should do to reply these emails. The emails are good with good grammar, right tone and also very polite.

Instructor 3

Foundation students' emails are pleasant to read. There are almost no grammatical errors. Most importantly, they introduce themselves and I know whom I am responding to.

Instructor 4

Well, there is no more venting in the emails. These students write excellent email. The tone of email is good and uses the right formatting. It is pleasant to read and to reply.

Instructor 5

My foundation students are good in writing emails and I now do respond to them. They are clear and polite. Very professional.

Clearly, these instructors were impressed with the professionally written email by students after being taught with email writing etiquette. As could be viewed from the excerpts, these instructors were happy with the improvement in students' style, tone and reduced number or none grammatical error in the emails they received from their students. This suggests that exposing students to the right etiquette to email writing enables students to write excellent and professional emails to their instructors.

Feedback on Using Online Teaching Platform to Teach Email Writing

The instructor also gathered feedback from the students on the use of these online teaching platforms. The students explain that the technology integrated teaching employed by the instructor has improved their email writing etiquette. The readily available materials provide easy access for students to obtain these materials as reference to compose effective emails to their lecturers. In addition, these materials cater to their

learning needs and matches with the characteristic of digital native students who wants easy to understand, concise and simple information. The notes on email writing etiquette are not lengthy but rather are in the form of infographic and videos. The space for peer to peer discussion encourages creative and critical thinking amongst these students as they need to be an active contributor to the lesson on email writing etiquette. This promotes active and collaborative learning. Moreover, the immediate feedback received by students helps them to retain and understand the lesson better. Instant gratification serves, as a motivation for these students be engage in the lesson and learn better. The following are the feedback from the students:

Student 1

I love to compete with others in class and it is really helpful for me to learn with Kahoot! Email writing activities help me to be more polite when writing an email to my instructor.

Students 2

The online teaching platform helps me understand the lesson better. Learning about email etiquette using online teaching platform improves my email writing skills. The in class group discussion helps me interact with my classmates and I learn to play a role in the group.

Student 3

Online teaching platform helps make lesson colourful. The email lesson helps me to refer to the examples when I need it in the future as it is readily available to me and I have access to it. I have also learned that writing good email is an essential communication skill. The group task helps me to learn collaboratively with my classmates. If one of us do not understand the topic, our friends can help explain. It is very effective. The class is not boring at all.

Student 4

In my opinion, using online teaching platform is good because students learn how to use online materials and learn better. It is also convenient. It encourages students to learn online. In addition, I can print the notes and exercise before class starts. It helps to study before class starts thus I am better prepared. The email writing lessons help me to write proper email the right way. Through the group discussion activities, I can exchange ideas with my group members. I can have discussions with them and this helps to improve my communications.

Student 5

The online teaching platform teaches me without me needing the teacher to be with me 24/7. I can write good email with the right etiquette and impress my lecturers so that I can get a response from them. The online teaching platform using Padlet helps me learn better as there is immediate rectification of error by my lecturer. It helps me improve my English. The group discussion is an excellent way to learn together and understand the lesson better.

Discussion and Conclusion

Educators should realise that the majority of our students are digital natives thus there is a need for educational reform. The chalk and talk method is no more suitable for technological inclined students. Our students today are all "native speakers" of the digital language where information is readily available on their fingertips with clicks of buttons into the World Wide Web. Therefore, these students get easily switched off with the traditional method of teaching that involves lengthy lecturer slides and notes. Hence, they choose not to pay attention because they believe that the lessons are not worth their time as compared to their experience through the World Wide Web.

These digital native students want learning to occur beyond the boundaries of the traditional classroom. They want independence and autonomy in their learning that promotes their thinking. The current generation of students have preferences for active and collaborative learning environment which enables them to work with their peers.

In sum, as digital technology advances and the digital native population continues to grow, instructional methods must also continue to evolve to meet the needs of our students. As educators, we seek to assist students in knowledge acquisition that promotes optimum learning environment. This study has demonstrated how email-writing performance of the current generation of students can be improved through the utilization of free online teaching tools.

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Authors' Bio

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International Journal of Creative Multimedia

Usage of Mobile Application in Assisting Chemical Experiments

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Abstract

ChemEx is a mobile application that is created to assist students in performing chemical experiments. Students who study Bachelor of Electronic Engineering majoring in Nanotechnology use chemical experiment to synthesise nanoparticles. Through observation, they lack of confidence during the nanoparticles synthesis because they were not involved in any chemistry activities after foundation. To overcome this issue, a mobile application called ChemEx is created using Android Studio. In ChemEx, the usage of apparatuses and instruments, lab safety, the concept molarity and dilution, as well as the data of chemicals are introduced. Pre and post-test are used to evaluate the effectiveness of ChemEx in helping the students. Besides this, feedback form is used to evaluate the satisfaction of students after using ChemEx. The pre and post-test results show that the students have improved their understanding in apparatuses, safety, molarity and dilution. In the meantime, feedbacks show students are satisfied using ChemEx.

Keywords Mobile learning; Chemistry; Laboratory

Introduction

EPE 3016 Capstone Project is offered to third year students in Faculty of Engineering at Multimedia University. One of the tasks in this project that needs to be accomplished by students who study Bachelor of Electronic Engineering majoring in Nanotechnology is nanoparticles synthesis. Students will be involved in chemical experiments while synthesising nanoparticles. There are no lectures after foundation and no chemistry laboratory after secondary school for those students. Under these circumstances, students lack of confidence while performing chemical experiments.

Based on the observation, students will spend more time to familiarize themselves on their first experiment that unabled them to finish their work in time. Furthermore, students work under high risk that is prone to wrong doings as they are lack of confidence in handling chemicals. Misuses of apparatus or instruments and improper waste disposals commonly happen during chemical experiments.

Through feedback from students, wrong doings, misuses and improper disposals are due to unfamiliarity with the practice in chemical laboratory as well as the need for revision on molarity and dilution of chemicals. Chemical laboratory is different from electronic laboratory. There are more safety precautions that need to be followed by students to ensure their safety. Furthermore, the apparatus and instruments are new to them as they have not been in chemical laboratory in years. Molarities of the used chemicals need to be determined by students while designing their experiments. Some chemicals in higher concentration need to be diluted before the chemicals are used in the experiments.

Literature review

Application of smartphones is no longer limited to communication only. Nowadays, smartphones can be used for games, entertainments, information retrieval and even trading. It is also a push to develop mobile applications for learning purposes. Esteban (2014) found in his survey that students in higher education found satisfactory when they can retrieve course content through smartphones and they perceived smartphones have high didactic function. The utilisation of mobile devices in supporting teaching and learning is known as mobile learning or 'm-learning'. The ubiquitous characteristic of mobile learning allows students to learn anywhere at any time (Masrom et al., 2016, p.268). Masrom et al. (2016) reported that the mobile learning in Malaysia begin with the mobile learning prototype designed by Wahab et al. in 2010. In 2016, Ismail et al. studied on the readiness of university students for mobile learning. Ismail et al. (2016) reported that the students were moderately ready for the integration of mobile technologies in education system. However, they are interested to know more about mobile learning. Malaysian researchers concluded their study that Malaysia should implement mobile learning to assist educational process (Masrom et al., 2016, p.268; Ismail et al., 2016, p.17).

Compare to using desktop computer in laboratory, mobile devices have advantages because they are portable, direct access to internet, lower cost and high computational power (Melo and Çomo, 2016, p. 49). Melo and Çomo (2016) created a mobile application to be used in physical chemistry laboratory for data collection during experiments as well as interaction between students-to-students and students-to-

teachers. They obtained positive feedback from students and teachers on the experience in using mobile devices during laboratory works. Enrique and Patricia (n.d.) had listed out numerous mobile applications that are useful in learning chemistry. In their survey, they concluded mobile applications can simplify learning and be a good assistant under teachers' supervision and guidance.

In this project, a mobile application, ChemEx, is developed to help students who study Bachelor of Electronic Engineering majoring in Nanotechnology in nanoparticles synthesise using chemical experiments.

Methodology

Content Planning of Mobile Application: ChemEx

ChemEx is a mobile application that is designed to assist students during chemical experiments in EPE 3016 Capstone. There are four functions in ChemEx that can minimise the issue of wrong doings, misuse and improper disposals during chemical experiments. They are "Lab Safety", "Apparatus and Instruments", "Molarity and Dilution" and "List of Chemicals and MSDS". The content of ChemEx is illustrated in Figure 1.

In "Lab Safety", rules and regulations in chemical laboratory are listed. A YouTube link will direct students to watch a video that explains 'Dos' and 'Don'ts' while being inside a chemical laboratory. A list of apparatuses and instruments that are available in Nanotechnology Lab 1, Faculty of Engineering will be provided in "Apparatus and Instruments". Image and description will be shown. A YouTube video on how to use the apparatus or instruments will be provided too. Concept of molarity and dilution are explained in the "Molarity and Dilution" function. Calculator for molarity and concentration of chemical solutions in dilution are created. Some chemicals that are available in Nanotechnology Lab 1 will be provided in the "List of Chemicals" function and the link of their material safety data sheet (MSDS) will be inserted.

Feedback on The Usage of ChemEx

Pre and post-tests were designed to evaluate the usefulness of ChemEx in the introduction of apparatuses and instruments, lab safety awareness, as well as the calculation of molarity and dilution in preparing chemical solutions. Before ChemEx was introduced to the students, they were asked to answer some questions according to their best understanding and their common knowledge in chemistry. The same

questions will be asked again after ChemEx was installed into their smart phone. At this moment, they can

answer the questions with the assistance of ChemEx. The questions are listed in Figure 2.
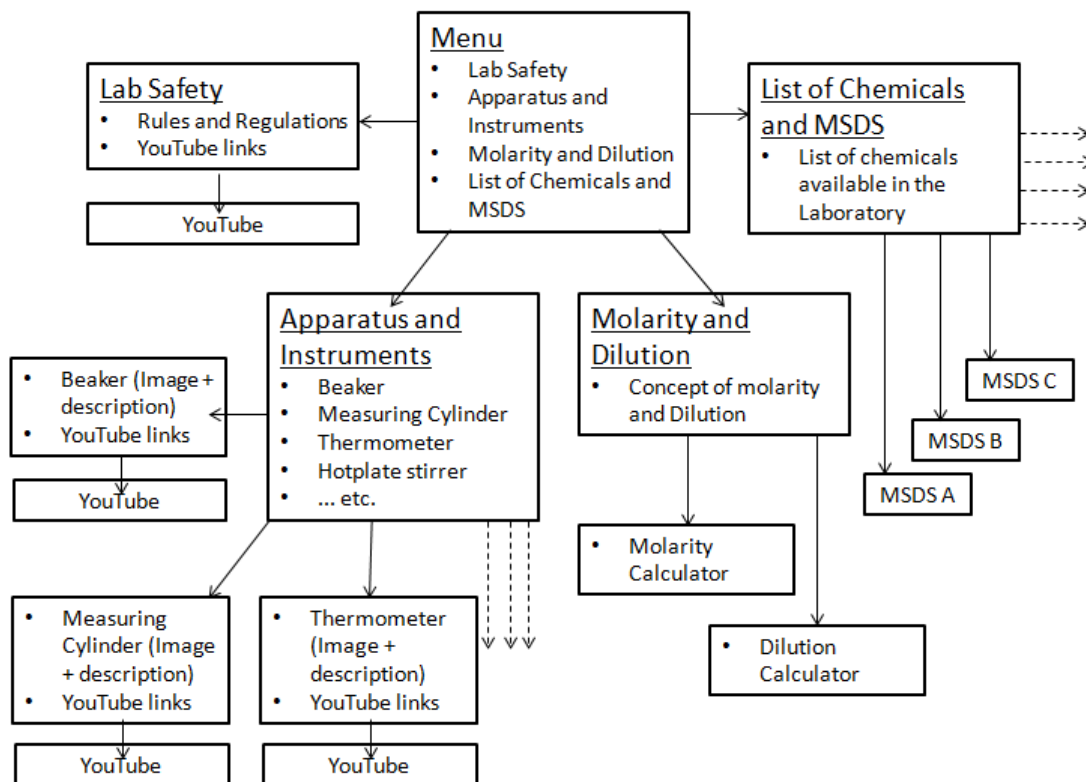

Figure 1 Content Planning for Mobile Application: ChemEx

1. What is the function of listed apparatus in Nanotechnology Lab 1?
   a. Beaker
   b. Glass rod
   c. Spin coater
   d. Erlenmeyer flask
   e. Furnace
2. What is the best tool to be used for measuring the volume of solution?
3. List out 3 Dos and 3 Don'ts in Nanotechnology Lab 1.
4. How many grams of NaCl (solid) is needed to prepare 50ml 0.5M NaCl solution? (Atomic mass for NaCl= 58.44 g/mol)
5. To prepare 50ml of 0.3M solution, how much ml of 1M solution and how much ml water is needed?

Figure 2 List of Questions for Pre and Post-test to Evaluate the Usefulness of ChemEx.

A feedback form as shown in Table 1 was distributed to the students to evaluate their satisfaction

in using ChemEx. Firstly, the feedback form evaluated the easiness of the usage of ChemEx. Subsequently,

the form evaluated the sufficiency of the list of apparatuses and chemicals, rules and regulations, as well as the effectiveness of molarity and dilution calculator in helping students to perform chemical experiments in the laboratory. Lastly, the students were asked about their willingness to recommend ChemEx to students that will take EPE 3016 Capstone Project. All statements were evaluated with 4 levels Likert scale: Strongly Agree, Agree, Disagree and Strongly Disagree.

Table 1 Feedback form to evaluate the satisfaction in using ChemEx.

	Strongly Agree	Agree	Disagree	Strongly Disagree
ChemEx is easy to use.				
You can know how to use apparatus with the help of ChemEx.				
The list of apparatus is sufficient.				
With the help of ChemEx, you know the Dos and Don'ts in Nanotechnology Lab 1.				
Do you agree the rules and regulations in ChemEx ("Lab Safety" function) can make sure you are safe in Nanotechnology Lab 1?				
You understand the concept of molarity using ChemEx.				
Do you agree that ChemEx (Molarity Calculator) can help you to calculate molarity easily?				
You understand the concept of dilution using ChemEx.				
Do you agree that ChemEx (Dilution Calculator) can help you to calculate dilution easily?				
The recipe in ChemEx ("Chemicals and MSDS" function) helps you to start the planning of your nanoparticles synthesis.				
You will recommend ChemEx to Capstone student working in Nanotechnology Lab 1.				

Results and Discussion

Mobile User Interface of ChemEx

The mobile user interface of ChemEx is created using Android Studio as shown in Figure 3. There are four icons that are linked to four functions: Apparatus, Lab Safety, Molarity and Dilution, as well as Chemicals and MSDS. As suggested in content planning, list of apparatuses was displayed after the Apparatus icon was tapped. Further from that, image and description of the apparatus or instrument was provided once its

name was tapped. For an example, the image and description of centrifuge was displayed as shown in Figure 3. Besides this, a YouTube button will show the video introducing the centrifuge.

Dos and Don'ts were listed when the Lab Safety icon was tapped. A YouTube is available to show the video which explains safety precautions while performing experiments in Chemical Laboratory. The students' safety can be enhanced when they aware what they should and should not do in Chemical Laboratory.

The concept of molality and dilution were introduced after tapping the Molarity and Dilution icons. An example for molarity was given. 1 gram sodium hydroxide (NaOH) is added into 25 ml distilled water to prepare 25 ml 1M NaOH. Calculator for molarity and dilution were provided to help the students in preparing the required molarity or concentration (Figure 3).

By tapping the Chemicals and MSDS icon, recipe to synthesise zinc oxide and titanium oxide nanoparticles were provided. The required chemicals were listed and the MSDS can be retrieved through the MSDS buttons. Furthermore, chemicals used for cleaning were listed as well as their MSDS.
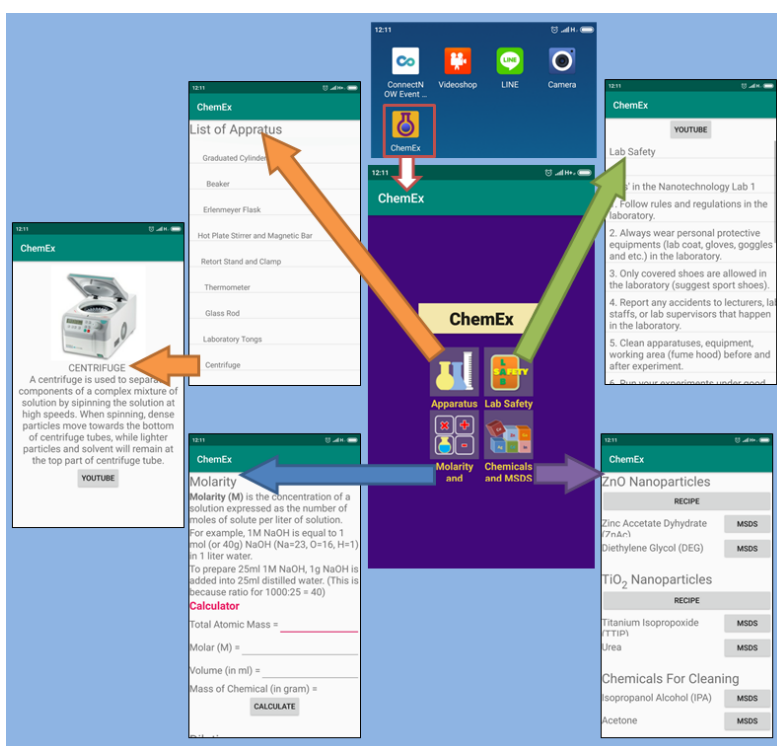

Figure 3 Mobile User Interface of ChemEx.

Pre and Post-Test Results Using ChemEx

There were seven students (Bachelor of Electronic Engineering majoring in Nanotechnology) who registered EPE 3016 Capstone Project in Trimester 1 of 2019/2020. Pre and post-test results using ChemEx is shown in Figure 4. A paired-sample t-test was conducted to compare students' knowledge in the function of apparatuses, safety awareness in chemical laboratory and ability in determine molarity of chemical solution before and after ChemEx was introduced to them. There was a significant difference in the scores for pre-test (Average=31.75, Standard Deviation=11.88) and post-test (Average=93.65, Standard Deviation=5.94); $t(6)=-18.73$, $p=0.0005$. The pre and post-test clearly shows that the ChemEx can help students to know better the function of apparatuses, be aware of the safety in chemical laboratory and prepare chemical solutions with correct molarity and concentration.
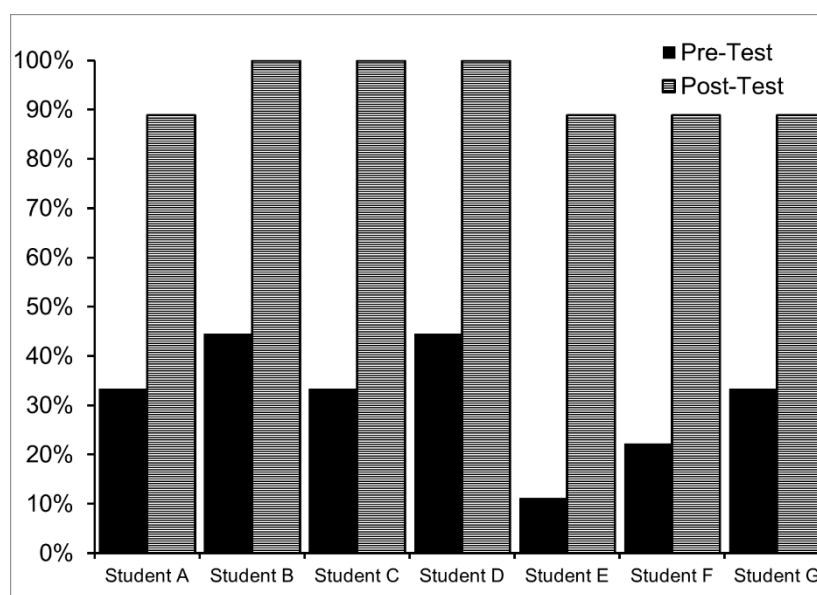

Figure 4 Pre and Post-test Results Using ChemEx.

Students' Satisfactions in Using ChemEx

Figure 5-11 shows the feedback results of students after using ChemEx. As shown in Figure 5, all students agreed that ChemEx is easily to be used. Furthermore, they agreed that ChemEx can help them know how to use the apparatuses, and that the listed apparatuses in ChemEx are sufficient. This is proved by the feedback results shown in Figure 6. In Figure 7, all students agreed that ChemEx can effectively introduce the Dos and Don'ts in chemical laboratory. 6 out of 7 students (86%) think ChemEx can ensure their safety while performing chemical experiments. Figure 8 (a) and 9 (a) respectively show that only 1 out of 7 students (14%) disagrees ChemEx can introduce the concept of molarity and dilution. All students agree ChemEx can help them to calculate molarity, while 86% students agree ChemEx helps in determining the

amount of chemical solution and water in dilution process. The feedback results are shown in Figure 8(b) and 9(b), respectively. Figure 10 shows that 86% students think ChemEx helps them in starting the planning of their nanoparticles synthesis. Figure 11 shows that only 1 out of 7 students (14%) will not recommend ChemEx to students from Capstone Project who are working in chemical laboratory.
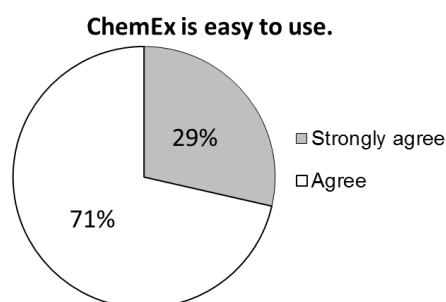
ChemEx is easy to use.

29%
71%
■ Strongly agree
□ Agree

Figure 5 Feedback Result on the Easiness of the Usage of ChemEx

You can know how to use apparatus with the help of ChemEx.

29%
71%
■ Strongly agree
□ Agree

The list of apparatus is sufficient.

43%
57%
■ Strongly agree
□ Agree

(a)   (b)
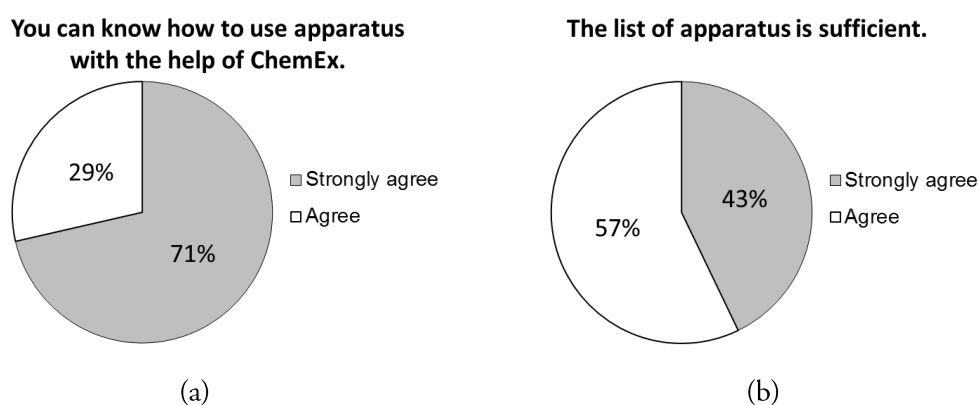
Figure 6 Feedback Result on (a) the Effectiveness of ChemEx in Introducing Apparatus or Instrument, and (b) the Sufficiency of the Listed Apparatuses or Instruments

With the help of ChemEx, you know the Dos and Don'ts in Nanotechnology Lab 1.

29%
71%
■ Strongly agree
□ Agree

Do you agree the rules and regulations in ChemEx ("Lab Safety" function) can make sure you are safe in Nanotechnology Lab 1?

14%
14%
72%
■ Strongly agree
□ Agree
■ Disagree

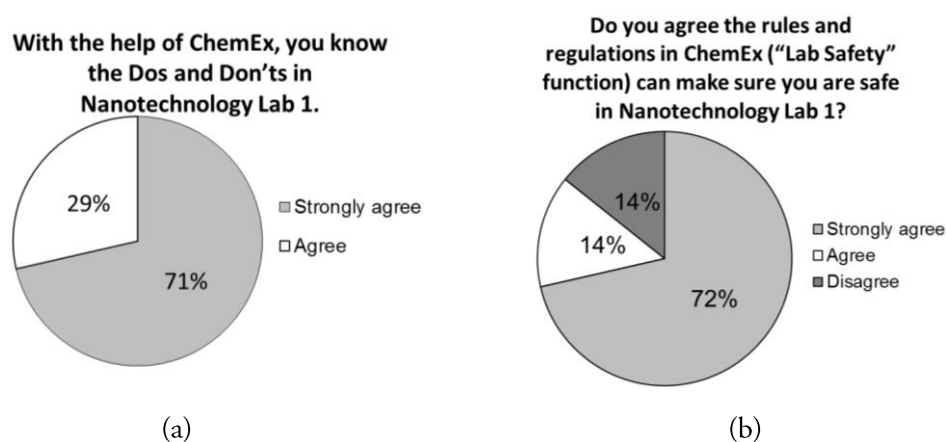(a)   (b)

Figure 7 Feedback Result on the Effectiveness of ChemEx in (a) Introducing the Safety Precautions in Chemical Laboratory, and (b) Creating Confidence in Safety while Working in Chemical Laboratory
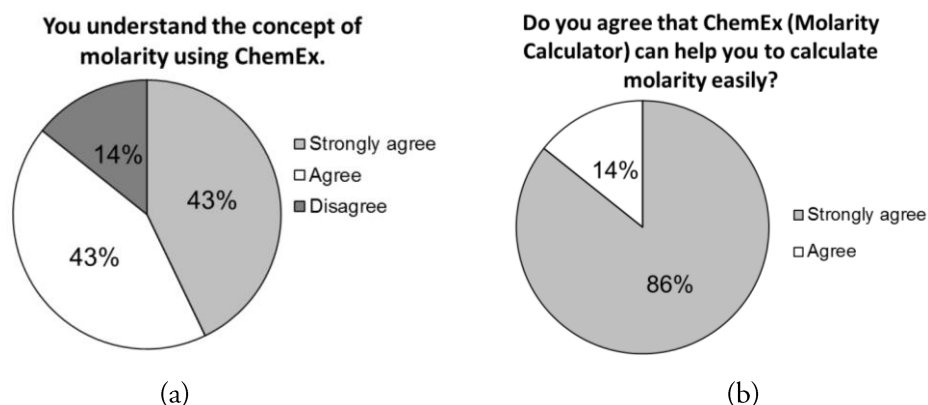
Figure 8 Feedback Result on the Effectiveness of Chemex in (a) Introducing the Concept of Molarity, and (b) Assisting the Calculation of Molarity
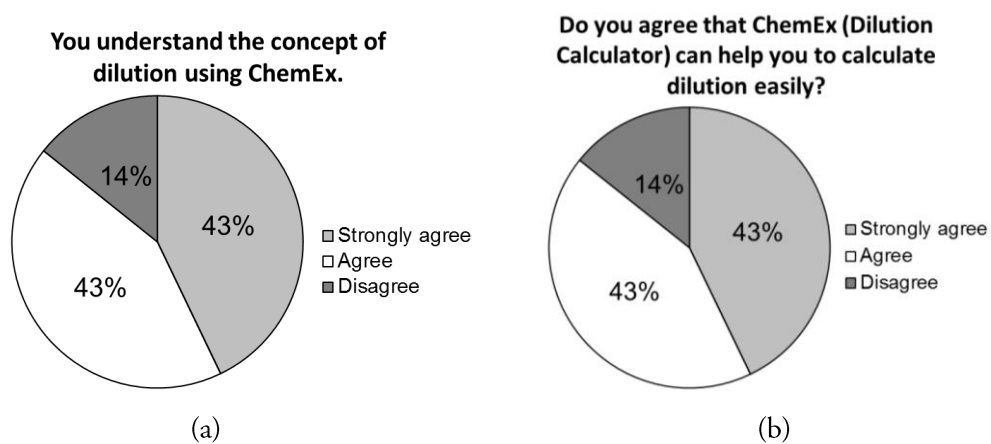

Figure 9 Feedback Result on the Effectiveness of ChemEx in (a) Introducing the Concept of Dilution, and (b) Assisting the Calculation of Dilution.
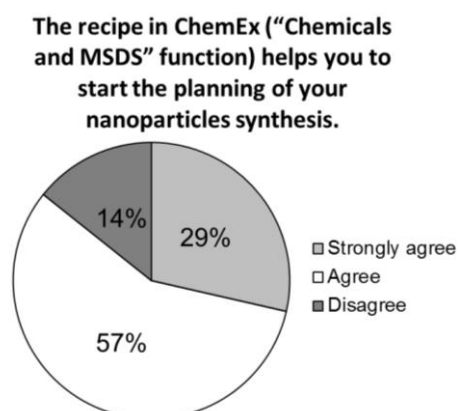

Figure 10 Feedback Result on the Effectiveness of ChemEx in Assisting the Planning of Nanoparticles Synthesis

You will recommend ChemEx to Capstone student working in Nanotechnology Lab 1.
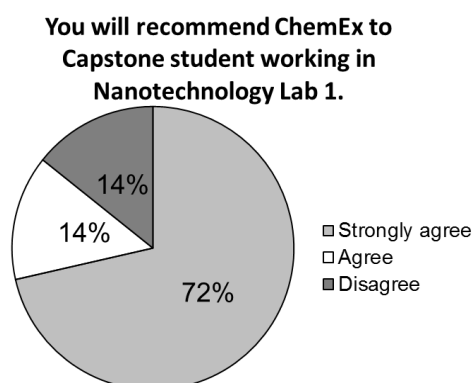

Figure 11 Feedback Result on the Willingness of Student to Recommend ChemEx to the Students Taking EPE3016 Capstone Project.

Almost all of the students are satisfied in using ChemEx and agree that ChemEx is helpful in chemical laboratory. However, students think that there is room for improvement in ChemEx. Students think the design of ChemEx can be more interesting and suggest ChemEx in iOS version to be created. Nik Mohammad et al. (2012) forecasted the cross platform solutions will be a challenge in mobile learning. Furthermore, students think BACK buttons are necessary to return to main page easily. Last but not least, students hope that more calculations and formulas can be included in ChemEx.

Conclusion

The pre and post-test results had shown the mobile application (ChemEx) can help to improve students' know-how on the usage of apparatuses and instruments in chemical laboratory. Awareness on the safety precautions in chemical laboratory were improved, hence students can minimise accidents from happenning. With the molarity and dilution calculator, students can prepare the chemical solutions at required concentration and molarity correctly. These were proved by the paired-sample t-tests with significant difference in the scores for pre-test (Average=31.75, Standard Deviation=11.88) and post-test (Average=93.65, Standard Deviation=5.94); $t(6)=-18.73$, $p=0.0005$. The feedback results also showed that students think ChemEx is easy to use. Furthermore, six out of seven students think ChemEx is helpful in understanding the usage of apparatuses, safety precautions, concept of molarity and dilution, as well as the chemicals. However, ChemEx encounters the challenge of cross platform solutions that was predicted by Nik Mohammad et al. (2012).

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Acknowledgements

Authors' Bio

Dr. Sin Yew Keong graduated Diploma in Laboratory Technology and Bachelor of Applied Science in Applied Physics and obtained his PhD. from Universiti Sains Malaysia in 2000, 2003 and 2010, respectively. He joined Multimedia University since July 2010. He is actively involved in projects like nanoparticles synthesis and simulation of electronic devices. He has taught subjects like Electronics I, Circuit Theory, Semiconductor Devices, Nano-Science and etc. Dr. Sin started facilitating EPE 3016 Capstone Project since 2014 which involves chemical experiments.

International Journal of Creative Multimedia

Web 2.0 Tools in Classroom: Enhancing Student Engagement through Technology Enabled Active Learning

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Abstract

The essentiality of teaching is to make student learning possible. This can be achieved by ensuring student engagement during lessons. Due to the paradigm shift in learning towards student-centred learning, pedagogical strategies need to be adopted to create a learning environment where students can be active learners. Hence, 21st century teachers are expected to be capable of enhancing active learning. As current learners accept technology; adapts to it, uses it to complete tasks in new and creative ways, pedagogical strategies such as active learning needs to be implemented in a technology enabled learning environment. This paper looks into the two cycles of action research, conducted to improve student engagement by creating learning activities using Web 2.0 tools to promote active learning among students, which in turn would enhance their engagement within the class. The purpose of the first cycle was to design learning activities using web 2.0 tools and evaluate these activities on the levels of active learning. Evaluators agree that each activity promotes active learning with a combination of low complexity, medium complexity and high complexity levels. The purpose of the second cycle was to measure the levels of student engagement when the learning activities were implemented within the classroom. Results suggest that they were highly engaged with performance of the highest level.

Keywords Active learning; Student engagement; Web 2.0 tools; Technology enabled learning

Introduction

In order to foster learning among students, it is important to keep students associated with the course. For this purpose, student engagement is considered the most important element (Kehrwald, 2008). Lack of

engagement within the course is among factors that contributes to students' disengagement, withdrawal, and failure in school (Skinner, Furrer, Marchand, & Kindermann, 2008). In general, student engagement is defined as "the extent to which students actively engage by thinking, talking, and interacting with the content of a course, the other students in the course, and the instructor." (Dixson, 2015) Due to criticality of student engagement for student learning (Dixson, 2015), helping students to engage in learning has become an important issue (Henrie, Halverson, & Graham, 2015). Hence, teachers and instructional researchers constantly look forward for ways to help students engage in learning and ways to measure their engagement (Dixson, 2015). After all, the aim of teaching "is to make student learning possible" (Ramsden, 2003).

In order to understand effective pedagogical strategies to increase engagement of learners, it is important to understand the learners and how they learn (Frick, Birt, & Waters, 2017). During the 20th century, higher education institutions underwent a paradigm shift with the application of student-centred learning approaches (Aguti, Walters, & Wills, 2014) instead of instructor-centred. This constructive approach of learning explains that knowledge and understandings are actively constructed and reconstructed by student's learning activities (Biggs, 2012). The learning environment should be designed to provoke student-centred approach where students are expected to be active learners and take responsibilities for their own learning experience (Keengwe, Onchwari, & Agamba, 2014).

Hence, 21st century teachers are expected to be capable of enhancing active learning (Virtanen, Niemi, & Nevgi, 2017). "Active learning is any instructional method that engages students and includes them as active participants in the learning process: students themselves are agents of the learning, and the teacher facilitates this process" (Prince, 2004). There are evidences supporting the improvement on student-teachers' learning with the implementation of active learning concepts (Virtanen, Niemi, & Nevgi, 2017).

The 21st century is driven by information and powered by technology; therefore to make 21st learners as an effective participant, there is a need for a change in teaching, learning and assessment (Kivunja, 2015). Since, 21st century learners accept technology; adapts to it, uses it to complete tasks in new and creative ways, pedagogical strategies such as active learning needs to be implemented in a technology enabled learning environment.

Working as a lecturer for the past four years, the researcher observed lack of student engagement when traditional mode of passive lecturing was used. It seems that they were not satisfied and were not motivated to learn. Hence, with the aim of finding a solution to enhance student engagement in classroom by promoting active learning through a technology enabled learning environment, an action research was initiated. This paper presents the two cycles of the action research which the researcher conducted in improving student engagement by creating learning activities using Web 2.0 tools that could promote active learning among students which in turn will enhance their engagement within class.

Literature review

Active Learning

The concept of active learning is defined from different perspectives including methods of teaching to student engagement processes. According to Prince (2004) active learning can be defined as any instructional method where students become the agents of learning propelling their learning forward through structuring and critical reflection while the teacher becomes the facilitator (Virtanen, Niemi, & Nevgi, 2017). In addition, active learning theories incorporates cooperative action and collaborative problem solving and other social elements of learning (Niemi, 2012, as tools for attaining deeper learning processes.

The Cone of learning proposed by Dale (1969) shows that active learning contributes to learning retention by students. Active learning activities include individual and collaborative activities such as discussions, presentations, simulations and tutoring, whereas students involved in passive learning tasks such as attending to lectures, viewing art, graphs and maps retain only about 10% to 30% of what they learn. (Shaaruddin & Mohamad, 2017).
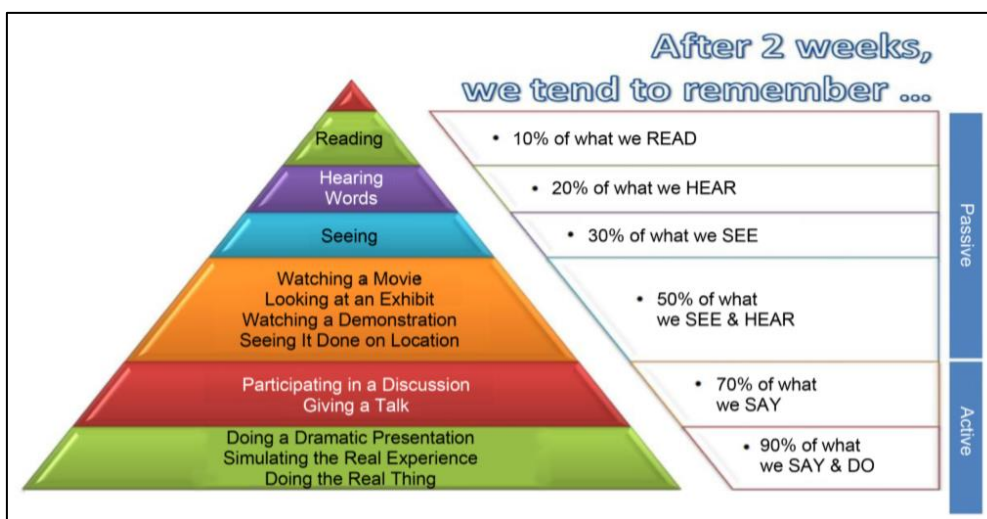
Figure 1 The Cone of Learning by Dale (1969)

Student Engagement

Student engagement refers to the investment or commitment, participation, or effortful involvement in learning (Henrie, Halverson & Graham, 2015). Student engagement is critical to student learning and literature agrees that in order to stimulate and endure student engagement, teaching must be effective thus students become good learners. To consider student engagement within the classroom, Handelsman, Briggs, Sullivan, and Towler's (2005) identified four main dimensions of engagement; skills engagement (keeping up with readings, putting forth effort); emotional engagement (making the course interesting, applying it to their own lives); participation/interaction engagement (having fun, participating actively in small group discussions); and performance engagement (doing well on tests, getting a good grade) based on exploratory factor analysis.

Figure 2 Four Dimensions of Student Engagement by Handelsman, Briggs, Sullivan & Towler's (2005)

Technology Enabled Learning

"Technology-Enabled Learning refers to the application of some form of digital technology to teaching and/or learning in a formal, non-formal or informal educational context" (Kirkwood & Price, 2016).

Technology-Enabled Learning (TEL) describes the use of technology to support students' learning. The word enabled refers to facilitation making learning possible with the help of technology. It does not imply the value judgment that the word enhanced necessitates. TEL is just about different ways of serving existing learners or, potentially, providing opportunities for learners who were previously regarded as being "out of reach" - that is, those learners who typically have little to no access to educational opportunities because of a variety of circumstances – in order to make learning possible (Kirkwood & Price, 2016).

Web 2.0 Tools

The rapid advancements in technology and the consequential evolvement of the World Wide Web has made it the ubiquitous platform for work, commercial, entertainment and academic purposes, with web 2.0 standards being the norm. Web 2.0 with its social interactivity, collaboration and information sharing capacities have given birth to a generation of internet with increased social networking and information sharing spaces including Blogger, Wikipedia, Facebook and YouTube among others.

Before the development of Web 2.0 tools, the main focus of computer systems was on data management, information and creation of explicit knowledge. Web 2.0 changed this with the focus shifted towards the development of more implicit knowledge as a result of social interaction and global participation (Dwivedi, Williams, Mitra, Niranjan, & Weerakkody, 2011).

Web 2.0 allows users to both read and also share information on the internet. Presently, there are many popular Web 2.0 interactive applications such as Blog, Podcast, Mashup, Tag, Rss/Atom, Wiki, P2P, Moblog, Adsense and other similar platforms (Rajiv & Lal, 2011).

Methodology

Action research is used as a research method. Stephen Corey (1953) defined action research "as the process through which practitioners study the problems associated with teaching, evaluate it and take possible actions to improve teaching practices." For this particular research, Individual Action Research type was

adopted followed by the spiral model proposed by Kemmis and McTaggart (1988) as shown in Figure 3. Two action cycles were processed with specific purposes.
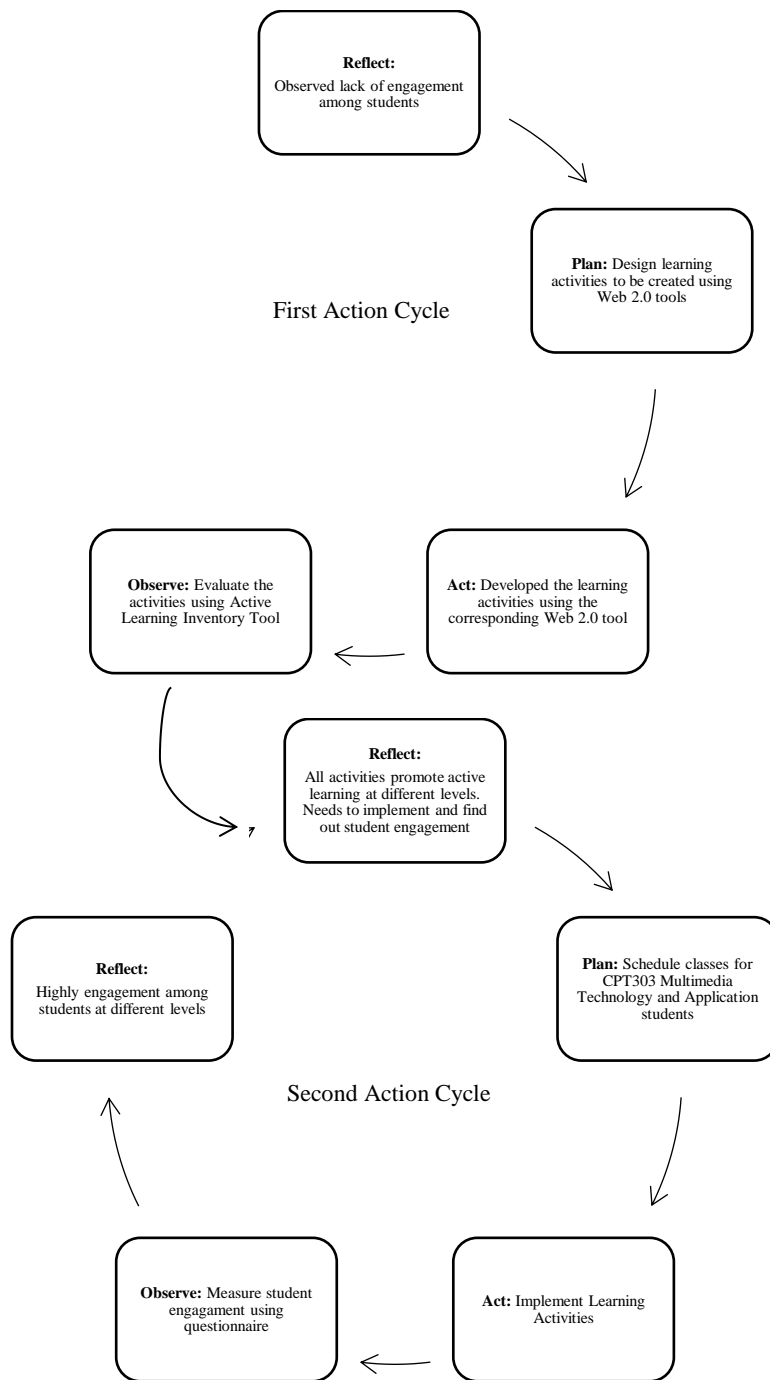

Figure 3 The Two Cycles of the Action Research

First Action Cycle

The main objective of the first action cycle was to design active learning activities (LA) using web 2.0 tools and to evaluate these activities on the levels of active learning they promote. The cycle followed the following phases:

- **Reflect (identification of the problem):** The researcher experienced lack of interest and motivation among students during class with passive mode of delivery. Current learners are considered active learners and teaching strategies needs to be changed from passive modes in order to increase their engagement. By adopting student-centred pedagogies several changes to the teaching strategies were brought in to make them active learners in the class through different learning activities (like group works, case study analysis and discussions). Even though several active learning tasks were incorporated, lack of active participation among IT students was observed. It seems that IT students were hesitant in writing in paper using pen and pencils. Hence, another solution needs to be looked into.

- **Plan:** Through literature it was identified that learning needs to be driven by technology for 21st century learners. Hence, it was decided to incorporate technology to create learning activities that could promote active learning. Web 2.0 tools were identified as a medium that could be used to create these activities. Therefore, it was planned to design learning activities using different web 2.0 tools and evaluate those using tools to ensure that the activities are directed to active learning.

- **Act:** Several activities were created using web 2.0 tools for one of the modules – CPT303: Multimedia Technology and Applications as illustrated in Table 1.

- **Observe (Findings):** The learning activities created were evaluated using Active-Learning Inventory Tool. Evaluation was carried out by the researcher himself and two other experts in instructional designing. The findings are discussed in the next section.

- **Reflect:** After the evaluation of the four learning activities, evaluators agree that each learning activity promotes active learning with combination of low complexity, medium complexity and high complexity levels. There is a need to ensure that these activities will engage students within

the classroom; hence, levels of student engagement need to be studied, which will be the main objective of the second cycle.

Table 1 Details of the designed Learning Activities (LA) using Web 2.0 tools

LA	Topic	Learning Outcome(s)	Learning Activity	Tool
LA1	Introduction to Multimedia	• Using own words, learner should be able to clearly define the term multimedia • In writing or orally, learner should be able to name all the five elements of multimedia • Given the uses of multimedia elements, learner should be able to identify the correct element. • When examples of multimedia projects are presented, learner should be able to classify it as either linear or non-linear with the reason. • In writing or orally, learner should be able to explain the applications of multimedia in different fields with examples	Students watch video: Chapter 1: Introduction to Multimedia While watching, students will be prompted with questions on their screens at different intervals. Students cannot skip the question without answering and if they do not know the answer, then they have the option to watch the content up to the question again. Video will continue only if the question is answered. For MCQ, questions immediate feedback will be provided and for open-ended questions, feedback will be provided once they complete the task. Teacher can monitor the progress, number of times a portion of the video is watched and so on. After the completion of task, answers will be discussed in the class.	Eduzzle
LA2	Images: vector graphics & bitmap graphics	• By collaboratively working with peers, learner should be able to prepare a presentation explaining all the features that differentiates vector from bitmap	Students are shared with a Google slide with some points that needs to be included based on Vector and Bitmap Images. They will be asked to complete the slides and present it to class. Students will be given option to decide on how they will	Google Slides

			proceed with it (division of work).	
LA3	Colours	Working in pairs and with supported resources, learner should be able to • Explain about the two colour models; RGB and CMYK • Describe at least three different colour harmony schemes • Explain the best practices in selecting background and foreground colour for a multimedia design • Explain the complete steps in calculating the size of a bitmap image	Students will be paired and for each pair a key point about colours will be assigned. Each pair needs to find information/content that explain the key points and also needs to provide evidence (websites, videos, articles) to support their content. All teams can rate others work based on their understandings and comment. At the end, there will be a discussion on the points.	Padlet
LA4	Principles of Visual Design	• Given a sample multimedia design and collaboratively working in teams, learner should be able to critically analyse the application of principles of visual design in the design	Class will be divided in two groups. Each group will be presented with a website design. They need to highlight and comment on the use of design principles and suggest how it can be improved. Once each group finishes, it will be exchanged among groups to review whether they have identified it correctly or there are any further issues or points that needs to be highlighted!	Concept -board

Second Action Cycle

The purpose of the second cycle was to measure the levels of student engagement when the developed learning activities were implemented within the classroom. The cycle followed the following phases:

- **Plan:** Third year students from the course Bachelor of information Technology who are completing the subject; Multimedia Technology and Applications (CPT303) were scheduled to be taught using the LA created during their classes.

- **Act:** As a lecturer, the researcher facilitated the lessons of the topic by using the LAs and allowed students to experience the LA implementation within the classroom.

- **Observe (Findings):** After implementing all of the four LAs, a questionnaire was administered online among the students. The questionnaire was developed based on the factors that measure student engagement based on the four dimensions. Students were asked to rate how well the presented behaviours, thoughts, and feelings describe to them during class. Then the results were analysed for further conclusion as detailed in the next section.

- **Reflect:** Results suggest that they were engaged within the four dimensions – with performance as the highest level of engagement.

Results

Evaluation of Learning Activities During First Action Cycle

In order to ensure that the designed activities using Web 2.0 tools promotes active learning, these activities were evaluated by a researcher and two other instructional designers, using the validated tool developed based on the published literature; Amburgh, Devlin, Kirwin and Qualters (2007). Experts in the field of educational research validated the Active-Learning Inventory Tool and its reliability was established by trained faculty members who used and evaluated it.

The tool presents different activities that promote active learning at different levels. Each learning activity was compared against the tool to identify the number of active learning tasks (episodes) within them and their corresponding level. An average of two active learning episodes for LA1, six episodes for LA2, ten episodes for LA3 and eleven episodes for LA4 were observed. Average percent agreement among the evaluators for the complexity level was calculated as illustrated in Figure 4.
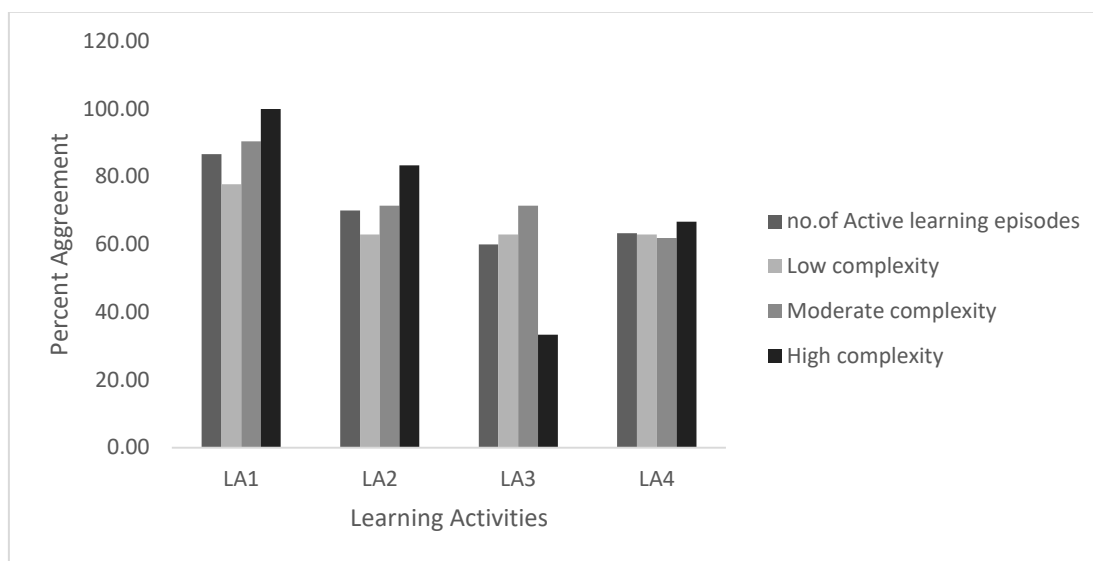
Figure 4 Percent Agreement among Evaluators for each Activity

Three different levels of active learning were observed per learning activity. The percent agreement among the evaluators for individual activity was reasonable.

The percent agreement for the total number of active learning episodes in all LAs was 70%, the number of tasks with low complexity level observed was 67%, moderate complexity level observed was 74% and high complexity level observed was 71% (Table 2).

Table 2 Average percent agreement for all the activities

	Average percent agreement
Total number of active learning episodes	70
Low complexity level	67
Moderate complexity level	74
High complexity level	71

Results showed general correspondence between the evaluators for the number of active learning episodes and their complexity levels.

Measure of Student Engagement During Second Action Cycle

Third year students from the course Bachelor of information Technology who were completing the subject Multimedia Technology and Applications (CPT303) were taught using the LAs. Students were then given an online questionnaire developed based on the factors identified after conducting an exploratory factor analysis by Handelsman, Briggs, Sullivan, and Towler's (2005) that measures student engagement. The four dimensions identified includes; skill, performance, participation and emotional. After the completion of all the LAs, students in the class were asked to rate how well the presented behaviours, thoughts, and feelings describe to them during the class (1. not at all characteristic of me, 2. not really characteristic of me, 3. moderately characteristic of me, 4. characteristic of me, 5. very characteristic of me).

Responses from all the 10 students were analysed by summarising the average percent agreement on the elements under each dimension based on two categories; not characteristics of me (ratings 1 and 2 combined) and characteristics of me (ratings 3, 4 and 5 combined). Results are presented in Figure 5.
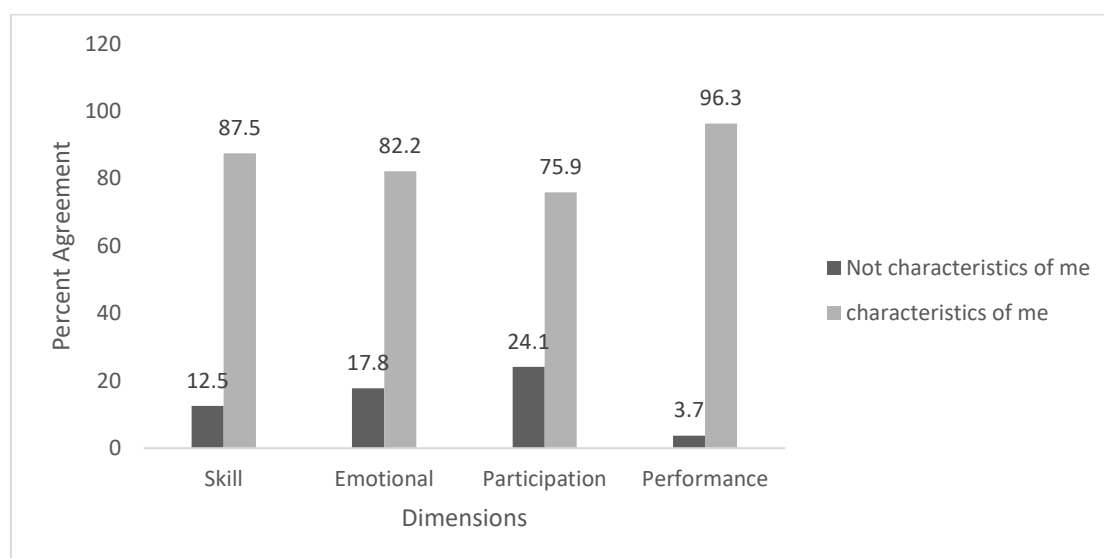

Figure 5 Percent Agreement among Students for each Dimension of Engagement

Students agree that they were highly engaged within the four dimensions; skill (87.5%), emotional (82.2%), participation (75.9%), performance (96.3%), with performance as the highest level of engagement.

Discussion and Conclusion

The research aims to find a solution to enhance student engagement in classroom which is considered as an important issue among educators and instructional researchers. Especially when catering for 21st century learners who are considered as active learners, new active learning strategies needs to be constantly looked into to help student engage in learning. Educators needs to create a learning environment to cater for the needs of learners in order learning to happen.

Researcher being a lecturer tried to create an active learning environment through learning activities created using Web 2.0 tools. After evaluation of these activities, there was rational agreement among the evaluators that they have included tasks which will promote active learning among students at different levels. Since the evaluation was carried out based on understandings among evaluators, noticeable differences were observed in the percent agreement. This could have improved if a moderation session among the evaluators were conducted prior to the evaluation. The average percent agreement on individual component was acceptable.

After the successful implementation of the learning activities, there were a high percentage of students agreeing that they were highly engaged during the lessons at all of the dimensions. Performance being the highest level with 96.3% tells us that students were confident that they will do well in learning tasks, assignments and tests which will help them to get a good grade. This supports partially the fact that in this era of technology, to make learners effective participants, pedagogical strategies need to be implemented in a technology enabled learning environment as the researcher previously failed to maintain student engagement through manual implementation of active learning. Since the implementation was only among IT students from a single class, the results may highly depend on characteristics of these students. So, to reconfirm, further research needs to be conducted for students from different disciplines.

Over all it can be concluded that Web 2.0 tools are helpful technological tools that can be used in classrooms to promote active learning among students in a technology enabled learning environment. Conducting the research as an action research, it helped the researcher to improve current teaching and learning practices, and found a solution to continue lessons by engaging students which will help to ensure that they are learning. Furthermore, the results will be a guide to other teachers to create learning activities using Web 2.0 tools that can be implemented within their classrooms by ensuring that the learners will be actively learning.

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Acknowledgements

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International Journal of Creative Multimedia

Effectiveness of Using Appropriate Blended Learning Tools for Teaching and Learning Computer Programming Related Courses

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Abstract

With the advent of technology there are plenty of blended learning tools available for us to use in teaching and training activity. Selecting appropriate tools for a particular category of students and the nature of the subject being taught is important to achieve better academic results. Hence, the objective of this research is to assess effectiveness of various blended learning tools and to find the appropriate tool for teaching a computer programming related subject. The subject considered in this research is "Knowledge-based systems (ECP3126)" offered for electronics engineering students at Multimedia University of Melaka campus in Malaysia. This subject was delivered using four selected blended learning digital tools; ED puzzle virtual classroom videos, Home works on MMLS, MMLS online Quiz and MMLS discussion board, at the beginning of Trimester 2, 2018/2019. They were asked in the middle of the trimester to rate the usefulness of the four selected blended learning digital tools in a 5-point scale using an online survey. The analysis made in the form of a bar graph of the students' feedback shows that out of the four tools "ED puzzle virtual classroom videos" is the most useful one with a score of 65, that is followed by "MMLS discussion board" with a score of 59. Hence more number of "virtual classroom videos" was used during the second half of the trimester. The effectiveness of using "virtual classroom videos" compared to other tools was revealed when the achievements of the students in terms of their academic performance were compared with previous year. It clearly shows that the academic performance of the students of year 2019 is better than of students of 2018. Hence it is recommended to choose appropriate tools based on students' interest as we are moving towards student centred learning.

Keywords Blended learning tools; Virtual classroom videos; Computer programming subject and student's academic performance

Introduction

In simple terms, blended learning is the combination of asynchronous and synchronous learning activities in one course. Blended learning offers numerous benefits, including; flexibility, independence, diversification, support etc. There is no doubt, that it provides richer, more interactive learning experiences to the students of higher learning institutions (Priyanka Gupta, 2016). Integration of videos, podcast and other multimedia makes learning richer and fun. With the advent of technology there are plenty of blended learning tools available for us to use in teaching and training activity. Selecting appropriate tools for a particular category of students and the nature of the subject being taught is important to achieve better academic results (Chew, 2008). That is why the primary aim of this research is to assess the effectiveness of using appropriate blended learning tools for teaching and learning computer programming related courses. The secondary aim is to find the appropriate blended learning tools for teaching the computer programming related subject, Knowledge-based systems (ECP3126), offered for electronics engineering students at Multimedia University of Melaka campus in Malaysia.

Literature Review

Blended learning is the combination of digital tools, techniques and materials with the physical traditional learning classroom (José et al., 2007). It is a hybrid teaching methodology or a style of education in which students learn through online electronic media and the face-to-face style of traditional teaching (Curtis et al., 2005). The pedagogical and socio-economic forces that have pushed Institutions of Higher Learning (IHL) to embrace and integrate ICTs in teaching and learning include "greater information access; greater communication; synchronous and asynchronous learning; increased cooperation and collaboration, cost-effectiveness and pedagogical improvement" (Sife et al., 2007). Even though the method which has evolved from distance education called "e-learning" has received great attraction from public universities, it should be combined with the face-to-face learning in order to be more effective. This blending leads to a new methodology called "blended learning". This blended learning has proven to be the most effective learning system in Higher Educational Institution (HEI) in Malaysia (Azizan, 2010). There are many tools available for the implementation of blended learning in classroom teaching (Khandve & Shelke, 2016). However, selecting appropriate tools for a specific subject and the particular group of students being taught is important to achieve better academic results (Chew, 2008). Specific blended learning models are required to teach computer programming in higher education (Mohorovicic & Tijan, 2011). The nature of students and the type of course are to be considered while preparing for blended e-Learning (Littlejohn & Pegler, 2017). Research shows that the instructors involved in implementing blended learning in classroom teaching are also benefited in various ways (Nihuka et al., 2012).

Methodology

Selection of appropriate digital tools for blended learning is very important for the successful implementation of it. Hence it was decided to choose the tools based on the feedback received from the students of the class and to use the selected tools for teaching the subject. Finally, an analysis was made on the academic performance of these students by comparing the results of the current year (2019) students and the results of previous year (2018) students of the same subject (Asarta & Schmidt, 2017). The lecturer teaching the subject last year should be same for consistency. Number of students participated in the online teaching evaluation at the end of the trimester this year (2019) and last year was also compared and the result was considered as one of the indicators.

At the beginning of the trimester (Trimester 2, 2018/2019), lessons of the subject (ECP3126: Knowledge-based systems) were delivered using four selected blended learning digital tools; ED puzzle virtual classroom videos, Home works on MMLS, MMLS online Quiz and MMLS discussion board. At the middle of the trimester feedback on the effectiveness /usefulness of using these blended learning digital tools was taken. All of the students were requested to complete the online survey carefully designed using google form. A graphical analysis was made on their responses obtained through the survey. Subsequently, it was decided to implement the most useful and beneficial blended learning tool during the second half of the trimester.

Results

All of the sixteen students in the class took part in the online survey designed using the google form. They were asked to rate the usefulness and effectiveness of the four selected blended learning digital tools in a 5 point scale. Their comments and suggestions were also obtained through the same form. The analysis of the students' feedback is shown in the form of a bar graph in Figure 1. Out of the four tools "ED puzzle virtual classroom videos" is the most useful one with a score of 65, which is followed by "MMLS discussion board" with a score of 59 (Appendix A). According to their feedback, "MMLS Online Quiz" is not very useful (scored only 40). It showed that the students were interested in practical type of assessment as the subject is computer programming based. The tool "Home works on MMLS" was in the third position scoring 57, close to MMLS discussion board, which showed that they were still interested in doing homework but at their own pace and time.
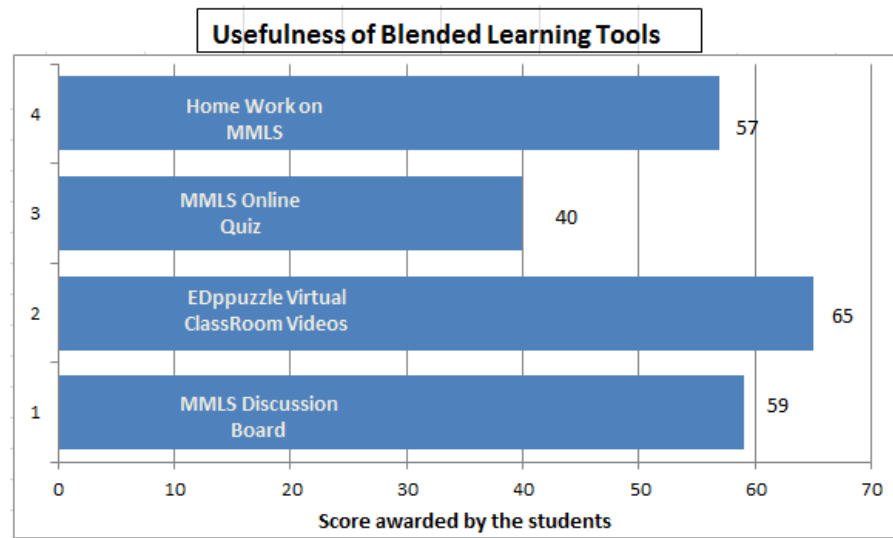
Usefulness of Blended Learning Tools

Figure 1 Analysis of Students' Feedback.

The same analysis in the form of pie chart is shown in Figure 2 for better clarity and understanding. It is clear from the pie chart that the most useful tool is the "ED puzzle virtual classroom videos" because of its multimedia content. The least useful tool was found to be the "MMLS online Quiz".
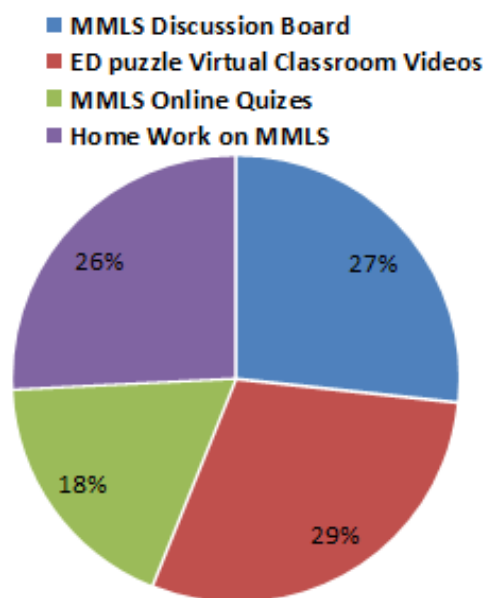

Figure 2 Pie Chart of Students' Feedback Analysis

The comparison of achievements of the students in terms of their academic performance during 2019 and 2018 is listed in Table 1. It is also graphically shown in the form of column graph in Figure 3.

Table 1 Academic Results in 2018 and 2019

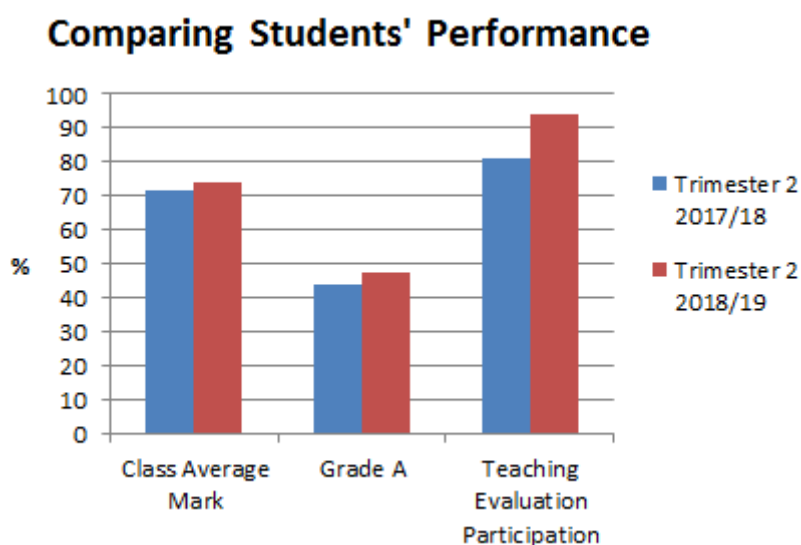| Trimester 2	Class Average Mark	Grade A Percentage	Teaching Evaluation Participation
2017/18	71.76	43.75	81.25
2018/19	73.96	47.06	94.12

Figure 3 Comparing Students' Performance in 2018 and 2019

Discussion and Conclusion

From the analysis it is clear that the academic performance of the students in the current year 2019 is better than the students of 2018 in terms of their class average score and the percentage of students who obtained "A Grade". The reason for the improvement is because of the course taught used tools more likable to the students. It is also reflected in the percentage of students taking part in the online teaching evaluation at the end of each trimester, whereby the lecturer is also benefited.

From the results, it can be concluded easily that the selection of appropriate blended learning tools for teaching and learning computer programming related courses such as Knowledge-based Systems can improve students' academic performance. Hence it is recommended to choose appropriate tools based on students' interests as we are moving towards "student centred learning".

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program and overall faculty operation. His research interest covers areas in artificial intelligence, neural network, pattern recognition, road traffic monitoring, machining-tools condition monitoring and robotics navigation. Along his career path, he has published numerous numbers of international journals and conference papers, book chapters and engineering text books. Dr. Lim also maintains strong industrial and international university collaborations such as, with Infineon Technologies and Chiba University.

Appendices

Appendix A Online Survey Data Obtained from Students' Feedback

Timestamp	MMLS Discussion Board	ED puzzle Virtual Classroom Videos	MMLS Online Quizzes	Home Work on MMLS
2019/01/30 4:18:56 PM GMT+8	5	4	3	4
2019/01/31 12:48:21 PM GMT+8	3	3	2	3
2019/02/08 5:07:57 PM GMT+8	3	5	2	3
2019/02/11 10:12:19 AM GMT+8	5	4	2	3
2019/02/11 5:03:11 PM GMT+8	3	4	3	4
2019/02/12 12:18:01 PM GMT+8	4	5	3	4
2019/02/12 1:38:12 PM GMT+8	2	4	2	3
2019/02/12 7:27:27 PM GMT+8	3	4	2	3
2019/02/14 4:19:50 PM GMT+8	3	4	3	3
2019/02/14 5:57:22 PM GMT+8	5	5	3	5
2019/02/15 10:09:36 AM GMT+8	4	2	2	4
2019/02/15 10:28:48 AM GMT+8	4	4	1	2
2019/02/15 12:52:55 PM GMT+8	4	2	3	4
2019/02/15 12:53:58 PM GMT+8	4	5	3	4
2019/02/15 12:54:19 PM GMT+8	5	5	3	5
2019/02/22 4:13:08 PM GMT+8	2	5	3	3
Total Score	**59**	**65**	**40**	**57**

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The Role of Blended Learning Technologies in Enhancing Student Engagement in Theory Dominant Subjects

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Abstract

The application of blended learning in education has seen a steady rise over the years, especially among undergraduate and postgraduate students. Consequently, educators are in a position where they are inclined to select the most appropriate approaches in teaching and learning in order to improve learning among students and to fulfil profession requirements. This paper aims to investigate the role of blended learning technologies in enhancing student engagement in theory dominant subjects. The data attained from respondents were analysed qualitatively. A class of 38 students were observed and trained using blended learning technologies. The results revealed that innovative teaching strategies, gamification, simplified teaching, sense of belonging and equal opportunity does have a significant impact in enhancing student engagement in theory dominant subjects. The results of this study will be valuable and useful in the development of various innovative teaching techniques which are able to attract students throughout the learning process, especially in theory dominant subjects.

Keywords Blended learning; Student engagement; Enhancing; Innovative teaching; Undergraduates; Theory dominant subjects

Introduction

The Malaysian education system aims to equip students holistically apart from preparing them for the challenges and opportunities of the 21st century (Ministry of Education Malaysia, 2013). The Malaysian government has managed to restructure the nation's higher education system in response to the call for

nation-building as per the nine challenges laid out in Vision 2020 (Grapragasem, Krishnan, & Azlin, 2014). According to the Malaysia Education Blueprint 2013-2025 (2013), Higher Education Institutions (HEI)s are highly encouraged to undertake and embrace change in order to achieve excellence to face competition in the overall global education market. Since the education process is constantly evolving; therefore, changes in both teaching and learning are inherent. Consequently, the traditional speech-like method of teaching (which educators and students have been accustomed to) is rapidly being replaced by a hybrid method known as blended learning. This particular method incorporates the use of digital technology alongside the face-to-face method and is deemed to be more student-centred. A huge fragment of blended learners fall under the higher education category. This means that undergraduates and postgraduates are those who are more likely to participate in lessons which apply blended learning techniques.

Problem Statement

Higher learning institutions are under increasing pressure to deliver innovative programs and methods of teaching that meet the rising demands of students as well as accrediting institutions (Albers-Miiller, Straughan, & Prenshaw, 2001). One of the biggest challenges faced by educators at the moment is the ability to capture students' attention during lessons which focuses on one hundred percent theory. Educators teaching theory dominant subjects are usually more focused on explaining a system of ideas, principles and concepts. There is basically little (or none) practical application in these classes. Traditional teaching methods are deemed to be ineffective because constant technological developments will always change the learning process (Simplicio, 2000). The traditional face-to-face teaching method causes students to get bored and inattentive throughout a two to three-hour lecture session. With no creativity being applied in teaching the subject, students easily get disengaged and at the end of the day, return home without learning anything. At the end of the semester, students would typically complain that they have learnt 'nothing' and that they have had difficulties retaining information from the classes as the subject was taught blandly.

Literature Review

Student engagement generally refers to the passion, degree of attention, curiosity and interest shown by students throughout the learning process (The Glossary of Education Reform, 2016). Student engagement in higher learning institutions is deemed to be important because it acts as a proxy for quality (Zepke & Leach, 2010). Furthermore, good student engagement would in due course extend to an increase in students' performance in class. In addition, students who are more involved in lessons tend to develop themselves holistically in terms of soft skills (Fauziah, Rosna, & Tengku Faekah, 2012). Ultimately, these

students will end up to be graduates that are more appealing to employers due to the soft skills acquired (Raybould & Sheedy, 2005).

Lee and Hammer (2011) explained that although educators are constantly seeking for new instructional techniques in teaching, students still face problems in terms of motivation and engagement. Parsons and Taylor (2011) have raised concerns that educators face difficulties in coming up with ideas to engage with students and this has resulted in them to completely scrap the idea of coming up with new and innovative teaching methods. Educators would then result back to traditional teaching methods and ultimately, this causes student disengagement, which is a major concern to institutions (Parsons & Taylor, 2011).

That being said, educators are still advised to select the best pedagogy (Johnsen, 2012) in order to improve learning among students as well as to fulfil profession requirements. It may be the simplest form of technique if the educator does not have a grand strategy. Following the current trend, the best pedagogy would be to apply blended learning techniques in theory dominant subjects which could eventually ensure that students are engaged throughout the course.

Blended Learning Technologies in Enhancing Student Engagement in Theory Dominant Subjects. Five blended learning technologies were carefully identified and chosen to enhance student engagement in theory dominant subjects.
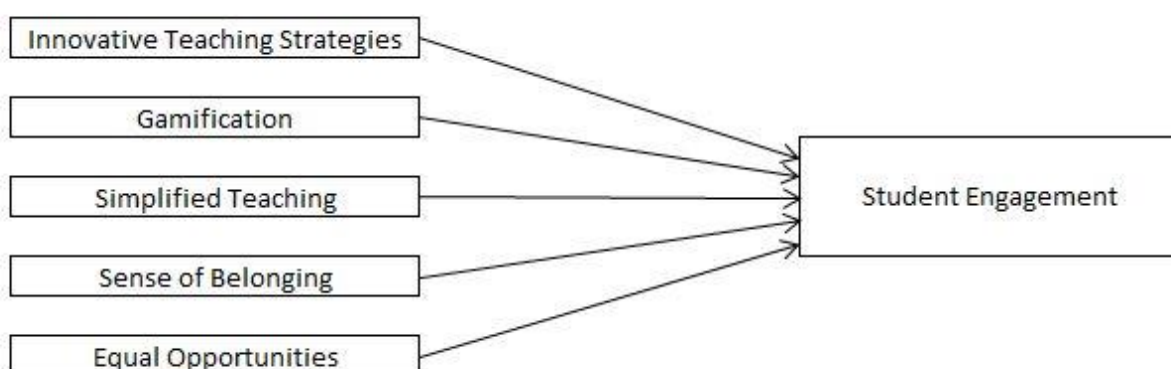

Figure 1 Research Model

Figure 1 depicts the model which educators could apply in future lessons. The five blended learning technologies include innovative teaching strategies, gamification, simplified teaching, sense of belonging and equal opportunities.

Innovative teaching strategies represent variability in lessons. Educators are encouraged to use creative methods with minimal incorporation of the traditional method. Some of the strategies suggested include the use of interactive materials, outdoor lessons, guest speakers and many more.

Gamification promotes a more casual learning environment whereby students are allowed to challenge themselves and each other in a series of online games. This is considered to be a more 'fun' approach as students are allowed to compete with each other and earn rewards. Furthermore, this method of learning enables students to quickly pick up and retain information.

Simplified teaching is basically a simpler and more practical way of teaching theory based subjects. This technique inclines more towards a student-centred approach. A course based on progress (practical application) instead of grading (memorising) would tremendously be beneficial to the students undertaking theory subjects as they tend to be more alert when the former is implemented. In addition, educators are also encouraged to provide lessons in concise summarisations instead of long, boring lectures.

Sense of belonging towards a class is also vital in ensuring student engagement. Students greatly appreciate the fact that their discussions are taken seriously and acknowledged by everyone (including their lecturer) in the class. They would like to feel that they are an important part of the class. Inclusion in class activities would further strengthen their understanding in the lesson as they are fully committed and immersed in the activity in hand.

Finally, equal opportunity for class involvement enables students to regularly participate in class activities without feeling left out. By allowing students to always play their part in the activities, they would be able to slowly unleash their creativity to tackle the topic or case in hand. This would only work if everyone is given the same opportunity to participate and if the lecturer encourages the students to develop their own voices.

Methodology

Focus Group Sessions were conducted to obtain detailed information about personal and group feelings, perceptions and opinions. The Focus Group sessions were conducted on a class of thirty-eight students in Multimedia University, Cyberjaya. The blended learning technologies were applied throughout each lesson within the semester and feedback from students were recorded. The end result is a focus group report which

highlights the relationship and role of blended learning strategies using games in classrooms to enhance student engagement especially in theory dominant subjects.

Students were exposed to an array of blended learning technologies which incorporate each of the technologies listed in the research model. Students were given chances to work in groups for activities such as Poison Ball, Scavenger Hunt and impromptu presentations. All these activities require equal participation among the students and at the same time, they were not restricted to a classroom setting. Students were also taught using Kahoot (an online quiz application) and media (video and audio). Furthermore, sessions where students were brought outdoors and had guest lecturers teaching them were also included as part of the research. Traditional games like Snap and Snakes and Ladders were also used as part of the quiz segment during lessons.

Results

Data was collected from students' feedback and thematically analysed to pick out the key points that lead to increased student engagement. It was found that innovative teaching strategies, gamification, simplified teaching, sense of belonging and equal opportunities played a positive role towards enhancing student engagement.

Discussion and Conclusion

Findings showed that students had better engagement as well as fun learning environment in the class. This method of teaching also increased students' understanding of the subject matter as well as performance in the final examination. The research findings may bring about the use of various innovative techniques to attract students. A more fun and enjoyable learning environment. Increase student numbers and indirectly increase revenue.

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Acknowledgements

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International Journal of Creative Multimedia

Exploring the Use of Immersive Technology in Education to Bring Abstract Theoretical Concepts to Life

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Abstract

Over the years educators have adopted a variety of technologies in a bid to improve student engagement, interest and understanding of abstract topics taught in the classroom. There has been an increasing interest in immersive technology such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). The ability of VR to bring ideas to life in three dimensional spaces in a way that is easy for students to understand the subject matter makes it one of the important tools available today for education. A key feature of VR is the ability to provide multi-sensory visuals and virtual interaction to students wearing a Head Mounted Display thus providing students better learning experience and connection to the subject matter. Virtual Reality has been used for training purposes in the health sector, military, workplace training, gamification and exploration of sites and countless others. With the potential benefits of virtual technology in visualizing abstract concepts in a realistic virtual world, this paper presents a plan to study the use of situated cognition theory as a learning framework to develop an immersive VR application that would be used to train and prepare students studying Telecommunications Engineering for the workplace. This paper presents a review of literature in the area of Virtual Reality in education, offers insight into the motivation behind this research and the planned methodology in carrying out the research.

Keywords Virtual reality; Learning with Technology; Situated cognition

Introduction

Educationalists have often sought various approaches to improve the learning experience of students, as research has found that students often report their learning experience to be boring, unengaging, abstract and inapplicable (Mathrani, Christian, & Ponder-Sutton, 2016; Sharp & Hemmings, 2016). The National Association of Independent Schools (NAIS) published the "2014 NAIS Report on High School Survey of Student Engagement" which revealed that 82% of students reported being disengaged in class due to learning materials being uninteresting (NAIS Research, 2015).

The advent of the internet and smartphones have even made traditionally designed classes less engaging as students found social media a tempting distraction when the lessons were not as interesting or relevant to them (Flanigan & Babchuk, 2015). Zachary (2017) mentioned that most teaching methods have not changed to meet the needs of this generation of students who want learning to be fascinating, engaging and relevant. A notable problem faced by students in the classroom is the disconnection between theory-based learning in the classroom and practical application in the real world which results in students not achieving the intended learning outcomes. This is so because theoretical learning method is difficult for students to understand, assimilate and remember (Mathrani, Christian, Ponder-Sutton, 2016). As such, although in recent years there has been an increased adoption of technology in the classroom, most of them have not been designed to allow students to grasp the real-life application of abstract information and theoretical concepts.

With the advancement of technology, some of the issues described above may be addressed when the use of emerging technologies in the classroom is carefully integrated with an appropriate learning theory. Therefore, this research study seeks to explore the use of situated cognitive theory developed by Lave and Wenger (1991) as a framework to develop a Virtual Reality (VR) application and is driven by the following research question: What is the implication of using Virtual Reality in the learning process of undergraduate students? This paper presents an overview of literature on the use of VR in education and the proposed research methodology that will be used.

Literature review

Challenges of Education in the 21ˢᵗ Century

Schmidt, Wagener, Smeets, Keemink, and van der Molen (2015) posits that while conventional lectures are able to aid in the achievement of learning objectives to a certain extent, these conventional forms of lectures "do not promote critical thinking; student attendance tends to be low and so is cognitive

engagement". Schmidt et al (2015) further explains that the key challenge with traditional forms of lectures is that they stem from the idea that telling students something is enough for them to learn. French and Kennedy (2017) argues that lectures do have its merits, such as providing an overview of the subject and being a cost-effective way to teach in a large scale, however they agree that the integration of more interactive forms of learning should be added to offset the shortcomings of lecturers. In recent times, educators have begun changing their roles in the classroom in an effort to move away from being just lecturers. Educators are beginning to understand that students are active learners who would benefit from having lecturers who facilitate their learning as these learning experiences allow students to construct knowledge and attribute individualized meanings to their achievements (Padilha, Machado, Ribeiro, Ramos, Costa, 2019).

Education in this 21st century requires students to be able to understand concepts that are complex or abstract however the most common method used to teach these abstract concepts, especially when it comes to science subjects, is through the use of metaphors and analogies (Chris, 2010). In Malaysia, there has been an alarming drop of interest amongst students in taking up STEM subjects as the perception is that these subjects are dry and boring (Chin, 2019). The Malaysian Ministry of Education has taken several initiatives through the Malaysia Education Blueprint 2013-2025 to change the way educators approach teaching and learning, encouraging the use of more innovative technology and blended learning approaches to increase students' interest in STEM subjects (Ministry of Education, 2012).

Importance of Virtual Reality in Education

One approach that educators are looking into when it comes to redesigning the classroom is the use of immersive technology such as Virtual Reality (VR) in an education setting. VR can be described as a method of visualizing a realistic or imaginary three-dimensional space through the use of various technologies with the possibility of allowing the user to interact within this virtual space (Chris, 2010). Chris (2010) further elaborates, "These environments often depict three-dimensional space which may be realistic or imaginary, macroscopic or microscopic and based on realistic physical laws of dynamics, or on imaginary dynamics." VR can also be defined as the "use of computer technology to create a simulated environment" where the user is immersed into the experience and interaction of this artificially created world rather than looking at it through a two-dimensional screen (Joe, 2019). Immersion in VR can be described as a situation where the user perceives they are immersed into the virtual world (Lin, Hsu, & Shih, 2013).

Research has suggested that VR is potentially a powerful technology that can create learning environments that allow simulations of scenarios, enabling students to experience and visualize these

scenarios (Chris, 2010). Students are able to concentrate better when they experience an immersive virtual 3D environment as it provides a learning experience that is able to maintain their attention and increase their motivation (Wang, Wu, Wang, Chi, & Wang, 2018).

In fact, the potential benefits of using virtual learning environments in the preparation of professionals, such as those in the field of healthcare, has been observed by educators from various disciplines (Davis, 2009). One example of this is the VR app "World of Comenius" which is being used in classrooms to provide students richer educational experiences and also to improve their engagement in the classroom (James, 2014). Figure 1 shows an illustrated example of a VR headset with hand held controllers used to study human anatomy.

Figure 1 Virtual Reality Technology is used to Study Human Anatomy. Creative Commons Licensed Photo by Jesper Aggergaard on Unsplash (https://unsplash.com/photos/38Hg7GMTogo)

Chris (2010) argues that the advantages of VR when it comes to its use in the education field is that VR allows students to observe, experience, and interact with concepts or lessons that would normally be challenging to illustrate through traditional methods.

Spence (2018) quoted Tolson as saying that "Virtual reality will allow students to gain an extra level of experience by visiting and engaging with sites which would otherwise be off-limits to most trainees,". Students from TAFE (Technical and Further Education) South Australia's Tonsley Campus are being taught refrigerant safety courses using virtual technology. The students take virtual tours of hazardous work environment and are taught safety precautions. The virtual training teaches students how to respond as if

they are really on the job site (Spence, 2018). Dr Jacqueline Thomas, as quoted in an article by Brown (2017) mentioned that "experiential, site-based learning is really critical and powerful. VR doesn't replicate a site 100 per cent, but it's taking students places and into environments beyond the classroom.". However, while some have argued that the capability of VR to create a completely realistic experience is still limited by the hardware and software prowess available, when it comes to education, it's not the technology that limits its use but how it is being utilized to enable students to learn (Martín-Gutiérrez, Mora, Añorbe-Díaz, & González-Marrero, 2017). The main objective of using virtual reality is to encourage students to think strategically by creating an environment where they can match their theoretical course work to virtual real-life observations (Brown, 2017). Hence, with increase accessibility and improving technology, VR is potentially able to create opportunities that will allow users to be immersed in experiences that are normally impossible or inaccessible (McCann, 2018).

Situated Cognition Theory

Situated learning as introduced by Lave & Wenger (1991) believes that learning takes place within an authentic activity, culture and context associated with the learning experience. Situational cognitive theory hopes to bridge the gap between abstract theoretical learning and practical application. Proponents of Situational cognitive theory believes that combining relevant authentic activities and context makes learning effective and relevant for students (Brown, Collins, & Duguid, 1989). According to Xinyu (2019) situational learning theory believes that knowledge has context and the learning should be conducted in the corresponding context. Situational cognitive theory believes there is a dynamic interaction between the construction of knowledge by learners depending on the context or situation they are in (Xinyu, 2019). Simply put, students are able to learn better when they are in a situation that allows for the application of said knowledge. Experiencing complex problems that mimic real life situations provides students with a learning experience that allows them to gain transferable skills (Wang & Cheng, 2011). The key principles of situated learning as noted by Lunce (2006) are:

- Presentation of knowledge within an authentic context (a scenario or situation where the knowledge would be applied).
- Learning requires collaboration and social interaction between learners in what is called a "community of practice".
- Tacit knowledge, which is defined as knowledge that is difficult to transfer to another, is assumed to be present.

- The process of learning known as "everyday cognition" to use tools or artefacts to achieve real-world objectives in a real-life situation.

Virtual Reality technology offers a platform for the integration of situated cognitive theory as it is able to stimulate a virtual learning environment where learning is backed up with seeing and doing (Abdi, 2013). Virtual Reality technology provides immersive content that students can use to visualize educational content as it applies to real life scenario, it also provides a platform where students can engage with and replicate learning scenarios as it occurs in real life. The use of VR in an exploratory form of education appears to promote creative thinking, positive attitudes towards learning, and higher motivation as it provides students with a better learning experience (Lin, Wang, Kuo, & Luo, 2017). According to King-Thompson (2018), the ability to view motion graphic images or videos in 360° allows for learners to form stronger connections in what they are learning as they are able to be immersed in their learning and more engaged within the virtual environment.

Methodology

The methodology for this research study is divided into two parts. Part 1 involves the development of an immersive Virtual Learning application that will utilize a Head Mounted Display and controllers for interaction. Part 2 will be the research methodology. The aim of this research study is to look at designing virtual reality learning applications to bridge the gap between abstract theoretical knowledge taught in the classroom and the skills needed in the workplace. Therefore, situated learning will be used as the pedagogical framework to guide the design of the content and interactive activities in the VR learning application. The plan is to design the VR learning application using telecommunications related content that are hard for students to visualize, with the help of a subject matter expert.

Part 1 – Designing and Developing the VR Learning Application

The goal of the application is to immerse students in the role of a telecommunications engineer and be given various simulated scenarios to problem solve and apply their theoretical knowledge. Using a virtual simulation also ensures that students are in a safe environment to learn from trial and error. One of the modules from a core telecommunication subject offered at Multimedia University which students need to take prior to going for internship will be selected and used in the development of the VR content. The lecturer of the course will be appointed as the subject matter expert (SME) and will be consulted from time to time throughout all stages of the development. The SME will also assist in the selection of topics to be developed into VR modules, ensuring the topics selected consist of challenging theoretical concepts that

can be visualize through the use of VR. The VR application will be designed to ensure that the course learning outcomes/objectives are mapped to the content and interactive activities within the VR application.

The application will be designed to incorporate situated cognition theory as the pedagogical framework and would be developed using different softwares such as 3d modelling applications, graphic manipulation applications and other relevant multimedia content design software. Blender will be used to recreate the telecommunications working environment in a 3-Dimensional (3D) virtual learning environment to simulate real working situations that students would face when they graduate. Blender would be used to model the 3D virtual learning space, characters and avatar, and also to animate the characters in the virtual scenes. Photoshop and substance will be used for texturing the models to give it a realistic fill, unity and visual studio would be used to program the assets, 3D models and characters that will be used in the virtual scenes, unity will be used to deploy the application to oculus rift, HTC Vive and other virtual reality devices.

Once completed, the VR application will be evaluated and reviewed by the SME before proceeding to be beta/pilot tested by a selected group of participants and feedback received will be used to reiterate and modify the application.

Part 2 - Research Methodology

This research will use experimental design to test the hypothesis. The experimental group is exposed and taught with the virtual technology while the control group is taught without the VR learning application. The target scope and sample of this research is undergraduate students from Multimedia University taking a Telecommunications Engineering course. The students would be randomly assigned to the control group and the experimental group for a period of 4 weeks to learn the selected module.

Pre and Post-tests will be prepared with the help of the SME as a way to benchmark student's prior knowledge and to determine if the learning outcomes have been achieved after the treatment. The Pre and Post-tests will consist of multiple-choice questions (MCQs) and have the same questions but in different orders to avoid the memory effect. Students will be given the pre-test at the beginning of Week 1. Students in the control group will then learn the content as they normally would, through the use of lecture slides, notes, and discussion groups. Students in the experiment group will learn the content using the VR learning application. Both groups of students will also have a project to complete within the 4 weeks. After going

through the treatment, they will be given the post-test at the end of Week 4. Both the experimental group and the control group will receive the same pre and post-tests questions.

Other research instruments used will include a 5-point Likert Scale survey questionnaire adapted from related research studies and focus group interviews to solicit qualitative and quantitative feedback from students in order to gauge their perceptions and attitudes towards the VR learning application. Collected data would then be analysed and triangulated to answer the research questions of the study. Figure 2 shows the overall proposed framework of the research methodology design.
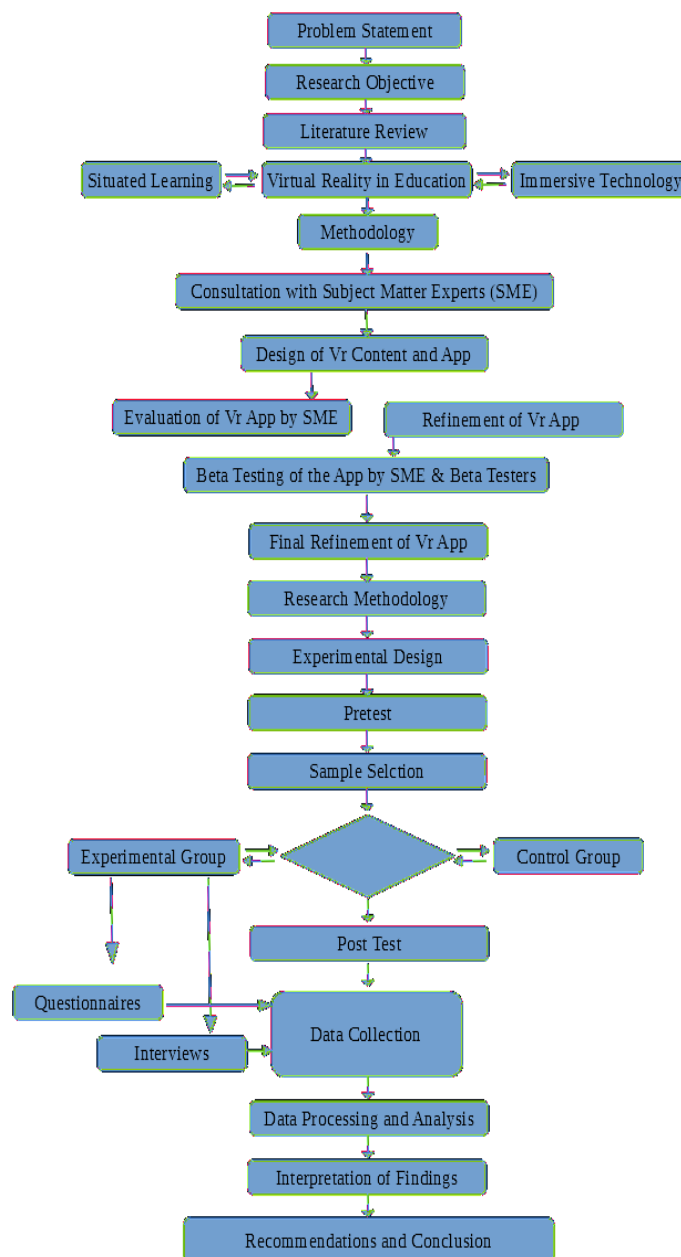
Figure 2 Proposed Research Methodology Framework

Implications and Possible Limitations of the Study

Research has shown that using the right pedagogy in designing a VR app can potentially help to stimulate students' interest in STEM topics. This study hopes to discover if similar results can be attained with Malaysian undergraduate students which may help to provide a basis for further research and development of VR app for educational purposes. It is hypothesized that students in the experimental group will show increased interest, engagement, and motivation towards the topic as the VR app will be able to visualize telecommunication concepts that are usually hard for students to understand. A possible limitation to this study would be the availability and accessibility of VR headsets for all students in the experimental group due to the high cost of purchasing a VR headset. The students involved in this research will have to take turns to use the app to learn the content if there are not enough VR headsets for all. Students also may not have access to a VR headset outside of the classroom which would then limit the usage of the application to within the classroom only.

Conclusion

This paper has presented an overview of the challenges faced by educators when it comes to engaging their students in STEM subjects that tend to be perceived as boring. Various research has found that Virtual Reality technology, when used in the right context, has the potential to help visualize concepts that are abstract and theoretical thus piquing the interest of students and increasing motivation. The research study is still on-going and is currently at the beginning stages of the VR development; therefore, findings and results of the study will be presented in future publications.

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International Journal of Creative Multimedia

The DARE Project: Exploring Creative Multimedia Students' Acceptance Towards Augmented Reality-enhanced Learning Environments

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Abstract

In an effort to prepare graduates for the onset of Industry 4.0, higher education institutions in Malaysia have been heeding the call by the Malaysian Ministry of Education to look into the utilization of technology to digitize learning materials and bring classrooms online. However, the physical learning space or classroom has largely remained the same. Hence there is a growing need to ensure that the physical learning environments are as engaging and immersive as online learning environments. Augmented Reality (AR) emerges as one of the key technologies that educators can use to "augment" the physical learning space. This paper presents a study that looked into the use of AR technology with Authentic Learning elements to develop AR-enhanced learning materials that can be used in a classroom. Students' perceptions and attitudes towards AR-enhanced learning were investigated through the use of a Technology Acceptance Model questionnaire. Results provide encouraging support for further research and development of AR-enhanced learning materials to create physical learning environments as students were positive towards the use of the AR learning app and showed a positive intention to use similar AR applications in the near future.

Keywords Augmented reality; Authentic learning; Technology-enhanced learning

Introduction

The onset of the fourth industrial revolution (Industry 4.0) brings to the fore artificial intelligence and automation that will transform the workplace, in particular jobs that are task or knowledge based (Xing & Marwala, 2017). Whilst it's been noted that there is still an on-going debate about the global impact of

Industry 4.0 (Morrar, Arman, & Mousa, 2017), the World Economic Forum (2016) in their "Future Jobs Report" identified complex problem solving, critical thinking and creativity as the top three skills workers will need to succeed in Industry 4.0 and emphasizes a need to revolutionize learning (Kang, 2019). As such the Ministry of Education through the "Malaysian Education Blueprint 2015-2025" has embarked on various key initiatives in an effort to transform the higher education landscape, in particular by changing the teaching and learning approaches. The Ministry of Education emphasized that educational institutions must innovate the delivery of knowledge through the use of technology in hopes of creating engaging learning environments that produce graduates who are innovative, creative and able to think critically (Ministry of Education, 2015). Similarly, on a global scale, educators have been looking at innovative ways to create engaging and interactive online learning environments (Gillett-Swan, 2017). However, the physical classroom has essentially remained status quo with lecture style seating and not much room for collaboration and group activities (Yee, Sim, Ng, Low, & Chong, 2017). Whilst there is a lack of research into the impact of the physical classroom environment on student learning (Han, Kiatkawsin, Kim, & Hong, 2018), educators have begun noticing the gap between the online learning environment and the physical learning environment. Hence the education landscape is now moving towards encouraging more "Makerspace" types of learning environment that facilitate group activities, project-based learning and encourage creativity (Saorín, Melian-Diaz, Bonnet, Carrera, Meier, & De La Torre-Cantero, 2017).

Research has shown that learning environments that are immersive are able to better engage learners in the content through increased interactivity (Webster, 2016; Parong & Mayer, 2018). Augmented Reality (AR) technology has since emerged as one of the key players towards the design and development of learning environments that are more immersive (Xing & Marwala, 2017). Azuma, Baillot, Behringer, Feiner, Julier, and MacIntyre (2001) defines AR as having the following characteristics:

1. The virtual environment is "blended" into a real environment
2. There is "real-time" interactivity involved
3. By accurately aligning the virtual object with real objects, it creates a realistic visual of a 3-Dimensional (3D) object existing in an actual environment.

Azuma et. al. (2001) claims that the fundamental intention of Augmented Reality is to enhance the way users perceive and interact with the real world by augmenting the physical world with virtually created 3D entities to create the illusion that the 3D virtual object exists in the same physical space. While

Azuma et al. (2001) have noted that AR has been applied with favourable results in different disciplines, it is not without its own set of challenges when it comes to usability (Akçayır & Akçayır, 2017). In order to allow AR technology to reach its potential in creating immersive and engaging experiences, the graphical user interface, content, and technology need to be synthesized in a meaningful way (Enrique, Rutledge, & Neal, 2012). Hence, this study sought to explore this research question: What are the perceptions and attitudes of Malaysian creative multimedia students towards Augmented Reality-enhanced learning applications?

Creating an Authentic and Relevant Learning Experience

Authentic Learning emerges as a potential solution to address the need for an effective pedagogical framework when it comes to the application of Augmented Reality in enhancing the field of education. Authentic Learning is underpinned by constructivism and focuses on creating learning environments that facilitate the solving of complex real-world problems (Herrington, Reeves, & Oliver, 2014). Authentic learning is often described as a learning that is seamlessly placed into a real-world situation where students are actively engaged in solving complex problems that allow them to see meaning in what they are learning (Howland, Jonassen, Marra, 2012). Authentic learning activities allow students to apply theory to practice (Lindsay & Wood, 2014) and are able to address the learning styles of the new generation of students (Gen Z). Generation Z is the generation after Millennials who are often labelled as "Digital Natives" (Mohr & Mohr, 2017). This generation of students want relevance and practicality in what they are learning and prefer lecturers to facilitate engagement with the content rather than merely presenting the content (Seemiller & Grace, 2017).

In recent years, authentic learning has begun to be incorporated into different types of emerging technologies to uplift academic results at all stages of education (Bhagat & Huang, 2018). Cai (2018) found that an authentic learning environment supported by AR technology was able to encourage natural interactions among students thanks to AR not requiring input devices like a mouse or a keyboard. This allowed the experience to feel real with the additional benefit of being able to access items that are harder to access under normal circumstances due to cost or danger. AR technology provides one possible solution to designing a learning experience that is authentic and relevant as it creates a learning environment that allows students to explore the application of theoretical knowledge through a secure and controlled environment (i.e. a classroom) (Le, Pedro, Lim, Park, Park, & Kim, 2015).

The DARE Project

The DARE Project, which is an acronym for "Digital Augmented Reality Environments" is a pilot project to develop an Augmented Reality (AR)-enhanced learning environment through the development of a mobile learning application using Augmented Reality (AR) technology with Authentic Learning elements (Herrington, Reeves, & Oliver, 2014) as a pedagogical framework.

The DARE Project is an extension of The MILE Project which was a multiple award-winning project where an online learning environment was developed to house multimedia interactive learning content, lecture slides, notes, video conferencing, learning journals (blogs), and an e-Portfolio. As the MILE Project had successfully made the online learning environment robust and engaging, the key focus of the DARE Project was to bridge the gap between the online learning environment and the physical learning space by augmenting the physical learning space using AR technology. Through the incorporation of AR-enhanced learning materials, the physical learning space could potentially be just as immersive and engaging as the online learning environment.

Therefore, in The DARE Project, an AR-enhanced mobile application called "DARE" was designed and created through the use of UNITY and Vuforia software. Development of the content for the DARE app focused on three fundamental design element topics: 1) Colour, 2) Shape, 3) Texture. These topics were chosen from the actual Design Fundamental class syllabus and since they are fundamental topics the content would not need to be frequently updated. This was an important criterion for the selection of topics to be developed as the AR development process is complex and takes time, therefore topics or content that need to be frequently updated would not be as suitable. Furthermore, the application was meant to be a supportive learning tool in the classroom to help students increase engagement and connect the physical learning and online learning. To illustrate this, in the topic of Shape (3D) students would normally transition straight away from physical 3D objects to building virtual 3D objects. It would take students some time to familiarize themselves with how virtual 3D objects are built as they try to imagine the digital building blocks (vertices, lines, and faces) that would create a digital 3D object that looks exactly like the physical object. The DARE mobile application would help to ease the transition as students can see the components that make up a virtual 3D shape overlaid on a physical 3D object. The application and its intended use was designed to incorporate the 9 Authentic Learning elements by Herrington, Reeves, and Oliver (2014) to ensure the application was pedagogically sound and to allow learning to be authentic and relevant to students. The 9 elements of Authentic Learning, guidelines for implementation into a

technology-supported learning environment as suggested by Herrington and Kervin (2007), and how they were adapted towards the design and usage of the DARE application are as follows:

1. **Authentic Context**

   Guideline: Providing authentic context to learning is about creating a meaningful setting or situation that shows students how knowledge that they are being taught in class is actually used in real life.

   Adaptation to the DARE app: The content chosen for the development of the DARE app was theoretical design knowledge taken from an actual subject's curriculum of which the practical application could be demonstrated through the use of AR.

2. **Authentic Activity**

   Guideline: The learning environment should provide complex, real-world task that are relevant.

   Adaptation to the DARE app: Within the mobile app, AR was used as a method to provide students with an immersive activity that would allow them to see the practical application of the concepts and theoretical knowledge they learn in class. In addition to that, the DARE app as a whole is designed to help support and enable students in their process of completing a complex group project.

3. **Expert Performances**

   Guideline: Students should be given access to variety of experts on the topic, and be able to watch an expert complete a task before attempting it on their own.

   Adaptation to the DARE app: The "experts" in this learning environment were the lecturers who guided the students. Within the DARE app, subject matter experts prepared content for the videos.

4. **Multiple Perspectives**

   Guideline: The learning environment should provide students with access to multiple views of the topic, not just a singular view based on a textbook.

Adaptation to the DARE app: The DARE app supported classroom learning through the addition of videos in the "Learn" section, offering students more perspectives outside their lecture notes.

5. **Collaboration**

Guideline: The learning environment should encourage students to jointly solve problem in a social context.

Adaptation to the DARE app: In addition to being a method of enhancing the physical classroom environment, the DARE app was designed to also be used by students as a supplementary learning tool while working on their group projects. As the class would be designed to center around a group-based project, students could easily use the DARE app as a reference while working collaboratively to complete the project.

6. **Reflection**

Guideline: Reflection is about providing a learning environment that gives learners a chance to think, reflect, and discuss.

Adaptation to the DARE app: The DARE app allowed students to stop and continue at any time of their learning process; thus, students were able to think and reflect on what they were learning. The short micro learning-style videos allowed students to recall the topics learnt.

7. **Articulation**

Guideline: Encouraging students to express their understanding.

Adaptation to the DARE app: The increased engagement while using the DARE app, in particular the AR "Explore" function of the app encouraged students to articulate their thoughts and understanding to each other.

8. **Coaching & Scaffolding**

Guideline: Lecturer supports learning through facilitation.

Adaptation to the DARE app: The lecturer took up the role of coach and facilitator, providing students with guidance as and when necessary.

9. Authentic Assessment

Guideline: Assessment should be part of the project rather than a separate test.

Adaptation to the DARE app: The DARE app can be used as a supportive learning tool, therefore assessments were integrated in to the group project that students worked on solving together.

As the DARE app was designed to be a supportive learning tool to enhance the physical classroom, each topic within the application contained a "Learn" section and an "Explore" section. In the "Learn" section, short micro learning-style videos that were no longer than 1 minute each were created as a way for students to informally learn the content "on the go". The main topic was broken down to sub-topics/areas that allowed students to quickly recall key points on the topics. The videos were graphically designed using an infographic style of visual communication as infographics have been found to be a memorable way to deliver information when designed to be colorful and visually appealing (Harrison, Reinecke, Chang, 2015). The idea was that if students were in the classroom working on a project and they need to recall key concepts pertaining to their project, they can quickly refer to the "Learn" section of the app. Figure 1 shows a screenshot from a sample video that can be found in the "Learn" section of the topic on Shapes.
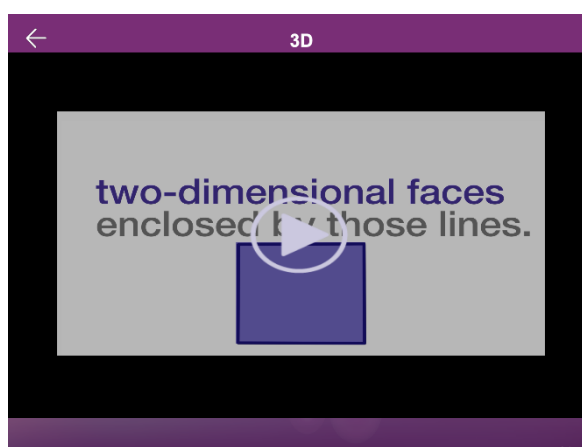
Figure 1 Infographic Style Video about 3D Shapes

Whereas in the "Explore" section, students could then explore the topic further through the use of AR technology as shown in Figure 2. The "Explore" section was designed to give students a better

understanding of how design element concepts are practiced or applied in a real-world setting. Tactile learning materials were also created to be used together with the DARE app as AR markers and would be overlaid with the virtual entities. Figure 2 shows how students would use the "Explore" section of the DARE app for the topic "Shapes". A real physical object is placed on the table and the DARE app is used to scan the object. When the app recognizes the object as a "cube", it then overlays the cube with some menu options. Clicking on these options, students can see how a real-life 3D object is made up of lines, vertices and faces. This is important because these students go on to learn how to use 3D software to recreate real objects in a virtual environment. Understanding how to build 3D models using lines, vertices, and faces is a basic fundamental knowledge that students need to have. In the example shown in Figure 2, students can physically rotate or angle the cube to see how many vertices (as illustrated by the colorful spheres) a cube would have if it were to be recreated as a 3D model.

Figure 2 Exploring 3D Shapes using AR Technology
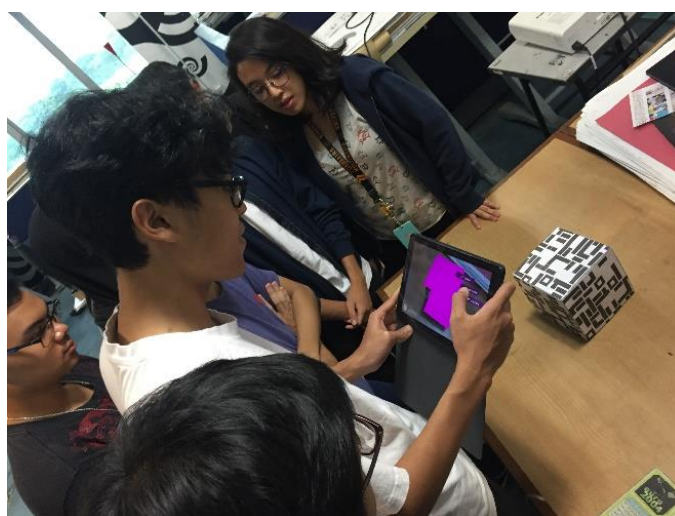
Figure 3 Students Learning about 3D Shapes Using the DARE App

A cohort of fifty-five students from the Faculty of Creative Multimedia at Multimedia University voluntarily participated in this study. These were students from the Foundation in Creative Multimedia course and were taking a class on Design Fundamentals which is a core subject. The class was selected as the topics found within the DARE mobile application were adapted from topics found in the class syllabus hence students would be able to provide feedback on whether they would like to learn these topics through AR. While class was in session, students were introduced to the DARE mobile application and were briefly introduced to the features of the application. Students were then given fifteen minutes to explore the DARE mobile application in groups of 4 - 5. Facilitators were on standby to assist students should they require help navigating and using the application, or if they faced any technical difficulties. Students were instructed to go through each topic within the DARE mobile application, watching the videos in the "Learn" sections followed by trying the AR feature in the "Explore" section. Figure 3 shows a group of students exploring the DARE app. After exploring the application, students were given a Technology Acceptance Model (TAM) survey questionnaire to fill up and provide their feedback on the DARE app.

Findings

The research design used in this study was a mixed-method research design using a combination of qualitative and quantitative data, to provide a deeper indicator of how undergraduate students in a Malaysian local private university perceive learning with Augmented Reality mobile applications, as well as their attitudes towards it. The Technology Acceptance Model (TAM) survey by Davis (1989) and Rasimah, Ahmad, and Zaman (2011) were adapted for the survey questionnaire used in this study. The questionnaire was used in this study to gather feedback on student perceptions towards learning with AR-enhanced learning materials as this was their first exposure to AR learning applications. The TAM survey also facilitated the identification of factors that would influence student's acceptance and likelihood to use these learning materials. The TAM survey items were measured on a 5-point Likert scale where "1 = Strongly Disagree" and "5 = Strongly Agree". Results of the TAM survey are listed in Table 1, organized according to the TAM constructs and in order of descending means. The survey yielded a Cronbach Alpha of 0.933, which according to Gliem & Gliem (2003) indicates the survey is reliable.

Table 1 TAM survey items

Perceived usefulness			
Items	Mean	Std. Dev.	%
1. Learning was made enjoyable	4.04	.719	83.6
2. Learning was enhanced	3.96	.637	85.5
3. App found to be useful for learning	3.93	.604	81.8
4. Helped to improve learning	3.91	.823	74.5
5. Increased understanding of design concepts	3.55	.741	50.9
Perceived Ease of Use			
Items	Mean	Std. Dev.	%
6. Felt the app was user friendly	4.02	.490	92.7
7. Learning how to use the app was simple	4.00	.577	83.6
8. Clear and understandable UI	3.80	.848	72.7
9. UI was flexible to interact with	3.67	.862	61.8
10. Was easy to skillfully use the app	3.51	.635	52.7
Attitude Towards Usage			
Items	Mean	Std. Dev.	%
11. Overall found app enjoying to use	4.09	.674	90.9
12. Believe use of app in classes is a good idea	4.07	.604	85.5
13. Like the concept of using the app	4.07	.634	87.3
14. The app was fun to use	3.87	.695	76.4
15. Generally in favor	3.73	.651	70.9
Behavioral Intention to Use			
Items	Mean	Std. Dev.	%
16. Expect to use the app next time	3.82	.796	70.9
17. Would use the app in class if available	3.73	.781	60.0
18. Would like to use AR apps for learning	3.71	.737	58.2
19. Intend to use AR apps frequently for coursework	3.62	.782	50.9
20. Plan use it as often as possible	3.29	.712	32.7

Results from the TAM survey as shown in Table 1 indicate that student attitudes and perceptions towards the DARE mobile application was generally positive. Overall, almost all survey items had a mean above 3.5. Students responded positively to the "Perceived Use" and "Perceived Ease of Use" of the app. 83.6% of students agreed that learning became an enjoyable process through the use of the app (m=4.04)

and felt their learning was enhanced (m=3.96). Students found the app user friendly (92.7%, m=4.02) as they had no trouble using the app (m=4.00). They felt the app was both useful (m=3.93) and was able to improve their learning (m=3.91). Students also reported an overall positive "Attitude Towards Usage" and positive "Behavioural Intention to Use" the learning application. 90.9% of students felt the app was enjoyable (m=4.09) and 85.5% of students believed that using the app in their classes is a good idea (m=4.07). Majority of students believe they would continue to use the app in time to come (70.9 %, m=3.82), whilst students also positively indicated that they would like to use AR applications for their classes if it was available to them (60%, m=3.73). Some of the "Behavioural Intention to Use" items had a lower percentage of students (30% to 58.2%, Items 20, 19, & 18) who agreed with the statements and it was found that students' responses were mostly undecided as learning with AR technology was still a very new experience for them.

Students were also asked to provide some comments and feedback through open-ended questions that were given after the questionnaire. When students were asked what they found favourable about using the DARE app, students said it was interesting, interactive, enjoyable, and would make learning the subject better. Examples of student comments taken verbatim are as follows:

1. *"Because it makes learning easier especially the 3D section. I can find the lines and edges easier with the app."*
2. *"The 3D part is cool when I could see the vertices and lines even though they were at the back back of the shape"*
3. *"I like how it is very easy to use. Also, it makes learning fun"*
4. *"On the 3D mode, it had a feature to make the outlines of the box. That was impressive."*
5. *"It was convenient for the studies of shapes"*

Students were also asked if they would like to see more AR learning applications used in their classes. Most students commented positively saying it will help improve their understanding of the design concepts. Some students also commented they would like more AR technology in their classes as it would make the classes more engaging. Samples of student comments are quoted verbatim as follows:

1. *"… because AR would definitely broaden my imagination and helps me to understand a concept better."*

2. *"Yes, for me to be more anticipated in class and for me to not get easily boring in class"*

3. *"Yes. For the complicated objects that need to use imagination"*

4. *"Design idea. Because we can have some ideas through the app to produce a better works"*

5. *"…it'll be more interactive among classmates"*

As this was a pilot project, students were also asked to provide some input on how the DARE app could be further enhanced or improved. Students commented that future versions of the app could be improved in terms of technical functionality (accuracy reading the marker and app stability), adding more interactive features, and expanding the topics available in the app. Student's overall positive comments support the results found through the TAM survey.

Discussion and Conclusion

Based on the results of the TAM survey and through a discourse analysis of the student comments, three key themes emerged: 1. Engagement was an important element when learning with AR technology, 2. Authenticity and relevancy of the learning materials played a key role in perceived usefulness of the AR-enhanced learning material, and 3. Technical stability and application usability was an important factor in the intention to continue using AR apps.

Engagement was a key factor that influenced the perception and attitude of students towards AR-enhanced learning materials as students found the DARE app to be an interesting and enjoyable way to learn. This supports Parong & Mayer (2018)'s findings that students who learn with immersive learning materials have higher motivation, interest and engagement. Usefulness of the app towards illustrating key concepts was also important to the students as they were able to better relate to the topic when they could see it applied into a real-world setting via the AR app. The learning experience become more authentic and relevant to them as a result of this, supporting what was noted by Cai (2018). Usability was also a key factor that influenced student's perception of AR-enhance learning materials as students had no problems using the DARE app and were able to navigate the app, but highlighted that app stability and marker scanning accuracy should be improved. As noted in the review done by Akçayır and Akçayır (2017), technical usability is one of the prevalent challenges when using AR for education.

Moving forward future iterations of the DARE app will look at expanding the topics with different levels of interactivity to suit different learner needs, as well as focus on improving the technical usability of

the AR portion of the app. In conclusion, the encouraging results from this study provide support for educators and researchers to delve deeper into the use of AR technologies with Authentic Learning elements as a pedagogical framework to create enhanced learning materials or learning spaces.

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Authors' Bio

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Student's Perception on Implementation of Blended Learning in UNITEN

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Abstract

Blended learning (BL) can be regarded as a teaching approach that combines online and face-to-face method of instructions in which it integrates the conventional classroom teaching with a combination of media, tools and teaching methods in web-based environment settings. Universiti Tenaga Nasional (UNITEN) has been implementing blended learning since 2016 on selected courses offered. The implementation of blended learning was carried out in four levels comprising of information dissemination, online assessment, flipped teaching and adaptive learning. The objectives of this study are to investigate students' awareness towards blended learning implementation and to measure their level of satisfaction on the courses they registered. A set of questionnaire was created on an online platform, and was disseminated to the respondents via an e-mail blast. The questionnaire has two different formats ('Yes/No' and 'Four-point Likert-scale'). At the end of the questionnaires, each student is asked to give suggestions on current BL implementation. Data were gathered from a sample of 489 undergraduate students comprising of three main programs offered which are foundation, diploma and bachelor degree. Based on the results, majority of students are aware that UNITEN is implementing BL concept (36% fully aware, 47% aware, somehow aware 13% and not aware at all, 4%). From the findings, majority of the students show satisfaction on BL implementation as well as responded with the perception of agreeing that BL has helped them in their studies, mainly in increasing CGPA, provides better time management and reinforcing their learning. The suggestions obtained from this research can be used to improve the BL implementation in the future.

Keywords Blended; Learning; Implementation; Satisfaction; Perception

Introduction

The development of information technology catalyses the growth of online educational programs which transforms the conventional system of education (Sher, et al., 2009). One of the developments of information technology is the utilization of internet as a part of education i.e. e-learning. E-learning is a web-based learning ecosystem which integrates participants with technology and processes (Alraimi, et al., 2015). Numerous higher education institutions (HEIs) in Malaysia initiated e-learning because of its effectiveness as an alternative approach to the classroom teaching method of spreading information (Masrom et al., 2008). The teaching and learning environment is embracing a number of innovations and some of these involve the use of technology through blended learning. This innovative pedagogical approach has been embraced rapidly though it goes through a process (Kintu et. al, 2017). Adoption of Blended Learning (BL) in delivering contents on higher education are considered as the "new normal" (Charles et al, 2013) and happens across the globe. It coalesces around access, success, and students' perception of their learning environments (Dziuban et al., 2018). The 2017 New Media Consortium Horizon Report found that blended learning designs were one of the short term forces driving technology adoption in higher education in the next one to two years (Adams Becker et al., 2017).

Literature Review

BL is an approach that integrates online and face-to-face method of instructions which is defined as an integration of conventional classroom teaching with a combination of media, tools and teaching methods in web-based environment settings (Graham et al., 2006; Sabri et al., 2010). The approach is flexible and includes provisioning of online content for individual learning combined with in-class discussion (Tune et al., 2013) or mostly consisting of online studies with only an initial face-to-face meeting with a lecturer and peers (Myroslava et al., 2016). BL is considered as effective as traditional learning (Frehywot et al., 2013) and also has the advantage of built in flexibility (Rowe et al., 2012), increased self-directions (Lotrecchiano et al., 2013) and higher engagement with course materials (Francis et al., 2013). BL has the potential to improve academic achievement by combining structured and unstructured learning, individual and group learning, face-to-face and online learning, self-directed and instructor-director learning, surface and deep learning, and context based and non-context-based learning (Hossein et al., 2019). BL also aims at using modern technology in teaching without abandoning the usual educational situation and classroom attendance. It focuses on direct interaction in the classroom through the use of modern communication mechanisms, such as

computers, networks, and internet portals (Thelal et al., 2018). An added advantage of using technology-enhanced teaching method is linking universities globally and supporting internationalization (Bollinger et al., 2011).

Being one of the competitive HEIs in Malaysia, Universiti Tenaga Nasional (UNITEN) has been implementing BL approach since 2016. Thirty-six pilot courses have been selected, along with the appointment of forty-nine pilot lecturers. These pilot courses and lecturers were involved since the early phase back in 2016 to give awareness of BL to the students. Four levels of BL were established by the BL Committee, Teaching and Learning Centre (TLC), UNITEN to measure the appropriate levels of implementation by lecturers as depicted in Table 1.

Table 1 Levels of Blended Learning (BL) implementation in UNITEN

Level	Explanation
1: Technology-aided Learning	To use technology as content repository by utilizing Learning Management System (LMS) to disseminate information and materials.
2: Enhanced Learning	To accomplish Level 1 and continue to enhance their teaching and learning process by utilizing technology.
3: Flipped Teaching and Learning	To employ flipped teaching or learning and promote higher order thinking.
4: Adaptive Learning	To personalize tracks for students with various academic background and learning dispositions.

Changes in science and technology guide in many new teaching and learning methods, such as e-learning and BL particularly in research and self-development areas (Thelal et al., 2018). However, BL implementation awareness may be dependent on many other factors and among them are student characteristics, course design features and learning outcomes (Mugenyi et al., 2017). The successfulness of blended learning depends on various aspects such as quality of the course materials, mindset and ability of the students to learn in interactive learning environments (Kavitha et al., 2018). This study focused on the investigation of students' awareness towards BL implementation and measuring their level of satisfaction on the courses they had registered. The BL strategy has enabled students to focus on learning process, contributing to the betterment of the learning process (Saad et al., 2019).

Case study has been long used in formal studies as early as half a century ago (Harrison et al., 2017). Employing holistic and thorough research is the bread and butter of case study. There are no single case study approaches that work specifically with specific research study. Outcome or information that could be extracted as an end result is what matters most. Program Implementation Case Study is a type of case study that targets on gauging of performances of programs (Hayes et al., 2015). Existence of huge data reservoir ensures the success of the study. Setback and triumphal parameters are identified through conducting Program Implementation Case Study, and it ensures future implementation of programs to significantly improve. Comprehensive decisions of choosing location, information gathering and accurate reporting assure research's best interest.

Methodology

The research employs Program Implementation Case Study with a quantitative approach where students' perception on blended learning was treated as variables that can be measured by a questionnaire. Distribution of questionnaire was done without compromising respondents' private information and locality. As a matter of fact, target audience was strictly defined as undergraduates. To ensure conformance and impartiality, respondents had been made aware that the integrity of all the information are uncompromised, and in no way would be relatable to them as individuals. A set of questionnaire was created by online platform, and was segregated to the respondents through the blasting of e-mail. Detailed instructions were also incorporated on the notification e-mail. Responses shall then be recorded and kept confidential. The questionnaire has two different formats (a yes /no format, and a four-point Likert-scale format) provided as response options. In Yes / No format, items are answered (0) False and (1) True. In a four-point Likert format, items are answered (1) Strongly Disagree, (2) Disagree, (3) Agree and (4) Strongly Agree. Online questionnaire were given to students with four sections which are Demographic, Awareness, Satisfaction and Suggestions on Blended Learning. Data obtained were analysed using IBM SPSS Statistics to check its reliability using Cronbach's alpha test. Reliability of the data refers to the consistency of responses. In order to assess the reliability of this questionnaire, Cronbach's alpha coefficient was calculated resulting in scores that were all at least 0.7, showing that the reliability level of the questionnaire utilized for this research was consistently high.

Results

Section A: Demographic

Data gathered from a sample of 489 undergraduate students from three main programs offered which are foundation, diploma and bachelor degree. Respondents are 331 male student (68%) and 158 female students (32%) from all four main colleges in UNITEN as shown in Table 2. The colleges are College of Engineering (33% respondents), College of Foundation and Diploma Studies (27%), College of Computer Science and Information Technology (27%) and College of Business Management and Accounting (13%). Majority of the respondents are bachelor degree students (60.3%), followed by foundation (23.5%) and diploma students (16.2%).

Table 2 Sample demographic

Gender	N	%
Male	331	68%
Female	158	32%
Total	**489**	**100%**
Colleges		
College of Engineering	159	33%
College of Foundation and Diploma Studies	131	27%
Computer Science and Information Technology	133	27%
College of Business Management and Accounting	66	13%
Total	**389**	**100%**
Instruction level		
Foundation	115	24%
Diploma, 1st Year	24	5%
Diploma, 2nd Year	21	4%
Diploma, Final Year	34	7%
Degree, 1st Year	82	17%
Degree, 2nd Year	114	23%
Degree, 3rd Year	47	10%
Degree, Final Year	52	11%
Total	**489**	**100%**

Section B: Awareness on Blended Learning

Based from the results, the majority of students are aware that UNITEN is implementing BL concept (36% fully aware, 47% aware, somehow aware 13% and not aware at all, 4%). Conventionally, the course

resources such as lecture notes and tutorial questions are shared through dissemination of hard copy documents between lecturer and students. With the usage of Learning Management System (LMS), lecturer can disseminate course resources online prior to the first day of the semester. As shown in Table 1, Level 1 of BL is for the lecturer to use technology as content repository by utilizing LMS to disseminate information and materials.

At the moment, the majority of the selected courses in UNITEN are currently implementing Level 2 of BL which is up to enhanced learning level. This result shows that BL implementation on the courses offered up until Level 2 BL is well introduced to the student. Some of the UNITEN lecturers have already move into Level 3 of BL which is flipped teaching and learning. This flipped teaching or flipped classroom emphasizes that each lecturer will provide their students with online content for individual learning combined with the discussions in class (Tune et al., 2013). Nevertheless, lecturers are advised to mention BL approach in teaching during the early semester as some students have never experience BL approach before.
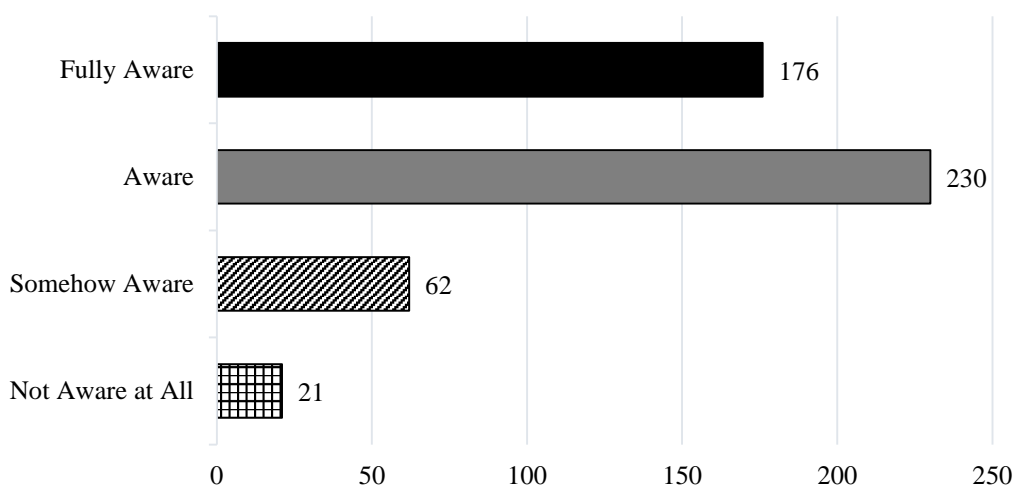
Figure 1 Student's Awareness on the Implementation of Blended Learning in UNITEN

Section C: Satisfaction on Blended Learning

Based on the result, majority of the students show satisfaction on BL implementation. There are ten queries related to Satisfaction section as listed in Table 2, which are:

Table 2 Questionnaire items

Items of Online Questionnaire For Blended Learning Satisfaction In UNITEN

"Blended learning has helped me in:"
1. managing my time better.
2. understanding course material and objectives.
3. effectively reinforced what I was learning in the face-to-face sessions of this course.
4. effectively reinforced what I was learning via the online components of this course.
5. improving my overall grade CGPA

"Overall I think that:"
6. UNITEN provides variety of sources (Blended learning approaches) other than lectures that are necessary for students to succeed in their study.
7. I prefer Blended Learning compared to Traditional or Conventional approaches.
8. my lecturer(s) is /are knowledgeable and skilled in implementing Blended Learning approaches in their teaching and learning processes.
9. UNITEN should continue with the Blended Learning approaches in some of the courses
10. Blended Learning approaches is useful for the current population of students (Gen Z)

Table 3 shows the frequency distribution on student's satisfaction on BL implementation.

Table 3 Student's satisfaction on Blended Learning (BL) implementation

Items	FD*		%	Items	FD*		%
Item 1	SD	17	3.48	Item 6	SD	17	3.5
	D	22	4.5		D	31	6.3
	A	328	67.08		A	332	67.9
	SA	122	24.95		SA	109	22.3
Item 2	SD	20	4.1	Item 7	SD	18	3.7
	D	13	2.7		D	48	9.8
	A	329	67.3		A	289	59.1
	SA	127	26		SA	134	27.4
Item 3	SD	17	3.5	Item 8	SD	22	4.5
	D	28	5.7		D	26	5.3
	A	320	65.4		A	298	60.9
	SA	124	25.4		SA	143	29.2
Item 4	SD	22	4.5	Item 9	SD	20	4.1
	D	16	3.3		D	10	2
	A	328	67.1		A	297	60.7
	SA	123	25.2		SA	162	33.1
Item 5	SD	22	4.5	Item 10	SD	20	4.1
	D	33	6.7		D	17	3.5
	A	320	65.4		A	290	59.3
	SA	114	23.3		SA	162	33.1

*FD = Frequency Distribution, SD = Strongly Disagree, D = Disagree, A = Agree, SA = Strongly Agree

Of all queries, majority of the students are satisfied with BL implementation in UNITEN.

Section D: Suggestion on Blended Learning

Students these days are living their life on the fast lane. The younger generation's attention span has been reducing over the years where they get bored easily and their focus towards information presented can be shifted within a split second. The way they captured information through their brain is different in which they prefer to learn things interactively. As such, there are several suggestions made by the students themselves on how to improve blended learning in UNITEN so that the BL model will be more effective to them. Some of the suggestions stated that educators need to provide a clear explanation about BL since it is still new in Malaysia and only been applied by a few educators in their teaching. If the concept has been familiarized to students, then BL can easily be adapted by educators in their own technology turf.

Software changes rapidly, so it is important for lecturers to set up a standard on software that are of good usability to the students. BL can be implemented via usage of several applications readily downloadable via Apple's App Store or Google's Play Store to their mobile devices or gadgets where they will be able to create numerous exciting and fun games in their class session i.e. Kahoot. To make BL really works, lecturers need to use all resources available including adapting students' ability to suit different needs and learning capability. Most of the students have their own creativity and BL is the medium where students can express their ideas. The idea is to get them to devise a creative solution to a real-world problem. Furthermore, students proposed lecturers to produce more online educational games via BL instead of a formal teaching method. In addition, besides implementing blended learning in class, students can share ideas actively in class instead of looking and copying lecture notes without giving any fresh and creative ideas in class. Hence, they can learn in fun and exciting ways as compared to boring, traditional ways. Lecturers can give some token or extra marks to those who manage to complete their task successfully.

Discussion and Conclusion

Majority of the students are aware of UNITEN's BL implementation. BL has been implemented at all levels of study (foundation, diploma & degree), at different BL level (Level 1, Level 2 & Level 3), and across different subjects. Majority of the students give positive feedback on the implementation of BL in their courses. UNITEN & the academic staff provide various learning resources to support teaching and learning which includes Blended Learning. Majority of students responded with the perception of agreeing that BL has helped them in their studies, mainly in increasing CGPA, better time management and reinforcing their learning. The suggestions obtained from this research can be used to improve the BL implementation in the future.

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Acknowledgements

Authors' Bio

Mr Rahmat Bin Abdul Wahid has been teaching Physics for more than five years for foundation and diploma students in Universiti Tenaga Nasional. He graduated from Universiti Teknologi Malaysia with Master of Science (Physics) in 2014 and Bachelor Degree of Science (Physics) in 2010. His research works are collaborative efforts with various expertise in the field of teaching and learning, statistics, computer science, information technology and engineering. His research focuses mainly on Blended Learning implementation, evaluation of assessment and collaboration learning.

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Mobile Learning Readiness among Students of Maldives Higher Education Institutions

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Abstract

Mobile learning and connecting development and trends are widely discussed globally. Literature evidences exist confirming mobile learning and its impact on higher education. Mobile learning opportunities can be one option for higher education institutions to reach a dispersed population of the Maldives. Although readiness of mobile learning has been analysed in several counties and contexts, this contributes as the first research on this subject in the Maldives. Therefore, this article is intended to find out students' readiness for mobile learning (mLearning) in the higher education institutes of Maldives. Basic readiness and mobile usage readiness of students from three different higher education institutions contributed to the research. A total of 343 institutional students enrolled in flexible delivery programs responded to the online questionnaire survey. Considering the level of programs, cluster sampling technique was used in shaping the sample of the research. Data was analysed using descriptive statistics and SPSS to interpret the findings on student readiness for mobile learning. The findings indicated that the students were confident in using mobile and other mobile devices in daily activities. Also, findings indicated that majority of students were confident with the basic and advanced mobile skills of mobile learning.

Keywords Mobile learning; Student readiness; Basic readiness; Higher education institutes; Maldives

Introduction

The involvement of mobile technology has changed the mode of communication at work and education with the introduction of smart gadgets such as mobile phones and tablets (Ozer & Kılıç, 2018). Blending

in technology in higher education instructional designs is growing widely through integration of intensive learning pedagogies of 21st century. Supporting this, Wagner et al. (2016) expressed that the efficiency of technology-based learning stimulates all types of verbal activities aided with computers, multimedia programs, and videos. Popular mobile devices owned and used by students include PDAs, tablets and mobile phones. Out of these devices, mobile phones gain the first place in rank (Hussain et al., 2012). More than 40% of the world population access the internet and learners are motivated to upgrade their learning skills making use of the learning options through online platforms (Becker et al., 2017). New approaches towards organizing the educational process in higher education institutes enable learners with technology enhanced mobility in education.

The population of Maldives spread across an archipelago of twenty-six atolls consisting more than one thousand one hundred and ninety islands (Maldives, n.d.). Higher education opportunities are mainly situated on the capital island, Male' and only a few are reached. Hence, institutions are adopting flexible models of learning to cater the unreached population on the islands. On the other hand, on average, Maldives is a technology friendly country, where mobile devices are abundantly used by all age groups of the population. Especially by young learners who use technology enabled mobility for academic and non-academic purposes inside and outside the classrooms.

This study was done to explore whether the technology enabled society is ready with basic mobile readiness to adapt mobile learning in the higher education institutes of Maldives. Thus, this study is expected to get answer for the following questions.

a. What percentage of higher education students own mobile phones and obtain internet access in Maldives?

b. To what extent do the students have of mobile basic skills and advanced skills?

The main focus of the research was to explore the basic readiness of Mobile Learning in the higher education institutes of Maldives. The content of the research consists of the problem that led to the development of the research, the methodology adopted is to find out the basic readiness and the results generated based on the response of students studying in Maldives higher education institute. The outcome of the data and results are illustrations in the form of tables and graphs.

Literature Review

Mobile Learning

Mobile Learning is defined as use of private electronic device in the learning process with supportive social and content interaction (Saxena & Saxena, 2015). The growing new style among youth and the desire to be connected anytime anywhere has brought a new angle of living in daily activities. The 21st century learners rely on mobile connections to grow their relationship upon (Saxena & Saxena, 2015). Supporting the new style, Poushter (2016) states that in spite of the location there is a massive rise in socializing, communication and entertainment happening in most of the countries due to the adoption of technology. Sönmez, Göçmez, Uygun, and Ataizi (2018), in a review on current studies of mLearning, stated that using smartphones and tablets for social interaction is commonly practiced by learners through different communication techniques which include reading books or articles, emailing and Facebook posting while having coffee or travelling.

The advantages of mLearning and its connectivity with eLearning cannot be disregarded. History of eLearning shows the lead from eLearning to mLearning is due to the insufficiency and limitations perceived from conventional eLearning (Mehidipour & Zerehkaf, 2013). Adding on, the authors stated that focus of mLearning is advantageous as it promotes mobility and the portable interactivity of the learner. mLearning outstands from other learning for its access to information and learning activities, interactivity and its multi-functional capabilities when compared to the traditional implementations.

Blending in technology in the higher education instructional designs is growing widely through the integration of intensive learning pedagogies of 21st century. Mobile devices play a key role in everyday activities for all age groups of human life. Smart devices have been seen as a common tool for accessing information globally (Wabner, 2016). According to Horizon Report (2017), more than 40% of the world population access the internet and learners are motivated to upgrade their learning skills making use of the learning options through online platforms such as YouTube.

Approaches to mobile learning are mostly through applications and its introduction in the daily activities have increased so much that mobile apps are being used worldwide from shopping to banking to education depending on the quality of the apps being functional both online and offline (Rajput, 2018). According to many researchers, mLearning has a special focus among learners and educators for the flexibility and digital reach. However, the differences in internet connectivity and the socio-economic status

of learners have forced higher education providers to continue maintaining or improving the quality and affordance of the deliverables (Horizon report, 2017).

Pedagogical approaches used in higher education are no longer fixed with hard copies, PowerPoint presentations, and textbooks. The integration of technology is unavoidable and hence challenging for educators not to use them in classrooms. Facing the challenges, Li & Wong (2018), implemented mobile learning using smartphone application at the University of Macau due to the observation of losing students' interest in the conventional pedagogy over smartphone applications and social networking. This step-up in the pedagogy resulted in significant improvement in teaching and learning. Affordable and accessible language recognition and translation mobile applications supporting inclusivity among learners.

"There are several mature speech recognition services being offered through cloud services, e.g.,
iOS Siri, Amazon Alexa, Android speech to text, IBM Watson, and Google Cloud Speech.
(Kasrani, et al., 2018)

Decades passed since mobile learning has enlightened the higher education systems incorporating the mobility and technology in the facilitation. A variety of factors attract mobile learning based on individual universities and countries. The abundant use of mobile phones, encouraging strategies and accessibility to shared information are some of the factors for Saudi Arabia (Elfeky & Masadeh, 2016). Likewise, in Maldives mobile learning is encouraged as the population is spread across the small islands separated by sea.

Methodology

Quantitative method was adopted to seek answers for the research questions. Survey design was chosen to implement and understand the current status of mLearning in Maldives higher education institutes. By studying a sample of the population, survey design can figure out statistical patterns creating opportunity for the researcher to generalize for the population (Creswell, 2009). Hence, the survey results from different institutes were used to generalize and obtain the readiness of the mLearning stand among students studying in the alternative or flexible delivery modes in Maldives higher education institutes.

Population and Sampling

Population for the research was students who studied in the first term of 2019, who also enrolled in flexible delivery programs offered by the higher education institutes of Maldives. A population can be considered as the entire group of people with common features (Kenton, 2019). A sample of 340 students from undergraduate and postgraduate programs enrolled in three higher education institutes participated in the research. The sample was selected using probability sampling technique. Singh (2018), states that in probability sampling, every element gets equal opportunity to take part in the research. Therefore, by using probability sampling technique known as single-stage cluster sampling, all students had the chance to take part in the research. Undergraduate (n=1295) and postgraduate students (n=392) were considered as two clusters, and by using purposive sampling, all students who attended all of the flexible programs were taken as the sample.

Instrument and Validity

An online survey questionnaire was distributed across the institutes including the main campus and island campuses using Viber application. The questions developed for the questionnaire were adapted from questionnaires used at Kampala University, Uganda to assess mobile learning readiness of their students in 2017. The questionnaire consists of three main parts. The demographic data, mobile phone and internet access readiness and basic mobile skills readiness. Single option selection, multiple selection and five-point Likert scale were used to measure responses to the main questions, with ratings of 'strongly disagree', 'agree', 'neutral', 'disagree', 'and', 'strongly disagree'. The questions were tested to check the Cronbach Alpha value to confirm the internal consistency of the questions and validity.

Statistical Procedures

Participants' responses to the questionnaire items were computed using the automatic analysis generated by Google forms and SPSS Version 23. Descriptive statistics such as frequencies and percentages and data summarising tables and graphs were derived from the data. In addition to this, Pearson Correlation test was run to check whether there is any significant connection between age group and mobile basic skills and advanced skills. The Pearson Correlation test is one of the tests or techniques used by researchers to confirm whether the null hypothesis can be qualified to reject (https://libguides.library.kent.edu/SPSS/PearsonCorr). The analysed results were evaluated and compared with the objectives, converged to make conclusions and recommendations for future research in mobile learning.

Results

Demographic Data

The results section demonstrates participants' demographic attributes mainly using descriptive statistics. The study shows that a total of 340 students from three different higher education institutes responded to the research.

Table 1 Gender, age, program level and program discipline

	Gender	Age	Program Level	Program Discipline
	Frequency/ Valid %	Frequency/ Valid %	Frequency/ Valid %	Frequency/ Valid %
Female	260 / 72.6			
Male	81 / 23.8			
18-25		77 / 22.6		
26-35		151 / 44.4		
36-45		83 / 24.4		
46+		29 / 8.5		
Masters			50 / 14.8	
Post Graduate Dip			6 / 1.8	
Bachelor's Degree			224 / 66.3	
Advanced Diploma			18 / 5.3	
Diploma			40 / 11.8	
Education				160 / 47.1
Health				82 / 24.1
Business				17 / 5.0
Religion				14 /4.1
Language				25 / 7.4
IT				6 / 1.8
Tourism				19 / 5.6
Other				17 / 5.0
TOTAL	340	340	340	340

Among the 340 respondents, male 81 (23.8%) and 260 (72.6%) were female. Results of the four age groups indicated that 77 (22.6%) were 18 to 25 years, 151(44.4%) were in the range of 26 to 35 years, 83 (24.4%) were in the range of 36 to 45 years and 29 (8.5%) were above 46 years (Table 1). The majority age group is 26 to 35 years, showing that this group of participants were not fresh school leavers but mature students who were studying while working. The least contributed age group was above 46 years showing that when there is flexibility to education, age doesn't matter.

The results also revealed that participants were from five different levels of programs. There are total of 50 (14.8%) participants studying in Masters' level, 6 (1.8%) were studying in Postgraduate Diploma, 224 (66.3%) were in Bachelor's Degree, 18 (5.3%) were in Advanced Diploma and 40 (11.8%) were studying in Diploma level programs (Table 1).

In addition to this, the results also confirmed that the participants belonged to the programs of more than seven disciplines that were delivered in different forms of flexibility. This included 160 (47.1%) from education, 82 (24.1%) from heath, 17 (5.0%) from business, 14 (4.1%) from religion, 25 (7.4%) from language, 6 (1.8 %) from IT, 19 (5.6%) from tourism and 17 (5.0%) from other disciplines. Almost 50% of participants were studying in education-related programs. Therefore, majority of the students trained in flexible or blended models are going to be future educators.

Basic Readiness

The basic readiness of students was assessed based on mobile access, internet access and usage patterns. The frequencies showed that all of the participants owned a mobile phone and mostly carried it with them. 70% always carried mobile phone, 25% usually carried mobile phone and 5% of students sometimes carried the mobile phone. Among the participants, 97% agreed to be having smartphones and 95% of the phones had a screen greater than 3 inches. The data also showed that majority of participants (73%) used their own mobile data packages, (86%) use home WiFi as the source of internet. On the other hand, 49% of students used campus WiFi and 42% used MiFi for internet access. Based on the results, it was seen that students managed their own internet for learning.

The data collected on the use of Microsoft skills indicated that most students opened and use documents of MS. Word by 85%, MS. Excel by 72%, PDF by 92% and PowerPoint by 76%. In addition to this, 88% students used video files, 81% used audio files and 86% agreed on using photo/ graphics from mobile phones.
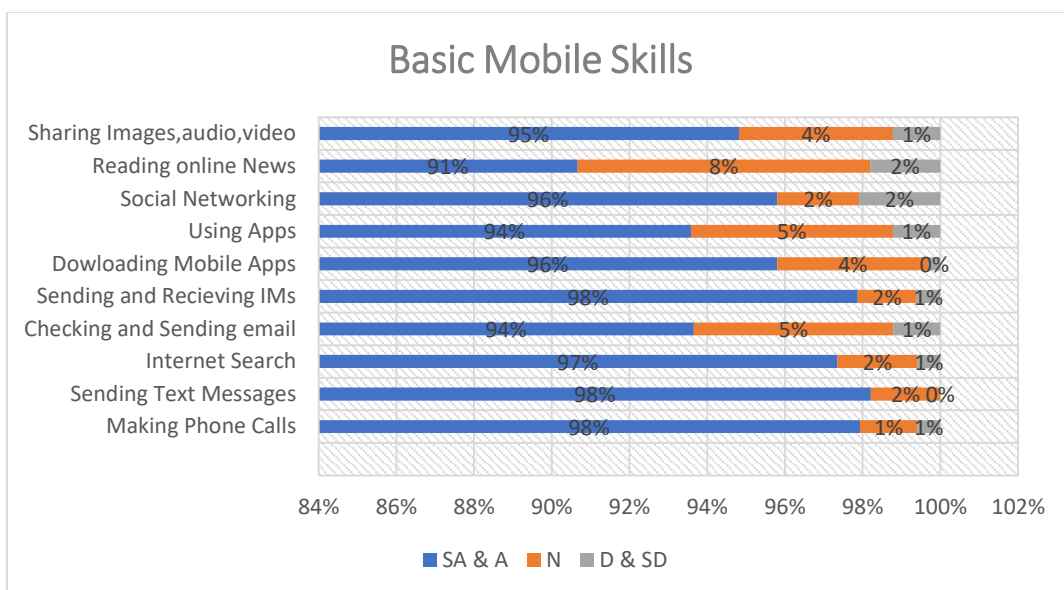
Figure 1 Use of Basic Mobile Skills among Students

The basic mobile skills acquired by students were assessed based on the agreement of participants' use of the skills. Evidently, more than 90% of students agreed on being equipped with basic skills as shown in Figure 1, numbered as: 1) Sharing images, audio and video, 2) Reading online news, 3) Social networking, 4) Downloading mobile apps, 5) Sending and receiving IMS, 6) Checking and sending emails, 7) Internet search, 8) Sending text messages and 9) Making phone calls.
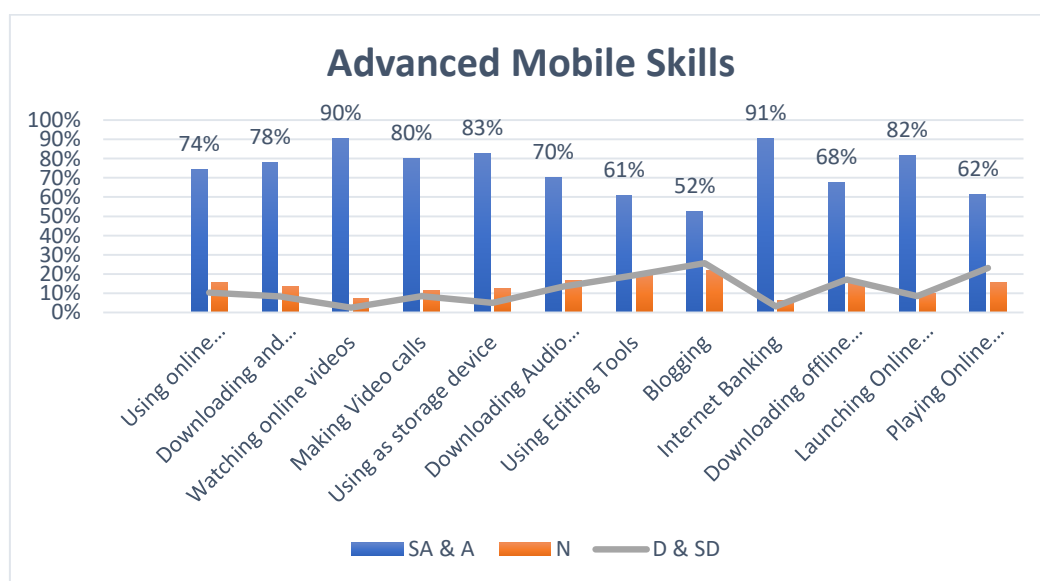
Figure 2 Use of Advanced Mobile Skills among Students

Similar to basic mobile skills, data collected on students' advanced skills showed a high percentage of agreement in the use of all the skills mentioned in the survey as shown in Figure 2. Watching online videos and internet banking were the skills practiced by 90% of the participants. 80% or more agreed on working on online programs, making video calls and using smart mobiles as a storage device. However, few students indicated that they do not engage in advanced mobile skills on the mobile device.

The mobile skills (basic and advanced) were computed with the five age groups (Table 2 & 3) to check whether there was any significant relationship between age of the students and the basic skills for mobile learning using Pearson Correlation.

Table 2 Pearson Correlation on age and basic mobile skills of students

		Age	Basic Mobile Skills
Age	Pearson Correlation	1	.104
	Sig. (2-tailed)		.056
	N	340	339
Basic Mobile Skills	Pearson Correlation	.104	1
	Sig. (2-tailed)	.056	
	N	339	341

Table 3 Pearson Correlation on age and advanced mobile skills of students

		Age	Advanced Mobile Skills
Age	Pearson Correlation	1	-.004
	Sig. (2-tailed)		.942
	N	340	337
Advanced Mobile Skills	Pearson Correlation	-.004	1
	Sig. (2-tailed)	.942	
	N	337	339

The Pearson correlation coefficient computed to assess the relationship between age and mobile skills resulted that there was no significant relationship between age and basic mobile skills or advanced mobile skills. The "p" value for both the tests was greater than .01. Therefore, statistically, it can be said that the increase or decrease in age has no impact on the basic skills required for mobile learning by students.

Conclusion

In all, the study assessed student readiness for mobile learning in the higher education institutes of Maldives. Students' readiness on mobile learning was explored by analysing the response of the students' survey aimed to gain an understanding of the students attending flexible mode of delivery programs. The analysis of the results suggested majority of them owned a smart mobile phones and other mobile devices for academic and non-academic purposes. The results also indicated that the students access and use internet in daily activities including social interaction, internet-based transactions, gaming and downloading resources such as videos. In addition to this, the results confirmed that the majority of students of Maldivian higher education institutions were confident in both basic and advanced mobile skills which show their basic readiness for mobile learning.

The use of technology-enabled mobility is more societal behaviour than focussing on a single group of students. Therefore, further research is recommended on the basic mobile readiness of students attending traditional programs in higher education environment.

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Acknowledgements

Authors' Bio

Fathimath Mumthaz is an instructional designer by profession and Lecturer at Centre for Educational Technology and Excellence of the Maldives National University (MNU). She obtained her Master of Instructional Design and Technology from Open University Malaysia. Ms. Mumthaz has been serving MNU in the e-Learning department since 2007. She maintained a good reputation as a lecturer, facilitator, content developer, instructional designer for e-Learning programs at MNU. Furthermore, she has been the Head of e-Learning Department (2014-2016) and training e-facilitators at MNU through short intensive workshops. She also trains e-Learning students of MNU to guide them to become e-Learners. Currently, Ms. Mumthaz is a PhD student researching on mobile learning in Maldives and one of the team members of the AMED Project (Advancing higher education in Maldives through e-Learning development) going on at MNU.

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Using LMS Analytics to Optimise Learning Design from the Activity Theory Perspective

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Abstract

E-learning technologies are widely adopted in today's university classrooms to supplement teaching approaches. Moodle is the most popular learning management system (LMS) that builds with the features of recording the learners' data and activities. Leveraging learners' data has become a trend in searching for informed guidance and actionable insights to optimise the learning design. Literature shows that the highest levels of participation do not correlate with the best academic results, and the most engaged students are likely the weakest students who try to improve their performance. Therefore, the ability to predict students' achievements plays a vital role in enhancing students' learning experience. In this paper, data extracted from the Analytics feature and Grade feature of Moodle and Echo360 ALP used at the University of Nottingham Ningbo China was organised into a dataset, available as CSV files after four steps of preparation. This dataset contains the information about 659 students, the logs of their interactions, and the summary of site entries over one academic semester. This paper uses RStudio for coding and performing the statistical analysis, aiming at identifying students' interaction patterns. There are three interaction patterns analysed in this paper, for studying the relative frequency distribution, the statistical relationship between students' access frequency and the five key variables, and students' attempts of the weekly quiz. An initial form of the pathway was designed based on the findings, and the component in the Engestrom's activity theory, for optimising the learning design in a university classroom. This pathway has multiple entries (openings) to drive learners into the processes of the entire activity system. In the future, the dataset will be expanded with students' academic performance details for a more sophisticated statistical findings and identifying more interaction patterns, hence enriching the design of the learning pathway.

Introduction

Despite learning technologies are widely adopted in today's university classrooms to supplement different teaching approaches, many instructors are still unfamiliar with strategies of using learning technologies. For instance, all users automatically leave their digital footprints when interacting with the content on the Moodle, an Open Source learning management system (LMS), and this allows the Analytics feature of the LMS that is capable of recording the users' logs to trace all the online activities of each user. It also allows the instructors or other power users who have the site administrative rights to extract data and gain more actionable insights for leveraging learners' performance or providing research-informed guidance.

Today's university students are expected to juggle multiple tasks in their studies with good academic performance, as well as are responsible for developing their soft skills, employability attributes, entrepreneurship mindsets and industry involvement, for staying competitive in the job markets. It is also observed that the highest levels of participation do not correlate with the best academic results, and the most engaged students are likely the weakest students who try to improve their performance. Therefore, the design of the course syllabus, curriculum, and content delivery plays a vital role in nurturing adaptive learning and engaging in self-learning before and after the contact hours. It is believed that effective learning design can help the university students to devise their learning plan for obtaining the level of achievement that they aim for. The learning design can be optimised as the university's instructors are able to predict students' achievements and outcomes when they are equipped with the mechanism to analyse how students collaborate on tasks, take actions, and use information technologies in the learning context (Sclater, Peasgood & Mullan, 2016). Hence, the LMS Analytics has the potential to transform the instructors to be more instrumental in identifying at-risk students and providing interventions to support the students in their learning environment.

Learning analytics has been widely developed in the USA, United Kingdom, Canada and Australia to measure and optimise the learning process. However, studies found that there is a lack of exchange of ideas, methodologies, and tools in using learning analytics, and the results are still isolated from the community that can collect, measure, analyse, and discover the data about students, instructors and institutions (Lemos dos Santos, Cechinel, Nunes & Ochoa, 2017). In this paper, the author focused on 1) the interaction patterns evolved from the student-LMS interaction, and based on the findings from the LMS analytics, 2) the design of the pathway with Engestrom's activity theory for optimising the learning design in university classrooms.

Activity Theory

Activity theory is a sociotechnical theory which has its origin from the psychological field. It is rooted in Vygotsky's (1920) works that conceptualized learning as a social activity that takes place among individuals. Activity theory was extended and popularised by Engestrom (1987) who organised the components of activity into activity systems and presented in a model that is depicted as a triangle. Activity theory posits that learning emerges from the activity and human mind, and the human mind emerges as a component of interactions with the environment. Hence, human activity is a precursor to learning, and learning is the product of mediating influences through the learning activities (Engestrom, Miettinen & Punamäki, 1999). Therefore, activity theory provides a powerful socio-cultural lens for analysing human activity. Researchers recognise activity theory as an interventionist research approach with the relevant concepts that are based on the interaction between the researchers and the people in analysing work, technology, education, HCI, and system design (Engestrom, 1987; Hasan & Kazlauskas, 2014).

The components of the subject, object, and tools as part of the upper triangle and the base of the triangle consists of components of the community, social rules, and division of labour. These six components are interrelated and centered at the subject and Object (see Figure 1). Specifically, the subject is the individual or group of actors engaged in the activity whereas the object is the product or goal that is sought throughout the processes. The tools consist of the materials, knowledge sources, or technologies used in the processes. The division of labour is the social structure of the system in which it divides the actors into different roles and responsibilities within the system. The social rules describe the way that the actors relate to each other through social interaction, as well as define what the culture allows, what is legitimate, rewarded, or discouraged. The community responds to contextual relationships among the collaborators in the activities for integrating with the external social needs. The goal of the activities may consist of intended and unintended learning, skills and attitudes (Engestrom, 1987; 2000; 2001).

Literature shows that the activity theory provides a set of frameworks for interpreting human activities in a real-world situation and exploring the balance between the goals, roles, norms, materials associated with pedagogic practices. Activity theory was used by Jonassen and Rohrer-Murphy (1999) as the framework to analyse the needs, tasks, and outcomes for designing the constructivist learning environment (CLE), which is a well-known model used for adopting a constructivist approach to promote technology-based learning. Over the years, the components in activity theory are increasingly used in analysing the elements in information systems studies or evaluating the information technologies. These

studies place the primary concern with the development of social activities and relationship for explaining the logic behind human activities in a specific context (Iyamu & Shaanika, 2019). Activity theory was also employed as an empirical framework by the technology developers to understand users' information behaviour in ways how they search, gather, and use the information in dynamic environments. It allows the design of the information systems to be more shaped to the information behaviour of this group of users, hence increasing the applicability to technology development (Allen, Karanasios & Slavova, 2011). In instructional design, activity theory is used as the framework in a collaborative student project setting to foster the transactional processes of learning. It emphasises on crafting the division of labour to facilitate learning between novices and experts and formulating rules to reflect real practitioners in a community (Hung & Wong, 2000).

In this paper, the activity theory is used as the framework to design the pathway to optimise the learning design in a university classroom based on the findings from students' interaction patterns on the University of Nottingham Ningbo China's Moodle Online System and Echo 360 Active Learning Platform (shorts as LMS in this paper). In Figure 1, each of the components in Engestrom's activity theory is associated with the students' learning context.
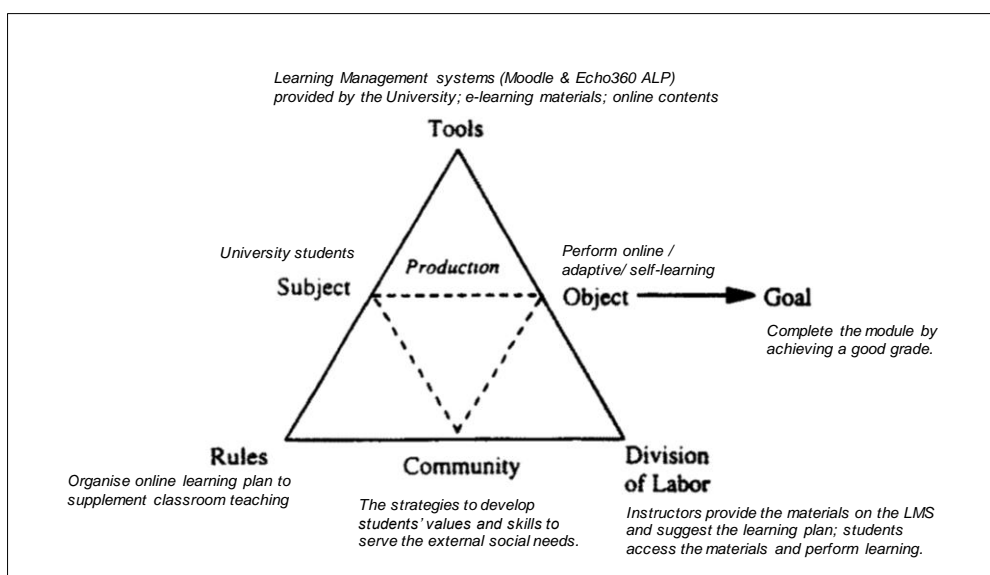
Figure 1 The Triangle of Engestrom's Activity Theory that Consists of Six Components

Methodology

Dataset

In this paper, data is extracted from the Analytics feature of Moodle and the Grade feature of Echo360 ALP used at the University of Nottingham Ningbo China (UNNC) (see Figure 2). This data was organised into a dataset and saved into a CSV file with the first column set as the unique identifiers. This dataset contains the logs of the online activities of 659 students, including their clicks and entries over one academic semester, from Feb 2019 to May 2019, for fifteen teaching weeks. These students were in their first year of the academic programme taking a compulsory module which was designed to enhance their knowledge of technologies and information systems. The learning activities of this module include 11 two-hour lecture, one group project, ten weekly online quizzes, four discussion forums; each for project work, class activities, and exam revision, an online video tutorial for gaining video making ideas and basic skills and four two-hour practical lessons in the computer laboratory. All the learning materials and web links were presented on the LMS in digital versions and downloadable after they were made available to the students, usually one week before conducting the lesson. This study was conducted after gaining ethics approval from the Ethics Committee of the University, where the author is affiliated to at the time of this study.

Currently, this dataset is locally hosted by the author on a high-performance workstation. However, as the size of the dataset increased over time throughout the study, the author subscribed for a web-based hosting service to store the datasets on the data centre which is certified with the international standard for information security. There are four steps of preparing this dataset. The first being the selection. It was done by using the Filters feature to select the necessary data and removing the duplicated data. The second being the anonymisation. It was done by representing the private information with the identifiers. The third being the transformation. It was done by formatting the data and converting it into a database schema (see Figure 2). The fourth being the exploration. It was done by writing the Excel formula and programming codes to perform calculations and statistical analysis (see Table 1).
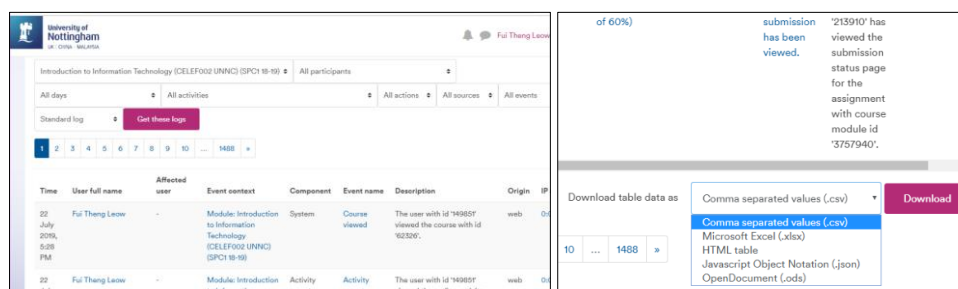
Figure 2 The Analytics and Filter Feature on the Moodle LMS for Downloading Users' Activity Logs

Software Tools

After removing the duplicated and blank data, the collected data consists of 76,000 records (rows) and is organised in a Microsoft Excel spreadsheet data (see Figure 3). Through the data transformation and exploration step, the sorted dataset consists of 659 records (each represents the summary of a student's activity log) and 48 variables (columns). The variables also include the score given to an accumulation of activities, such as a score that ranks the number of login and number of different events combined. Some of the scores or variables are used in this paper to perform the statistical analysis for exploring the interaction patterns of the students in the LMS data (see Figure 4). Some Excel formulas used in generating the variables in the dataset are presented in Table 1 below:

Table 1 The formula used in Microsoft Excel for generating the variables in the dataset

Formula used in Microsoft Excel	Purpose
=INDEX(logs!$C$147:$C$218,MODE(MATCH(logs!$C$147:$C$218,logs!$C$147:$C$218,0)))	To search for the most frequently visited page of a student.
=COUNTIF(logs!$D$2:$D$146,J$2)	To calculate the maximum number of times a student watched the online tutorial video.
=SUMPRODUCT(1/COUNTIF(logs!$C$147:$C $218,logs!$C$147:$C$218))	To count for the total number of different events involved by a student.
=COUNTIFS(logs!$A$147:$A$218,">="&AJ$3, logs!$A$147:$A$218,"<="&AJ$4)	To calculate the maximum number of logins of a student within a duration of one week.

Figure 3 The Collected Data Consists of 76,000 Records (rows) after Removing the Duplicated Data

Figure 4 The Dataset after the 4-step Process Consists of 659 Records and 48 Variables.

The dataset was arranged into several database tables by using DB Designer.net, an online database schema modelling tool. Each database table houses a set of relevant characteristics. These tables were sorted based on student behaviour and student performance for visualising the structure and relationship of the current data (see Figure 5). It was also done for generating the SQL script to be used in MySQL, which is the next step of storing and managing the datasets (not discussed in this paper).
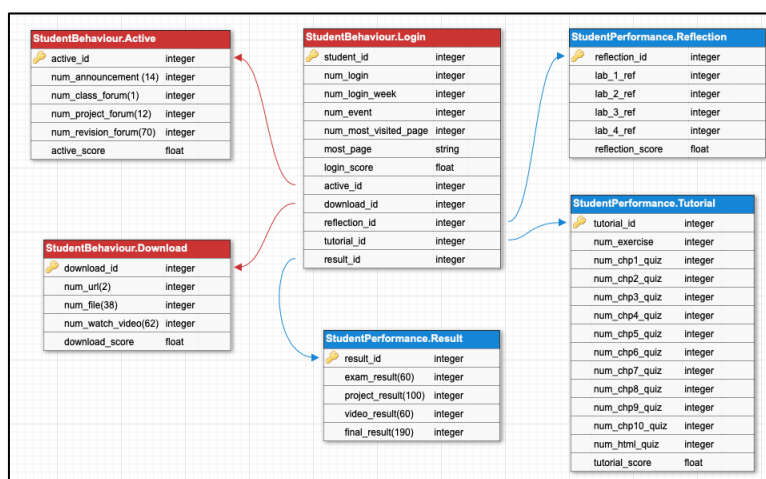
Figure 5 The Database Schema of the Current Dataset Generated by DB Designer

This paper uses RStudio, an integrated development environment (IDE) for coding R, a command-line driven programming language, to transform the data and perform the statistical analysis (RStudio Team, 2015; DataFlair Team, 2018). To identify students' interaction patterns that evolved from the student-LMS interaction. The dataset with 659 records and 48 variables was imported as a CSV file (contains the variable names in the first row) into RStudio by using the command of *dataset1<-read.csv("ALL_logs_no_formula.csv")*. In the Appendix section, Table 2 presents the minimum count, maximum count and mean of the key variables in the dataset. Figure 12 presents the use and process of coding R programming in RStudio.

Results

There are three interaction patterns analysed in this paper and presented in the following sub-sessions.

Interaction Pattern 1 – LMS Access Frequency

The interaction pattern 1 focuses on studying the relative frequency distribution. It is used to identify how often students accessed the LMS throughout the semester (sampled 15 weeks) based on the frequency proportion with an interval of 20 in each category (see Figure 6). With 1 and 322 being the lowest and the highest record, respectively, it can be noticed that the majority of the students accessed the LMS between 60-80 times throughout the semester. It means, on average, each student accessed the LMS 4 to 5.3 times per week, one time per weekday. It also explains that the majority of the students are on the right track and up to the instructor's expectation of daily access.
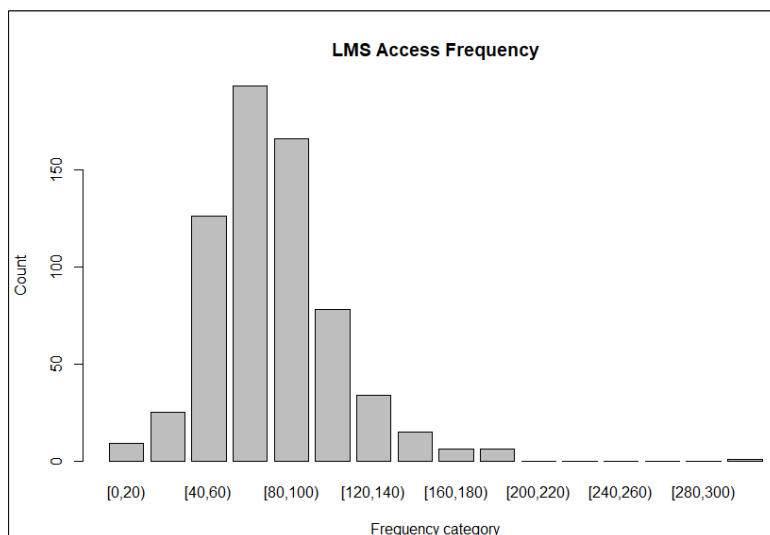
[0, 20)	[20, 40)	[40, 60)	[60, 80)	[80, 100)	[100, 120)	[120, 140)	[140, 160)	[160, 180)	[180, 200)	[200, 220)	[220, 240)	[240, 260)	[260, 280)	[280, 300)	[300, 320)
9	25	126	193	166	78	34	15	6	6	0	0	0	0	0	1

Figure 6 The Relative Frequency Distribution of Students Accessing the LMS

Figure 7 shows the frequency of students' weekly login for a total of 15 weeks in an academic semester. For a class of 669 students, only 30% of students accessed the LMS before the class started. There are three peaks found in the weekly login, happened in week 2 with 8049 times, week 10 with 9048 times, and week 13 with 10768 times. On average, each student accessed 12 times per week (more than two times per weekday) in week 2, 13.5 times per week (more than two times per weekday) in week 10, and 16 times per week (more than three times per weekday) in week 13.
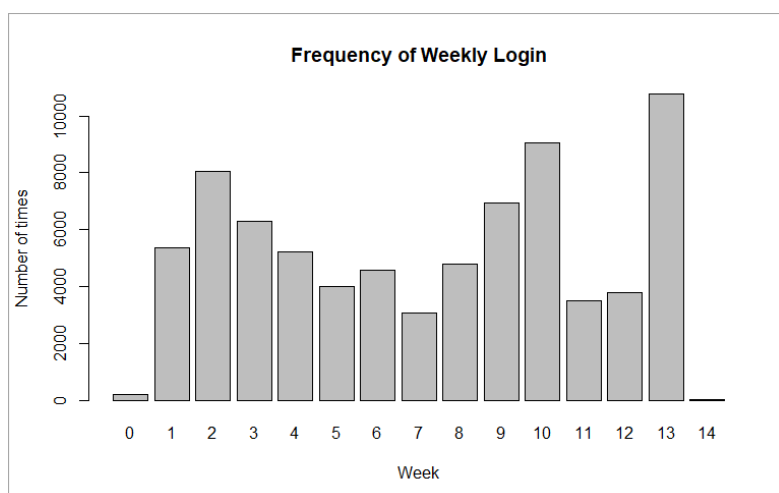
| Week 0	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
201	5355	**8049**	6299	5213	4001	4580	3056	4796	6947	**9048**	3487	3800	**10768**	22
Number of times each student accessed the LMS (average)														
0.3	8	**12**	9.4	7.8	6	6.8	4.6	7.2	10.4	**13.5**	5.2	5.7	**16.1**	0.03

Figure 7 The Frequency of Students Accessing the LMS in Each Week

Interaction Pattern 2 – Correlation between Access Frequency and Purposes

The analysis in interaction pattern 2 is categorised into five variables to understand how the statistical relationship between students' access frequency can be used to predict the variables which have been identified in this paper. All the variables are the continuous interval variables, which means the numerical values are used in the analysis. The correlation is used to study the statistical relationship between these variables. In a scatterplot in Figure 8a) shows the correlation value of r=.64, indicating a fairly strong positive relationship between students accessing the LMS and downloading the files. It is followed by another fairly strong positive relationship (r=.55) between students accessing the LMS and attempting the weekly quiz (see Figure 8b). The relationship between students accessing the LMS and interacting with others on the discussion forum is found at moderate positive (r=.44) (see Figure 8c). The positive relationship is very weak between students accessing the LMS and watching online tutorial videos (r=.15) (see Figure 8d). The only weak negative relationship (or very close to no correction) is between students accessing the LMS and reading the notification (r=-.001) (see Figure 8e). Also, all the correlation coefficients show the p-value less than the significant level (p < 0). Therefore, it is evidenced that the frequency of student accessing the LMS correlates to the five purposes (variables) at various level. It is also sufficient to reject the null hypothesis of having no linear relationship between the two variables.

The correlation analysis provides the information to rank students' purposes of interacting with the LMS. Firstly, students accessed the LMS for obtaining the learning materials which were usually distributed in downloadable files. Secondly, accessing LMS enabled students to attempt the quizzes, which were added every week. Thirdly, students accessed the LMS to participate in the forum discussion or obtaining updates from the new posts. Fourthly, students accessed the LMS for watching online video tutorials to gain new ideas and skills in project development. On the other hand, it can be noticed that, very slightly, the more students accessed the LMS, the less they read the weekly notifications (to disseminate information about the task and reminder for a particular week), which indicates that they became more aware of their weekly tasks and arrangement, hence less relying on the notifications to learn about their tasks.
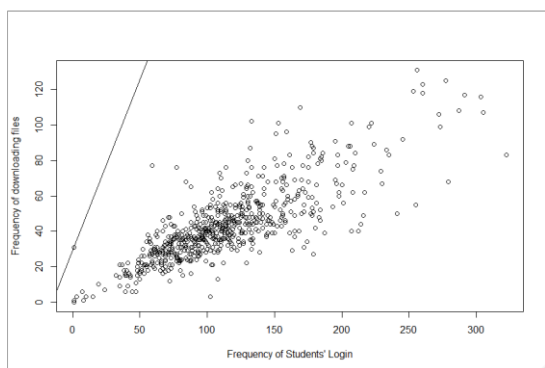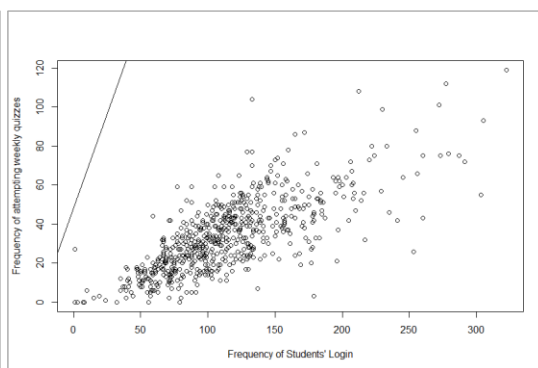
(a)   (b)
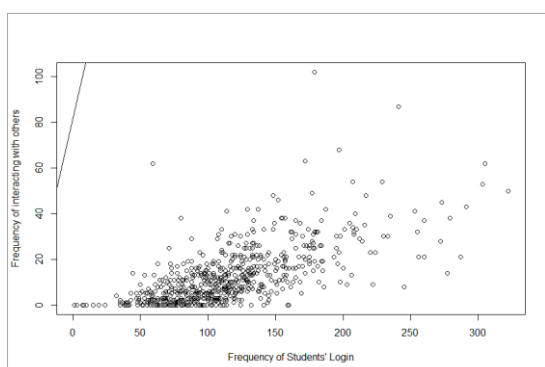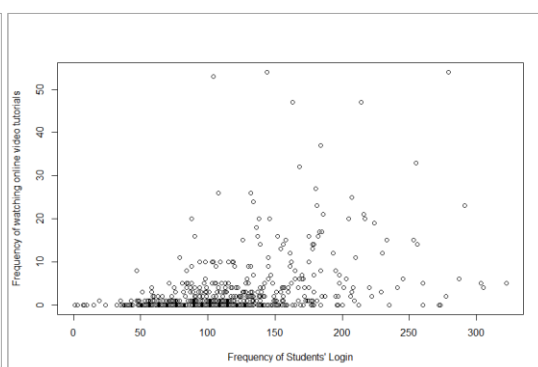
(c)   (d)
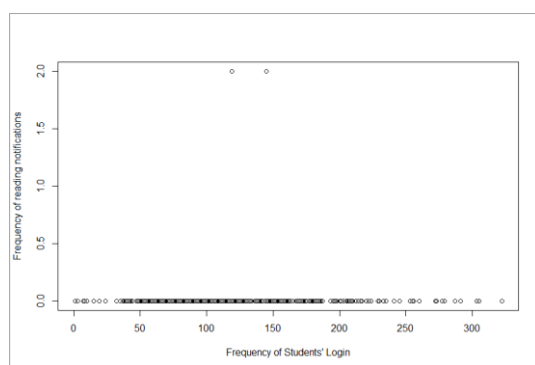
(e)

Figure 8 The Scatterplots with Correlations of the Access Frequency and a) The Frequency of Downloading Files (+0.64); (b) The Frequency of Attempting the Weekly Quiz (+0.55); (c) The Frequency of Forum Interaction (+0.44); (d) The Frequency of Watching Online Video Tutorials (+0.15); (e) The Frequency of Reading Notifications (-0.001)

Interaction Pattern 3 – Weekly Quiz Attempt

Based on the records of students attempting the weekly quiz (see Figure 9), the data is widely spread, from 0 to 144 times of attempts throughout the semester. It indicates that the weekly quiz attempt is less consistent across the student population. The peak of students' weekly quiz attempt occurs at 20-30 times. The mean score is 33.89, and the median score is 32. The histogram of students' weekly quiz attempt is skewed right, which is positively distributed and explained that there are students who attempted more than 50 times throughout the semester.
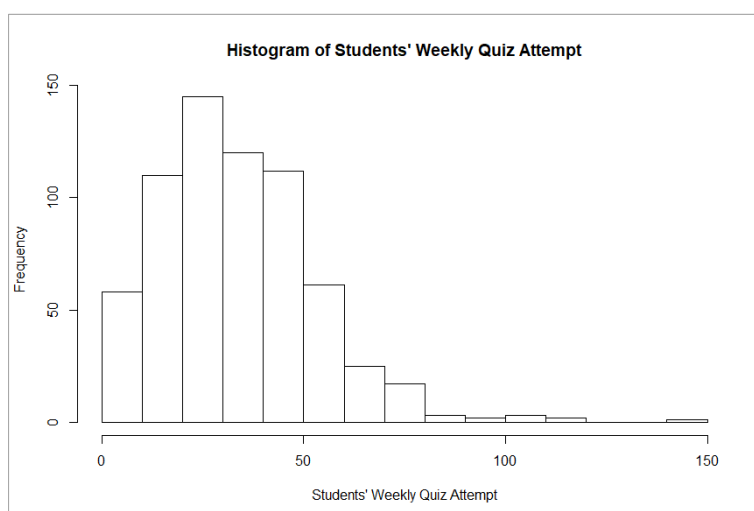
Figure 9 The Histogram of Students Attempting the Weekly Quiz

Figure 10 shows the histograms of the quiz attempt in each week. For the first week, it recorded a mean of 4.58 attempts from a total of 3023 attempts and a peak at the 0-5 attempts per student. For the subsequent weeks, the mean scores decreased from 2.29 (week 2 quiz), 2.13 (week 3 quiz), 2.01 (week 4 quiz), 1.90 (week 5 quiz), 1.96 (week 6 quiz), 1.64 (week 7 quiz), 1.42 (week 8 quiz), 1.33 (week 9 quiz), to 1.19 (week 10 quiz), all with a peak at the 0-1 attempt per student. However, the mean score increased to 13.43, with a peak at 10-15 times per student for the HTML quiz which was posted in week 11. Overall, all histograms are right-skewed, showing the positive distribution, which means there are many students attempted each quiz more than the average times throughout the semester.

(a)

(b)

(c)

(d)

(e)

(f)

(g)

(h)

(i)

(j)

(k)
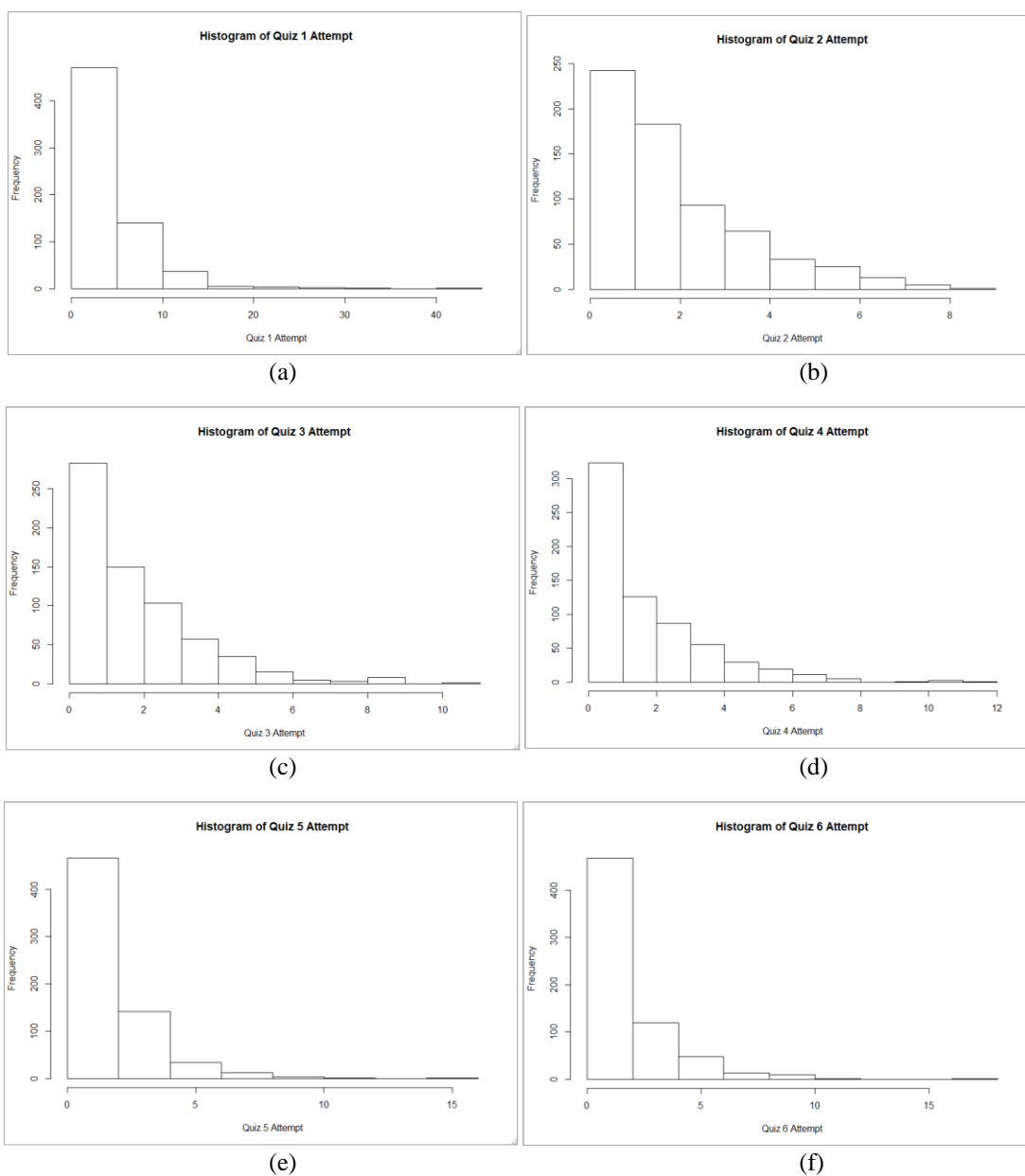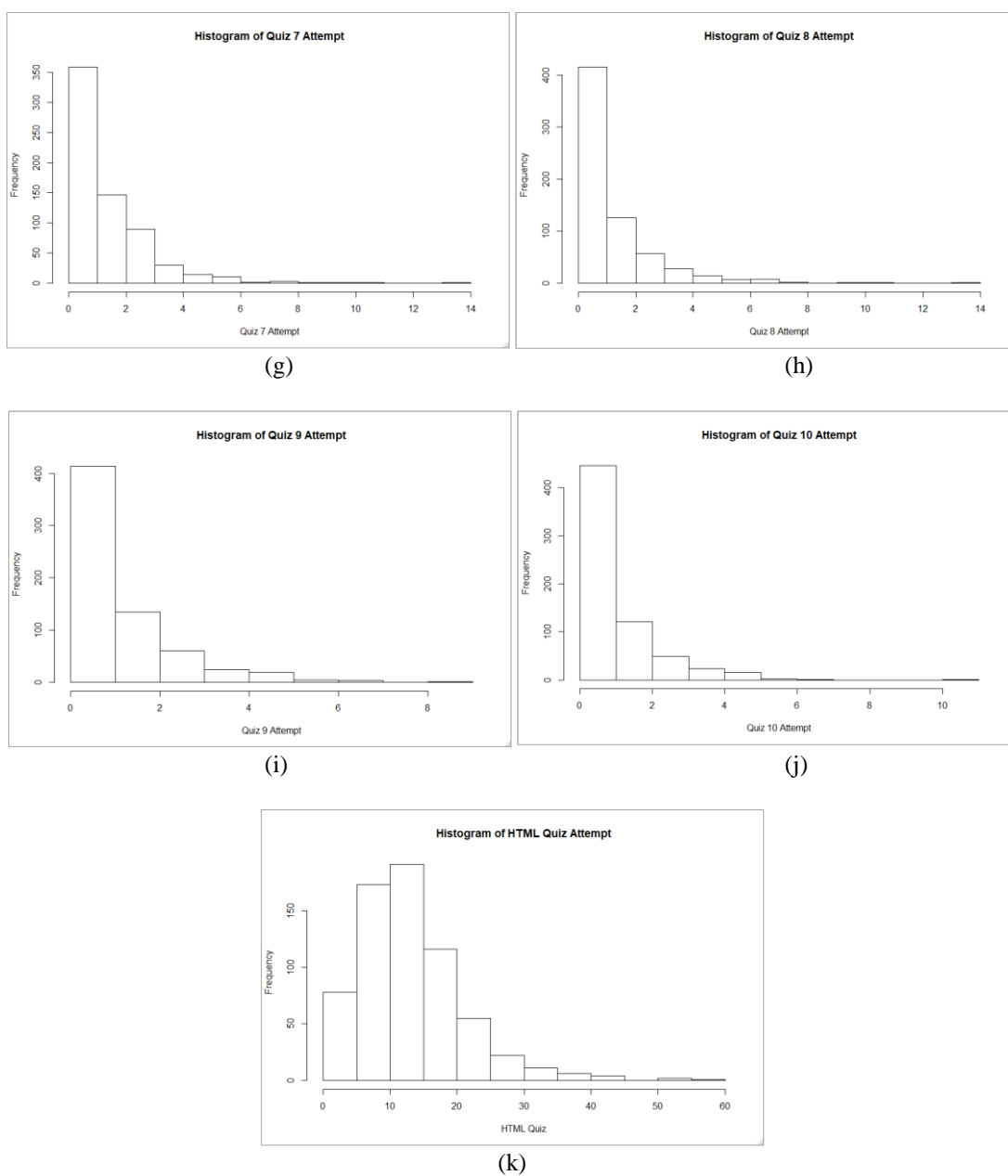
Figure 10 (a-k) The Histogram of Quiz Attempt in Each Week

Discussion and Conclusion

It can be observed that the interaction Pattern 1 shows that the frequency of students accessing the LMS is influenced by the timeline of student assessment. It is also noted that the frequency peaked at every milestone set by the instructor. Specifically, it peaked in week 2 when students checked out their project specification and group members' name, in week 10 when students submitted their project report, and in week 13 when students checked their project mark, as well as engaged in the online quizzes and exam discussion forum in preparing for the final examination which took place at the end of week 13. This result

explains that the learning design and the capability of the system feature to support the learning activities are the potential predictors in increasing the frequency of students accessing the LMS. This translates to the usage of the learning technologies in the university classrooms.

The interaction Pattern 2 shows the correlation coefficients between the students accessing the LMS and each of the five purposes, which were emphasised in the learning design of this module. These 5 purposes are downloading the files (learning materials are presented in the downloadable files), watching the online video tutorials (provide additional skills and ideas in supporting their project development), attempting the weekly quizzes (as a form of revision of the lessons), interacting on the discussion forum (ask questions, participate in discussions, or share ideas with the others), and reading the notifications (posted by the instructors as a form of weekly reminders of tasks and deadlines). The main finding from the correlation coefficients shows that students accessed the LMS mainly for downloading the learning materials which were distributed on the weekly or bi-weekly basis. It indicates that the LMS is significantly perceived by students as a means of disseminating learning materials. On the other hand, it means that by providing frequent and consistent content updates on the LMS, it can maintain the frequency of students accessing the LMS. Subsequently, it can potentially increase the frequency of participating in other online activities on the LMS. The second finding of this interaction pattern is that students tend to engage with the activities that require less time to complete, easy to navigate on the LMS and have a sense of urgency. For instance, students attempted the quiz which requires only 10-15 minutes and a few mouse-clicks to complete, and students joined the forum discussion when they were asked to present a flow chart within 24 hours or to ask questions about proposal writing before the submission deadline. The third finding of this interaction pattern is that the technical requirement and predictability can potentially create resistance in using the LMS. It can be noticed that a very weak positive relationship between accessing the LMS and watching the video tutorials despite video is generally known as the richest and most entertaining media in delivering the content. It is believed that students often experienced the unstable connections that are caused by the limited internet bandwidth and the service capability of the third-party video hosting platforms on the LMS, hence it was perceived as time-consuming and less user-friendly to the students. The predictability also plays a role in increasing the viewership of the content on the LMS. The negative relationship from the correlation coefficients explains that as students became more familiar with the routine or repeated tasks, they tend to ignore the content and hence, it is less effective when used as a strategy to increase the students' access and use of the LMS.

For interaction Pattern 3, the data presented in the histograms explained that the interaction pattern of students attempting the weekly quiz. It is noticed that the attempt started to decline from the second quiz, the mean score recorded 50% lower compared to the first week, and attempts continued to fall, but not more than 10% from the previous week, until Quiz 10. It explains that students were attracted to the interactive class quiz when they first encountered it and were interested to try again to obtain a better score. It also shows that students had quickly adapted to the routine of attempting each quiz for 1 to 2 times instead of ignoring it. It is believed that this consistency was contributed by the instructor's practice of administering the weekly online quiz at the end of each lecture. However, the outstanding result of the HTML quiz, 3 times higher than the quiz 1 attempt, can be explained by its approach and content as it was administered in week 11 during a practical lesson in the computer laboratory, and was used to test students' skills in coding an HTML page, which is different from other quizzes that tested students' theoretical knowledge. Therefore, the interaction pattern of students attempting the weekly quiz shows that interactive class activities can potentially receive students' attention in the first place, with their positive attitude in engaging with it. In conclusion, it requires 'surprises' (not repeating the same approach over weeks), challenges (content that allow students to test their knowledge or skill level), and the weekly routine (instructor's teaching plan) in sustaining and increasing the number of quiz attempts, which translate to the usefulness and meaningfulness of the learning activities.

This paper focuses on preparing the dataset and identifying the interaction patterns evolved from the student-LMS interaction. Based on the findings, the author designed the pathway, with the component in the Engestrom's activity theory, for optimising the learning design in the university classrooms. Figure 11 presents the initial design of this pathway. The main idea of this pathway is that it has multiple entries (openings) to drive learners into the processes of the entire activity system. Each of the entries starts from a 'stop', which is like a 'hook' to motivate the learners, and there is a total of 10 stops. In the learning context, each of the stops represents an actionable approach that can be initiated by the instructors or requested by the students for engaging with the components in the activity theory. For instance, when the instructor provides constant updates (*Stop 10*) in the learning process, it triggers the learners (*subject*) to frequently check out (*action*) what is new (*surprise*) and what needs to be done (*task*) in order to fulfil the requirement and get a good result (*goal*). Hence, one of the ways to optimise learning design is to be strategic in releasing or distributing the learning resources on a timely and relevant manner.
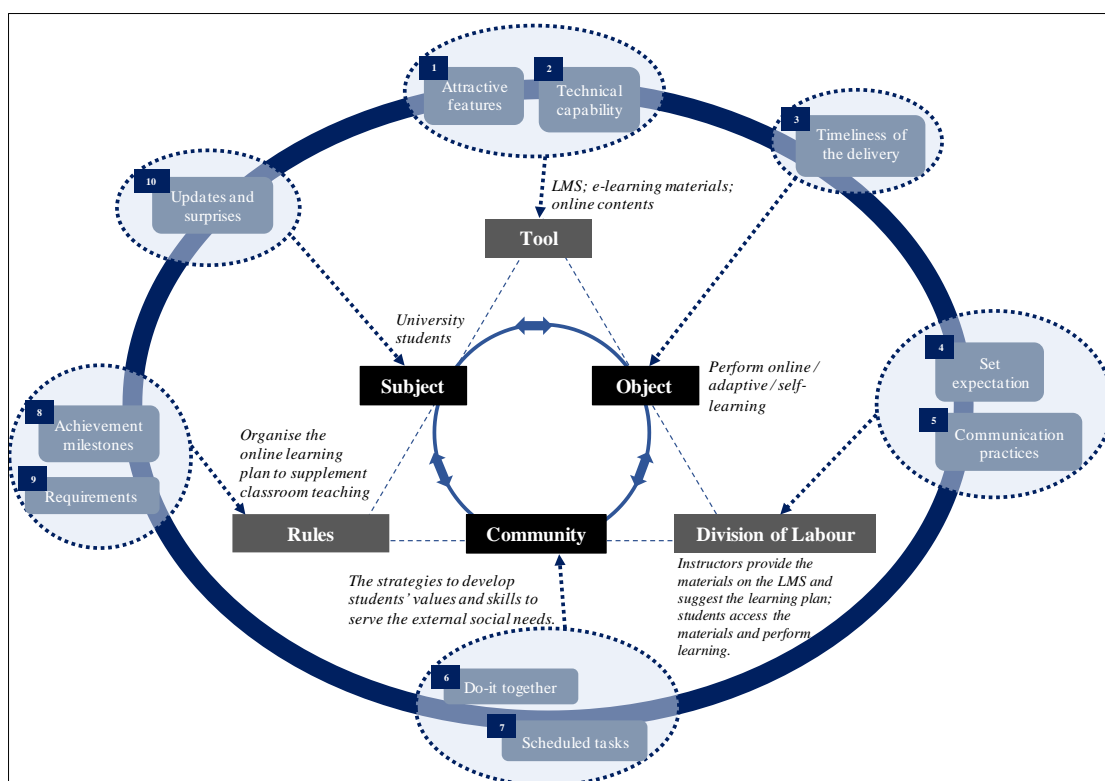
Figure 11 The Pathway with Engestrom's Activity Theory and Ten Stops for Optimising the Learning Design

Due to the word limit, this paper presented three interaction patterns. For future publication, the author will extend the analysis with more interaction patterns and include the variables of students' final examination result and project performance mark in the dataset. By investigating the variances, regression analysis, and significant level between students' academic performance and online activities on the LMS, more interaction patterns can be identified. That said, it enriches the development of the learning pathway and provides more comprehensive guides to support the instructors in learning and activity design. It is also expected that the findings and the dataset in this study can contribute to the development of the predictive model to unearth students' behaviours and interaction patterns with learning technologies.

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Authors' Bio

Fui-Theng Leow (FT) has more than 12 years of teaching experience in international universities. In addition to teaching, FT involves in various scholarly activities, including guest speaker lectures and student project supervisions. She has experience in the programme coordination, e-learning training, conference organisation, journal editorial board, and student assessment review. She was also trained as the trainer of Blackboard LMS and the learning designer for implementing online learning system. FT has been working on multiple research projects at various scales across different disciplines for more than ten years and published over 20 articles in peer-reviewed journals and international conference proceedings. She also presented in international conferences, conducted workshops on educational technologies, and reviewed research manuscripts.

Appendices

Table 2 The minimum count, maximum count and mean of the key variables in the dataset

Variable	Minimum	Maximum	Mean
No. of Days of login	1	543.0	114.1
No. of different events	0.1648	97.0000	47.1110
Top-5 most frequently visited page			
1. Quiz: HTML Quiz		381	
2. Project Forum		74	
3. Activity Forum		61	
4. File: Chapter 1		34	
5. Chapter 1 Quiz		26	
Video tutorial resource	0.00	54.00	2.88
File download	0.00	164.00	43.67
Announcement	0.00	2.00	0.006
Click on the URL link	0.00	7.00	0.59
Link to Echo360 ALP to access			
- Chapter 1 Quiz	0.00	44.00	4.58
- Chapter 2 Quiz	0.00	9.00	2.29
- Chapter 3 Quiz	0.00	11.00	2.13
- Chapter 4 Quiz	0.00	12.00	2.01
- Chapter 5 Quiz	0.00	16.00	1.90
- Chapter 6 Quiz	0.00	18.00	1.95
- Chapter 7 Quiz	0.00	14.00	1.63
- Chapter 8 Quiz	0.00	14.00	1.42
- Chapter 9 Quiz	0.00	9.00	1.32
- Chapter 10 Quiz	0.00	11.00	1.19
- HTML Quiz	0.00	56.00	13.43
Social interaction on			
- Exam Forum	0.00	42.00	1.34
- Project Forum	0.00	102.00	5.11
- Class Forum	0.00	20.00	0.32
- Activity Forum	0.00	65.00	5.46
Total number of logins in			
- week 0	0.00	9.00	0.30
- week 1	0.00	105.00	8.12
- week 2	0.00	90.00	12.21
- week 3	0.00	43.00	9.55
- week 4	0.00	62.00	7.91
- week 5	0.00	25.00	6.07
- week 6	0.00	42.00	6.95
- week 7	0.00	80.00	4.63
- week 8	0.00	76.00	7.27
- week 9	0.00	65.00	10.54
- week 10	0.00	64.00	13.73
- week 11	0.00	51.00	5.29
- week 12	0.00	47.00	5.76
- week 13	0.00	67.00	16.34

(a)　　　　　　　　　　　(b)

(c)　　　　　　　　　　　(d)

(e)　　　　　　　　　　　(f)
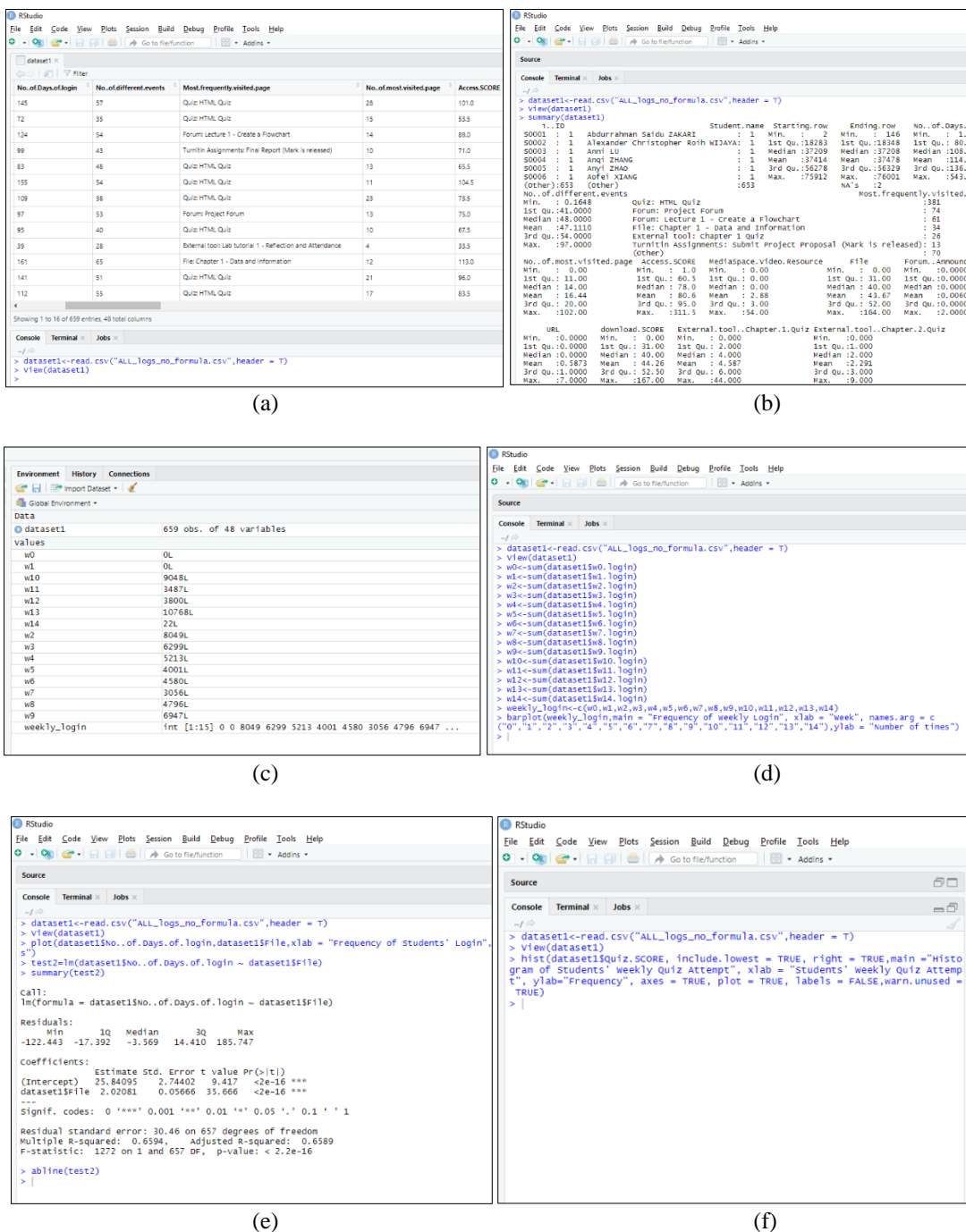
Figure 12 (a) The Display of Dataset in Rstudio in the Source Pane; (b) Coding in the Console Pane; (c) The List of Variables in the Environment Pane; (d) R Codes for Generating the Bar Charts; (e) R Codes for Generating the Scatterplot; (f) R Codes for Generating the Histogram

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The New Roles of Teachers in 21ˢᵗ Century Learning

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Abstract

Education is important for a society's growth and development. A teacher must be able to effectively educate students and create interest in them. The main discussion aims to identify the new roles of teachers in the 21ˢᵗ century learning. This paper also discusses the impact of students' learning motivation towards their subjects. The problem some teachers face includes situation where students pay less attention to difficult subjects while having negative learning mindset. Lack of enthusiasm and rigidness from the teacher are also part of the problem. The new role of teachers is measured in three ways which are learning mindset, roles & qualities of teachers and Bloom's Taxonomy. An online survey was conducted among 30 lecturers using convenience sampling technique. The suggestions given are based on the S.M.A.R.T concept which comprises of structure of class, teachers as motivators, assessment conducted, teachers' role as consultants and blended learning tools used by teachers. This paper also discusses the use of Bloom's Taxonomy which will help teachers to have proper classroom management and preparation of a constructive lesson plan. The key finding of this paper is that the new roles of teachers in the 21ˢᵗ century learning should give impact to students based on the 4Cs.

Keywords Negative learning mindset; S.M.A.R.T concept; Bloom's Taxonomy; 4Cs

Introduction

The traditional roles of teachers are seen as a class leader, lecturer and information provider (Murchu, 2005). Teachers who adopt traditional roles refuse to change and strongly believes that their method is the best. These teachers who practice a one-teacher and one-classroom model will face with massive workload

(Barrett & Arnett, 2018). The role of teachers in the 21st century is known as consultant, motivator and resource provider. Currently, teachers are changing their method of teaching to be more approachable for students' learning (Berge, 2000). Teachers act as key actors who form the learning environment that enhances and sustain students' motivation thus engaging students in learning (Hornstra, Mansfield, Veen, Peetsma & Volman, 2015).

Problems or Issues Faced in Teaching & Learning in Higher Education that Called for the Innovation

Mindset refers to students' belief about school and learning (Mindset Scholar Network, 2015). Past study also mentioned that, mindset can be an outcome of students' achievement (Zhang, Kuusisto & Tirri, 2017). Students with learning mindset are found to be able to execute challenging task and form the way they respond to challenges (Mindset Scholar Network, 2015). Problem arises when students have negative learning mindset when they believe that they are not good in certain subject in school (Mindset Scholar Network, 2015). With that, they do not want to take the initiative to find ways to improve their academic performance resulting in them giving up. They also have the "copy and paste" concepts where they think it is the fastest way to complete the task given by their teachers. Learning mindset gives impact to students whereby they understand the bigger meaning of the challenges they face and it is a way they translate their daily experiences (Mindset Scholar Network, 2015). With that, students have the perception that if they have obtained high coursework marks, there is no need for them to do comprehensive preparation for final examination as they want to just obtain a pass for the subject. Previous study mentioned that, students who have the believe that by failling to obtain good results in certain subject they will study lesser and conclude that they are not good at it (Mindset Scholar Network, 2015). They are not bothered about the grades that they will obtain or even their overall academic performance. This led students to have negative learning mindset while believing that they are not smart.

Literature Review

Negative Learning Mindset, New Roles of Teachers & Bloom's Taxonomy

Bloom's Taxonomy can be used to identify students' thinking and ways they convey their understanding (Heick,2019). Students with negative learning mindset are creative at times. They have this mindset due to the boredom they experience during challenging subject classes. Bloom's Taxonomy can be used by teachers to build solid foundation for learning (Flanagan, 2019). Based on Bloom's term '**create**', students need to use innovative or **creative** thinking (Heick,2019). Students will be encouraged to transmit from lower levels to higher levels when points are given to them for each level (Heick, 2019). This may change the negative

learning mindset of students. Blair, Tobman, Kremling and Morris mentioned that when students are challenged to do things that they think they can't do or don't want to do, they will be resistant. This will lead them having negative mindset.

The new role of teacher as a **controller** encourages students to participate in discussion and able to give explanation and clarification (Kudryshova, Gorbatova, Rybushkira & Iwanova, 2016). This refers to **understanding** in Bloom's Taxonomy whereby teachers explain task given to students. The structure of the class should be based on the 21st century design. A study mentioned that students learning at higher levels during group discussions support the concept of Bloom's Taxonomy (Athanassiou, McNett & Harvey, 2003). A teacher's role as a **moderator** creates conditions for students to analyse the knowledge that they have (Kudryshova et al., 2016). Teachers later observe students' activities and this is related to **analyse** in Bloom's Taxonomy. The role of teacher as a **facilitator** relates to **evaluate** in the concept of Bloom's Taxonomy whereby it simulates professional situations and encourage students to form alternative solutions. Teachers act as **leaders** when they observe students' behaviour and skills. The study done by Thanh (2018) stated that students in the 21st century have quick access to the knowledge store. This will enable them to **communicate** with people during evaluation process so that they can achieve their goals.

Negative Learning Mind-Set, New Roles of Teachers & S.M.A.R.T Concept

Heick mentioned that the **structure** of the class should include information rich environment, persevere connectivity and powerful media forms. Previous studies stated that teachers should use textbook as the second source to find information. Teachers should integrate technology in their classes so that students have more sources of information. Teachers should be **motivators** in students' learning by being enthusiastic and dedicated in their job. According to Thanh (2018), teachers must change their conventional way of thinking and influence students' learning style. He also stated that teachers must be responsible in encouraging student-centred learning concept in classrooms. One of the authors from Your Therapy Source (2018) mentioned that the reaction that we project to students towards their learning will bring impact to them. When a teacher respond "good job" or give any positive remarks to their students, students will feel motivated to do more and will change their negative learning mindset. **Assessment** conducted by teachers aim to test the knowledge about the subjects taught in class. Teachers can infuse Bloom's Taxonomy in their assessment which can be in the form of multiple choices, short answers and essays (Eber & Parker, 2007). The study also stated that it is essential to assess students based on rubrics whereby it can minimise the time spent on evaluating students. Previous study suggested that the assessment

should be constructed based on students' performance in order to determine their needs and achievement. The new **role** of teachers as consultant will help students to give better response in classes. Thanh (2018) mentioned that teachers should guide and help students to have an aim in learning. When students have an aim, they will not have negative learning mindset in learning. Previous studies mentioned that teachers should play an active role in preparing students for the 21st century workplace environment. In order to adapt to the 21st century learning, students must have access to digital technology so that they are exposed to blended learning **tools**. There are many teachers depending on technology to help student to understand concepts and enhance learning (Wedlock & Growe, 2017). They also suggested that learning will be at its best if students and teachers are learning together. This is possible when teachers provide explanation whenever a new learning tool is implemented during lessons.

Methodology

Negative Learning Mindset, New Roles of Teachers & 4Cs

This research paper also relates Bloom's Taxonomy and the 4Cs in the 21st century learning; creative, communication, critical thinking and collaborative. Based on the current study conducted, some group of students felt demotivated and reluctant to complete the task given to them because they think it does not benefit them and no marks were rewarded. This projects negative mindset as they only do the task when there are marks given. With the help of Bloom's Taxonomy's **create** and the use of digital technology (blended learning), students can access various ways to do their task on their own time by thinking and reading (Heick, 2019). This may possibly change the mindset of students as they have **creative** methods to learn their subjects. The term **evaluate** in Bloom's Taxonomy give students chance to evaluate their own progress and provide justification. This will definitely change the mindset of students as they feel that they can be independent learners and can help to improve the quality of learning. Based on past experiences, when the researcher was teaching Business Management subject, students were given questions on current issues to discuss and present. Question and answer sessions are highly recommended as it gives opportunity to students to **communicate** with their peers. They are required to work as a team (**collaborative**) and use **critical thinking** to understand and **analyse** a given situation. Some students faced difficulties in answering the questions as they are not determined to think critically. The role of teachers as controllers may change the mindset of non-business students who think that having business subject in their course is irrelevant to them. Students will be able to **understand** the concept of the subject taught when they are assessed by teachers. The group activities given to students have showed cooperation between them to achieve a common goal. Hence, this will brush away negative learning mindset of the students.

Survey Questionnaire

A Likert Scale questionnaire is used to find out what the target population think about the new roles of teachers in the 21st century learning. The lecturers in Multimedia University are regarded as the target population for this research. The sample size is 30 respondents from Cyberjaya and Melaka campus. The respondents are lecturers teaching all levels of programme (Foundation, Diploma, Bachelor and Postgraduate) which consist of Business and Management academic discipline. Convenience sampling was applied for this research.

The survey questionnaire consists of five parts and it was analysed based on the responses given by the respondents. Part A shows the respondent's demographic (4 items). Part B aims to know the feedback on students' learning mind-set (3 items) and observe student learning mind-set (4 items). Part C relates to the role of teachers (5 items) and qualities of teachers (6 items). Part D assesses their implementation of Bloom's Taxonomy (12 items). Part E relates to the concept of 4Cs (12 items) which is related to the outcome of implementing the new roles of teachers and Bloom's Taxonomy. Data collection was conducted using Google Form due to time constraint.

Results

Demographic

The demographic of the respondents is shown in Table 1. Most of the respondents are female (21; 70%) compared to male (9; 30%) and the respondents are mainly from the age group of 31 - 40 years old (15; 50%). Majority of the teachers are Chinese (14; 46.7%) and most of them are teaching undergraduate students (20; 66.7%).

Table 1 Demographic of the respondents

Demographic		Frequency	Percent
Gender	Male	9	30
	Female	21	70
Age	21 - 30 years old	2	6.7
	31 - 40 years old	15	50
	41 - 50 years old	10	33.3
	51 - 60 years old	3	10
Race	Malay	13	43.3
	Indian	14	46.7
	Chinese	3	10

Teaching level	Foundation	6	20
	Diploma	3	10
	Undergraduate	20	66.7
	Postgraduate	1	3.3

Learning Mindset

Table 2 shows respondents' feedback and observation on students' learning mindset. The average score for teachers' feedback on students learning mind-set is 37.8% whereas the average score for teachers' observation on students' learning mindset is 36.7%.

Table 2 Learning mind-set average score among the respondents

Part B.1: Learning mind-set (Teachers' feedback on students' learning mind-set.			
No.	Question & answer	Percentage	Average
	How often do you ask your student's feedback about the following?		
1	Are there subjects that you find it challenging to understand? (Quite often)	33.3	37.8
2	What do you do if you obtain bad results? (Quite often)	33.3	
3	Do you have the motivation to obtain better results? (Quite often)	46.7	
Part B.2: Learning mind-set (Teachers' observation on students' learning mind-set)			
No.	Question & answer	Percentage	Average
	How often do you observe the following?		
1	Students willing to learn from students who have good academic results. (Quite often)	36.7	
2	Students are comfortable with their current results and do not want to strive for more. (Quite often)	43.3	36.7
3	Students adopt 'copy & paste' method to complete the task easily. (Often)	36.7	
4	Students refuse to pay attention during challenging subject classes. (Quite often)	30.0	

Roles and Qualities of Teachers

Table 3 shows the roles and qualities of teachers among the respondents. The average score for the roles involved in class is 56% whereas the average score for the quality required of teachers to teach in 21st century is 55.8%.

Table 3 Roles and qualities of teachers

Part C.1: Roles of teachers			
No.	Question & answer	Percentage	Average
	What roles are you involved in class?		
1	The prompter (Agree)	56.7	56
2	The resource (Agree)	60.0	
3	The assessor (Agree)	66.7	
4	The participant (Agree)	40.0	
5	The tutor (Agree)	56.7	
Part C.2: Qualities of teachers			
No.	Question & answer	Percentage	Average
	What do you think the qualities required of teachers to teach in 21st century?		
1	A teacher needs to know the students and their mind-sets (Agree)	53.3	55.8
2	Teachers should be collaborative problem-solvers themselves (Agree)	53.3	
3	A teacher needs to understand how students go about learning with information technology usage (Agree)	63.3	
4	A teacher needs to be creative in developing curriculum (Agree)	53.3	

Bloom's Taxonomy

Table 4 shows the concept of Bloom's Taxonomy used by the respondents in order to change the negative learning mind-set of students in the 21st century learning environment. The respondents recorded the highest score in Bloom's Taxonomy 'creating' (58.9%; average) followed by 'understanding' (48.3%; average), 'analysing' (46.7%; average) and 'evaluating' (42.2%; average).

Table 4 Bloom's Taxonomy

Part D.1: Bloom's Taxonomy (Understanding)			
No.	Question & answer	Percentage	Average
	How often do you encourage your students to do the following?		48.3
1	Describe detailed concepts in my class. (Often)	43.3	
2	Discuss detailed concepts in my class. (Often)	53.3	
Part D.2: Bloom's Taxonomy (Analysing)			
No.	Question & answer	Percentage	Average
	How often do you allow your students to do the following?		46.7
1	Compare the terms taught in class. (Quite often)	46.7	
2	Debate the terms taught in class. (Often)	46.7	
3	Differentiate the terms taught in class. (Often)	46.7	
Part D.3: Bloom's Taxonomy (Evaluating)			
No.	Question & answer	Percentage	Average
	How often do you encourage your students to do the following?		42.2
1	Choose the best problem-solving solution. (Often)	43.3	
2	Justify the best problem-solving solution. (Often)	40.0	
3	Recommend the best problem-solving solution. (Often)	43.3	
Part D.4: Bloom's Taxonomy (Creating)			
No.	Question & answer	Percentage	Average
	How often do you allow your students to do the following?		58.9
1	Design solutions for task given in classes. (Often)	60	
2	Plan solutions for task given in classes. (Often)	60	
3	Generate solutions for task given in classes. (Often)	56.7	

The 4Cs Concept

Table 5 show the concept of 4Cs based on the respondents' observations towards their students. Critical thinking (51.1%; average) recorded the highest average score followed by communication (44.4%; average), collaboration (37.7%; average) and creativity (33.4%; average).

Table 5 The 4Cs Concept

| Part E.1: Critical thinking			
No.	Question & answer	Percentage	Average
	How often your students do the following?		
1	Make comparison from different sources to complete a task. (Often)	56.7	51.1
2	Create their own interpretation based on their understanding about your subject. (Often)	56.7	
3	Analyse problem-based task to find for solutions. (Often)	40.0	
Part E.2: Collaboration			
No.	Question & answer	Percentage	Average
	How often your students do the following?		
1	Work in a group to complete assignments. (Very often)	40.0	37.7
2	Do presentation as a team for the completed assignment in class. (Often)	40.0	
3	Provide feedback to peer during presentation. (Often)	33.0	
Part E.3: Communication			
No.	Question & answer	Percentage	Average
	How often your students do the following?		
1	Use oral presentations (charts, tables, diagrams) (Often)	46.7	44.4
2	Project their ideas using posters, videos or other forms of tools. (Often)	43.3	
3	Conduct Q&A sessions during presentations. (Often)	43.3	
Part E.4: Creativity			
No.	Question & answer	Percentage	Average
	How often your students do the following?		
1	Use mind mapping or brain storming. (Often)	26.7	33.4
2	Create their own ideas about how to solve a problem-based task. (Often)	36.7	
3	Create their own notes based on lesson taught in classes. (Often)	36.7	

Discussion and Conclusion
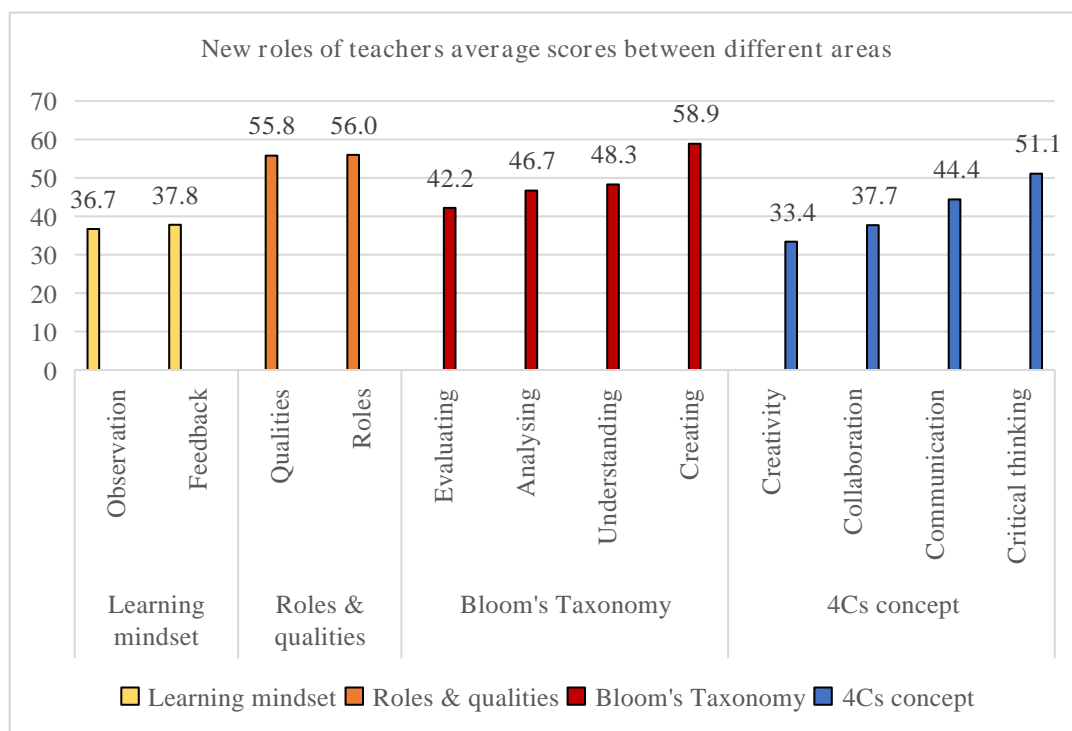
Figure 1 New Roles of Teachers Average Scores between Different Areas

Based on the feedback of the respondents on student's learning mindset, most of them often ask students whether they have the motivation to obtain better results. This refers to past findings which stated that teachers should give early feedback often and believe that students can do well (Shrivastava, 2012). Based on the respondents' observation, they find that quite often students are comfortable with their current results and do not want to strive for more. Shrivastava (2012) suggested that teachers should help students to find personal meaning so that they will continue to progress. This reflects the importance of teachers to know their students' learning mindset so that students will not have negative learning mindset. Most of the respondents agree that teachers should play the role as assessors. The findings are consistent with past studies which reported that teachers who act as assessors will understand students' attitudes, skills, method of learning and their progress (Francisco, 2014). Majority of the respondents think that the quality that teachers need is to understand how students go about learning with information technology usage. This finding is supported by past study stating that technology will be regarded as an educational tool to assist teachers in facilitating learning (Wedlock & Growe, 2017). This is important as it will continuously create interest in student learning.

The greatest percentage scored by the respondents for 'creating' under Bloom's Taxonomy where they often allow students to design and plan solutions for the task given. Previous study stated that by doing this, it shows that students understand the task given, construct plan and generate solutions (Eber & Parker, 2007). Majority of the respondents often discuss detailed concepts in their classes. Past study analysis stated that students will be interested in learning and they will feel like they are part of a learning community. Based on Bloom's Taxonomy 'analyse' the respondents quite often allow students to compare, debate and differentiate terms taught in class which related to previous study done by Kelly (2019). She mentioned that, students will be able to understand the fundamental structure of knowledge and will be able to differentiate between fact and opinion. Most of the respondents encourage students to choose and recommend the best problem-solving solution. This result is consistent with past study done by Kelly (2017) stating that students will be able to make judgement about certain ideas and utilise all that they have learned.

Based on one of the 4Cs concept of 'critical thinking', most of the respondents often ask students to make comparison from different sources to complete a task and create their own interpretation based on their understanding about the subjects. Past studies done by Ferlazzo (2011) stated that critical thinking help strengthen the brain where students will be able to be creative and innovative. The respondents often ask students to work in group to do presentation in completing the assignment in class. This result is related to a study done by Berge (2000) stated that students become more collaborative when they work as a group. Majority of the respondents often asked students to use oral presentations to communicate. According to Applied Educational System [AES] (2019), communication is important to aptly transmit ideas and avoid confusion. Most of the respondents often ask students to create their own ideas about how to solve problem-based task and create their own notes based on lesson taught. Previous study stated creativity allow students to perceive concepts in different perspective (AES, 2019).

Although some teachers are willing to take up the new roles, there are some limitations. Firstly, we cannot change students' mindset overnight and it takes time to monitor their progress. Secondly, not all teachers want to take the initiative to adopt the new roles of teachers and implement Bloom's Taxonomy concept as they still believe in traditional roles. Further research should focus on specific roles of teachers and relate it to the implementation of Bloom's Taxonomy and S.M.A.R.T concept. Also, the small sample size is one of the limitations as well as it could limit the applicability of the findings.

In general, teachers play an important role in the 21st century learning in order to change students' negative learning mindset. It is essential for teachers to be aware of the students' learning mindset and be enthusiastic in helping students' learning process. The new roles of teachers work hand-in-hand with the qualities of teachers that are required to teach in 21st century. Teachers must be willing to make changes and infuse different techniques so that students will not adopt negative learning mindset. The new roles of teachers can be exercised by using the S.M.A.R.T and Bloom's Taxonomy concept which will enable teachers to change students' negative learning mindset. The structure of the class should be created based on the students' level of understanding. The role of teachers as motivators will enable students to feel motivated hence building good rapport between teachers and students. Students will cultivate the interest in learning new things especially when technology is implemented in class such as blended learning tools. The standard of the assessment set should be relevant to the subjects taught so that students are not afraid of assessments. The implementation of Bloom's Taxonomy in the 21st century learning is essential because students will be able to sustain themselves to be competitive and employable in the 21st century environment. Hence, they will be trained to not have negative learning mindset as they already have proper teachings by their teachers. After implementing S.M.A.R.T and Bloom's Taxonomy concepts, there is a possibility that students will have the 4Cs (creativity, collaboration, communication & critical thinking) in them which are the main focus in 21st century learning. Students will be able to find solution to problems, work with the society, communicate with people and innovate.

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Authors' Bio

Cheryl Chan was born in Melaka in 1985. She received her Degree in Business Administration majoring in Banking and Finance in 2008 from Multimedia University, Melaka. She has experience in the field of banking, education and finance. She currently works for Multimedia University where she teaches subjects like Economics, Accounting, Finance and Business. She is a certified trainer under HRDF Malaysia and had experience conducting training for SL1M Program. She acted as one of the facilitators in "I Love English Workshop" which promotes the importance of English among school students in Melaka. She served as a mentor for International Young Social Entrepreneurs Competition 2018 and IIUM EMSS International Challenge 2019. She is one of the co-authors for a research paper sponsored by MMU mini fund which she presented in the 9th International Economics and Business Management Conference (IEBMC 2019).

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Enhancing Students' Collaborative Learning Experiences with Laurillard's Conversational Framework

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Abstract

Collaborative learning (CL) is becoming increasingly recognised as a popular pedagogical practice in higher education that promotes socialization and learning among students. However, the use of collaborative learning does risk placing too much responsibility on the learner and reducing face-to-face interaction with the educator. Therefore, there is a need for educators to find a balance in the interaction and engagement with students to help improve their perceived collaborative learning experiences. This paper presents the development of blended learning environment through the use of Laurillard's Conversational Framework (LCF) to facilitate project-based learning, mediated by multimedia and online tools. Students' feedbacks gathered indicated that students experienced meaningful learning and improved socialization when communicating and collaborating with each other. The findings showed that the LCF is very useful in helping to design technology-based learning environments with collaborative project-based activities. However, educators do need to know that factors such as students' lack of collaborative skills, issues on free-riding, student's competency level, and friendship among students are important factors in determining the effectiveness of collaboration among students.

Keywords Collaborative learning; Student perceptions; Project-based learning; Conversational framework; Learning experiences

Introduction

Technological advancement plays an important role in influencing the change in people's attitudes towards education and how they learn. It has become an important part of higher education where students can learn, collaborate and share ideas with each other through the Internet and the ever-improving technology (Al-Emran, Elsherif, & Shaalan, 2016). The change in technology has widened the gaps in terms of the use of technology in developing students' 21st-century skills. In order to keep up with this situation, HEIs in Malaysia have started initiatives to introduce innovative learner-centred approaches to provide students with meaningful, effective learning experiences and to empower them to be capable and competent lifelong learners through combining online instruction with face-to-face sessions (f2f) that is commonly known as blended learning (BL).

In more developed countries, initiatives have been carried out in researching and introducing technology-enhanced innovative approaches in lesson delivery. They have moved from a teacher-centred approach towards a learner-centred or learner-driven approach, where learning is more about developing students holistically rather than preparing them for examination kind of education. For example, Finland introduced the multi-disciplinary phenomenon-based learning into their education system where students play an active role and are self-regulated, set their own objectives and solve problems independently and collaboratively (Symeonidis & Schwarz, 2016; Silander, 2015).

Herranen, Vesterinen & Aksela (2018) defined learner-centred approach as where the teacher holds the control of determining the choices and learning goals for the learners, although the learners are taken into consideration while the learner-driven approach is where the learners have more autonomy and independence and they take active ownership of their learning. In this study, the learner-centred approach used is as per defined above, with the exception that facilitator holds a certain degree of control on determining the choices and the goals for the learning. Students participated in this study were given the choice of choosing their topic based on certain themes while learning objectives were decided by the facilitator. The intention was to help them to become autonomous and responsible learners. On the other hand, CL is becoming increasingly considered to be an important learner-centred pedagogical practice in higher education as it promotes socialization and learning among students. It provides the opportunity for students to communicate and interact with their peers in solving problems as a group. Therefore, in this study, the learner-centred CL model developed to better engage students comprised of three key integrated components: the LCF; the project-based learning approach (f2f and online); the use of a blended learning

environment. The LCF is used to facilitate project-based learning, mediated by the web 2.0 technologies and f2f sessions. The focus is to investigate the students' perception of the collaboration and communication processes between the facilitator, students, their peers, and technology. The learning was designed around a project as a performance of understanding to provide a platform for students to interact, communicate, and collaborate with their team members, other teams, and the facilitator.

Literature Review

This literature review discusses on CL, LCF and project-based learning. Other than that, it provides an understanding of the use of LCF to support the implementation of collaborative project-based learning.

Collaborative Learning

CL is a collection of strategies used to promote collaboration between students in small groups to optimise their learning (Asterhan & Schwarz, 2016; Redes, 2016). The learning environment emphasizes that each group member needs to have a perception that they are interdependent in achieving the goals of the given group. It requires students to engage in constant communication, establish mutual understanding, dispute opinions, and to negotiate solutions together (Boling, Hough, Krinsky, Saleem & Stevens, 2012; Chu et al., 2017). Learning occurs when students learn from each other through these interactions while utilizing resources made available through the use of technology (Scott, 2015). They are supposed to also learn to communicate their ideas and accept criticism for their ideas. Students' communication skills also play an important role in collaborative learning. It provides opportunities to resolve challenge and differentiation, enhances students' confidence level and self-esteem as well as strengthens their social skills. Students who develop good social skills stand a better chance of adapting to the workforce in their later life as they have the ability to deal with people and have a sharper Emotional Intelligence (EQ) (Binsaeed, et al., 2017; Davis, 2019).

However, many students are unaware of the values and strategies that make effective collaborative learning and they often have misperceptions on collaborative learning (Chu, Zhang, Chen, Chan, Lee, Zou & Lau, 2017). The most common barriers to the student collaboration process are mainly due to students' lack of collaborative skills, perception on student's competency level, issues on free riding and the friendship among peers (Le, Janssen & Wubbels, 2017). The lack of interpersonal and teamwork skills may also have a bad effect on the individual and collaborative learning experiences within a team (Shimazoe & Aldrich, 2010; Le, Janssen & Wubbels, 2017; Stover & Holland, 2018; Chang & Brickman, 2018). Other than

that, collaborative learning will only be effective when students are skilled in collaboration and the lack of it may lead to the issue of free-riding. The students' perceptions of the competency of their peers may also limit their collaborative learning. Students at the low-competence level are usually hesitant or demotivated in participating actively and are often overlooked, while their peers at the high-competence level are more likely to contribute and appear to ignore the contributions of peers they viewed as low-competence. Contrary to common beliefs, the friendship between students may not necessarily improve collaborative learning in a group (Le, Janssen & Wubbels, 2017). Students' resistance to collaborative learning is another obstacle to the process of student collaboration. Tolman and Kremling (2017) mentioned that student resistance is rather a motivational state that can be influenced. Such resistance is motivated by internal and external factors such as students' previous negative experiences with collaborative learning, students' own self-awareness of how they learn, and how they perceive education and knowledge (Stover & Holland, 2018). Studies also found that many university students were reluctant to amend other's works or comment upon other's ideas. They tend to focus on their own work, avoid criticism and conflict to aim for group harmony, and considered interfering with their peers' work as inappropriate (Nguyen, Terlouw, & Pilot, 2005; Chu et al., 2017). The students' reluctance becomes a hindrance to engage them in collaborative activities to optimise their learning. To enhance interaction and collaboration among students, peers, and facilitators, there is a need to have a strong integration of activities for both offline and online environments that would need to be created. As such, combining technology, pedagogy and a framework of learning that emphasizes active learning through conversation and acquiring knowledge through experiencing things would help develop more dynamic and engaging learning environments.

Laurillard's Conversational Framework (LCF)

Diana Laurillard developed the LCF to provide a guide to support teachers in designing learning environments with ICT (Laurillard, 2012). It involved having a balanced set of learning experiences for students and a focus on communication and conversation between students and teachers as well as between students and their peers in the learning process (Laurillard, 2012). The focus of the framework is to help educators to think about teaching and learning from the learners' perspective. In LCF, the learner is at the centre of the framework (see Figure 1), and learning is an activity that developed from concepts and practices. In this framework, concept development is done through the process where teachers and learners communicate about concepts and learners doing the same with their peers. This is shown at the top section of the LCF. Then, the teacher and learners could model and share their practices through actions and

feedbacks in a learning environment created by the teacher. Learners could also integrate their concepts and practices when facing a challenging learning environment.
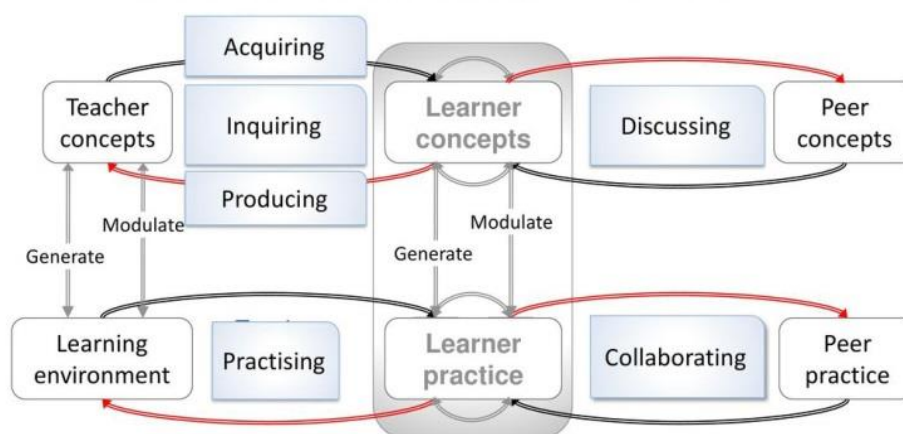

Figure 1 Laurillard's Conversational Framework (Laurillard, 2012)

The framework identified six learning types to categorize learning activities that could be introduced to help learners in their learning process. The six learning types identified in the framework are: learning through acquisition, inquiry, discussion, practice, collaboration, and production, where each type of learning activity is a cycle between the learner and their teacher, or the learner and their peers. The combination of these learning types would help to provide the best possible learning experiences for the learners.

a) Acquiring

This is where learners carry out activities such as reading from books or websites, listening to a lecture, and watching demos or videos to help them develop concepts.

b) Inquiring

This is where learners come out with questions and searches, explores, compares and critiques materials that represent the concepts and ideas being taught or created. It enables learners to continue developing the conceptual process.

c) Discussing

This is where learners express their ideas and concerns, share ideas, challenge and respond to the teacher's and/or peers ' ideas and arguments.

d) Practising

This is where learners adapt their actions to the purpose of the task and use the feedback to develop their next output. Feedback may come from self-reflection, peers, the teacher, the activity itself, or even from external actors from the personal learning network of the learner.

e) Collaborating

This is where learner engages in production together with their peers to produce a shared output such as design or diagrams, reports, etc. Learners need to negotiate the ideas and practices with their peers until they agree on a solution. The idea is about having them debate, challenging each other and providing feedback, integrating and developing concepts and practices to get the best output that they can.

f) Producing

This is where learners integrate things they have learned and practised and to express it through generating an output to be evaluated by the teacher.

Project-based Learning

Project-based learning (PBL) is a pedagogy that helps learners to develop their own understanding by doing, creating, and demonstrating their new skills, and helping them to acquire knowledge and useful skills (Barron & Darling-Hammond, 2008). This is done through a learning environment where learners are to collect information and initiate a project based on the questions provided by the teacher or themselves - inquiry and guided by a driving question; establish a group, discuss possible projects and form a project plan - learner voice and choice; execute the project – critique, revision and reflection; present project results and conclusions - public audience (Li, 2018; Bender, 2012; Krauss & Boss, 2013). This pedagogical approach helps to promote collaborative learning by having learners develop knowledge and skills required to accomplish a project in a real-world context. It helps to promote learner collaboration by working on a project as a performance of understanding (Poonpon, 2017).

Several studies have established that the PBL approaches did affect learners' interest and self-efficacy positively (Bilgin, Kar-akuyu, & Ay, 2015; Brown, Lawless, & Boyer, 2013; Holmes & Hwang, 2016). This is reinforced by the findings that learners appreciate the experience of engaging in authentic projects (Sababha, Alqudah, Abualbasal, & AlQaralleh, 2016; Tseng, Chang, Lou, & Chen, 2013). Another research found that PBL helps slow learner students in improving their self-efficacy (Zainudin, Mohamad Ashari,

& Kosnin, 2017), However, there are some issues linked to the use of the PBL approach in providing effective teaching and learning. This includes issues such as teachers' experience, knowledge, skills, and learners' lack of collaboration among the group members (Zhang, 2019; Song, 2019; Sadrina, Mustapha, Ichsan, 2018; Mohd Hawari & Mohd Noor, 2018). Therefore, there is a need for a framework to guide teachers and learners in optimising the potential of PBL in enhancing learning.

Methodology

Designing the LCF Supported Project-based Learning Environment

LCF seems to be a good fit framework to support the implementation of a project-based learning approach that supports the teaching and learning needs in higher education. It enables learners to be involved in doing, creating, demonstrating their new skills, as well as acquiring knowledge and useful skills while helping them to understand the learning content by having them to reflect and adapt information regarding their tasks, and by input from the teacher and their peers. In implementing the LCF to support PBL, a course from Tunku Abdul Rahman University College was used in this research. The participants (N=78) were second year undergraduates doing the Bachelor of Creative Multimedia degree course from the Faculty of Communication and Creative Industries. The selected course for the study required students to create a database-driven website using server-side scripting, web and database servers, and multimedia tools such as Adobe Photoshop, Adobe Illustrator and Brackets IO within a given timeframe of fourteen weeks to complete the project. The course was conducted in a blended mode where it combined the f2f sessions with interactive materials and videos posted online to allow students to learn at their own time online, a web-based project that is to be developed, collaborative activities carried out via social communication tools, Google Suite for education, and web-blogging to enable students to record and communicate progress of the project, as well as to collaborate online with their team members on the assigned project. The course project was group-based; thirty groups with three to four members each were formed and thirty group leaders were selected for each of these groups. The students were then required come out with a team contract, as well as to prepare a detailed proposal of their fully-functional database-driven website from a list of suggested topics, which they were to develop during the second half of the semester. The groups were required to present their progress to gather feedbacks and suggestions from all students during the checkpoint presentation or sharing sessions during the semester. These sessions were also used as an opportunity for the students to learn from each other on improving their respective outputs.

Each group was required to come out with a group blog to document their project development progress using Google Sites, which is part of the Google Suite for education made available to the students. The blog, which was monitored by the group leader, had to be updated on a bi-weekly basis, up to the completion of the project. The lecturer could get a general idea of the progress of the project and ensure that all members of the group are involved, spot possible problems and interfere if necessary to improve the learning process by reading students' progress records posted on the blog over time and noting their development. The students were then asked to evaluate how they perceived the process of collaborative learning of their respective groups. At the end of the duration of the project, each group was to present their final work to gather feedback and critiques from all students during the final work presentation sessions during the final week of the semester.

Table 1 Technology tools and learning activities.

Tool	Learning Activities
Blog	Each group maintained a blog for their project using the Google Sites, which is part of the Google Suite for education made available to the students. The blog had to be updated on a bi-weekly basis, up to the completion of the project. The group leaders were given the task of monitoring their respective group's blog. The blog is used to describe the tasks performed by the group members and the problems they encountered informatively, reflecting on their learning experience, as well as their findings and solutions.
Collaboration	Each group used the Google Suite for education tools to share and work on files collaboratively. This was used as the group's virtual working space for the project that was accessible from any devices online. This facilitated the organisation of information and collaboration where group members could share information and work together on the project online.
Common Learning Platform	The Google Classroom, part of the Google Suite for education, was used as a common platform for all groups to communicate with the lecturer. The lecturer organised and shared materials to assist students in their learning on this platform. It was also used for the lecturer to post announcements and instructions to the groups, and students could also post questions related to the project.
Informal Communication	The Messenger and Whatsapp applications were used as an informal communication platform for the groups to discuss, exchange ideas, coordinate, and undertake decision-making.

Figure 2 illustrates the mapping of Laurillard's Conversational Framework to the class design to support the project-based learning environment.
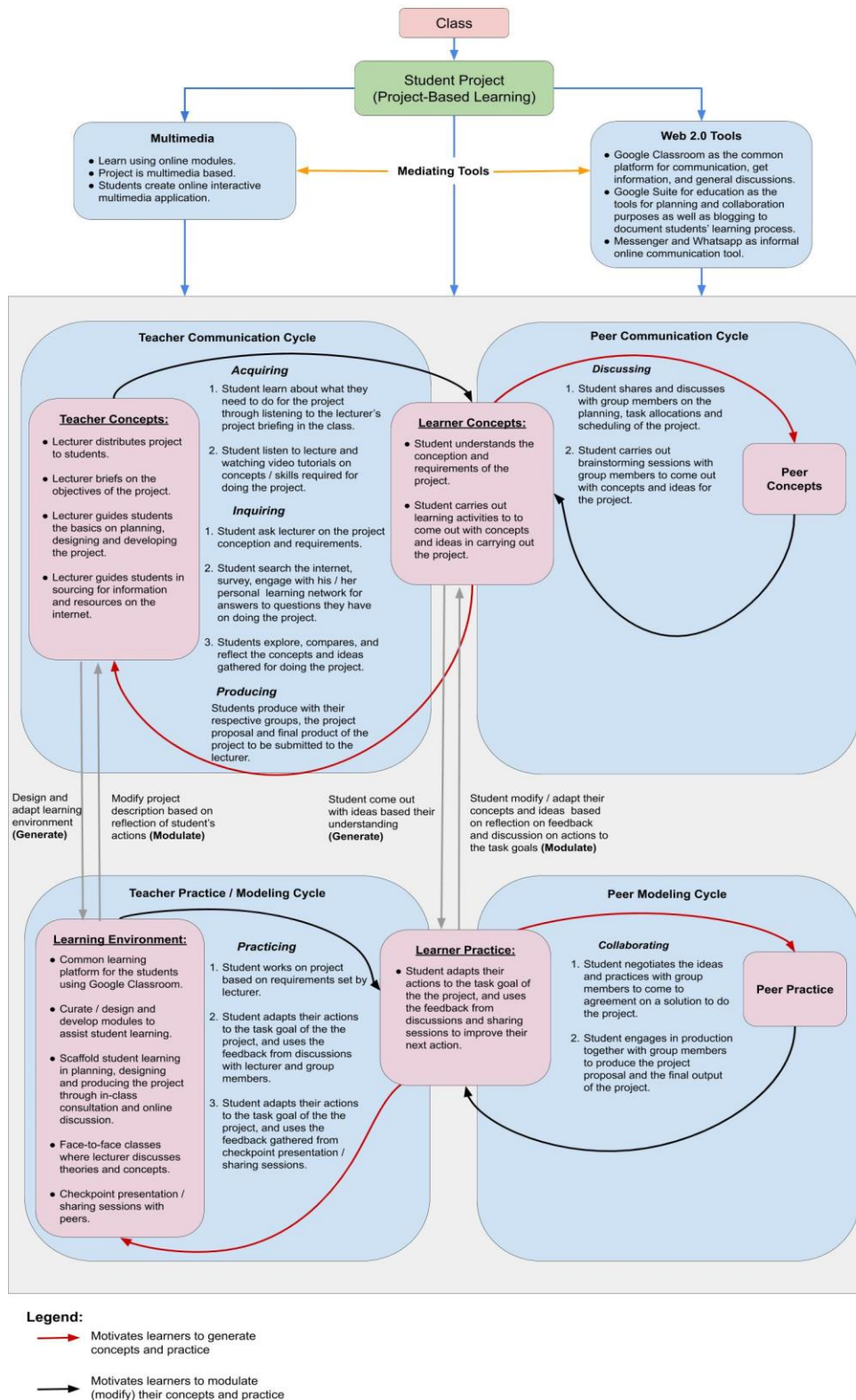

Figure 2 Mapping of Laurillard's Conversational Framework to the Class Design

Figure 3 illustrates an example of a group's project of a student portfolio social website, while Figure 4 shows the group blog that the group has created for the project.
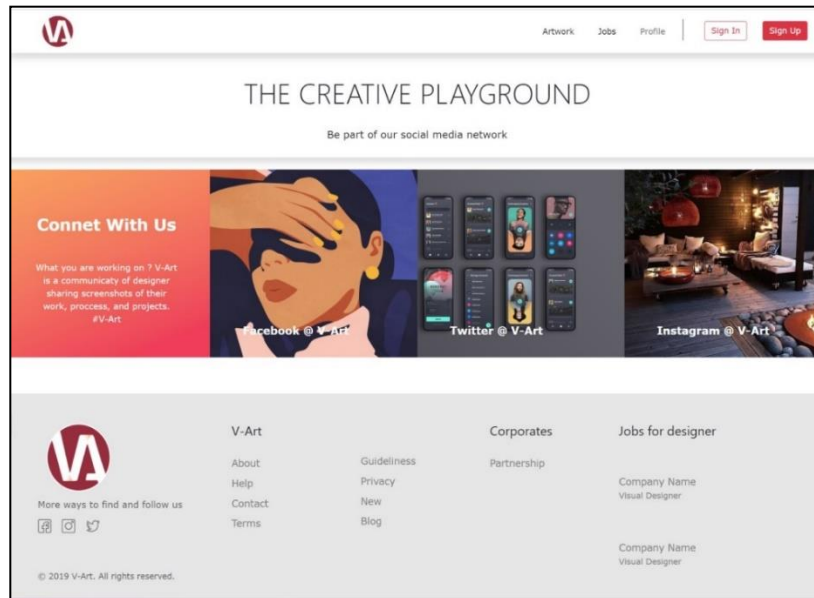

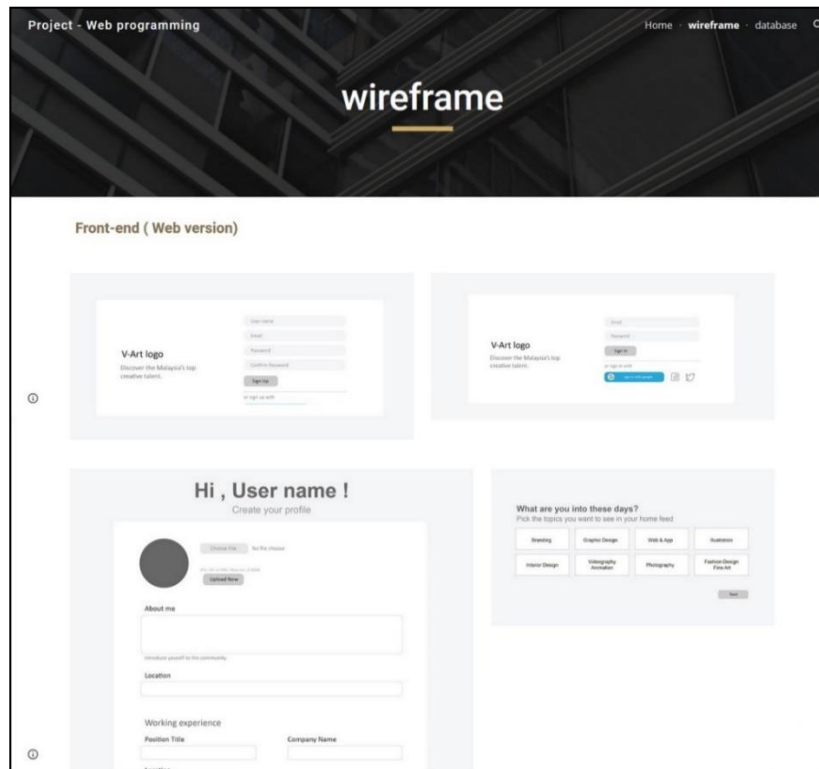Figure 3 Example of a Group's Final Work – A Student Portfolio Social Website

Figure 4 Example of a Group's Project Progress Blog

Results

Students were given a survey questionnaire to assess their perceptions of their collaborative learning experiences in the learning environment. The questionnaire consisted of both open-ended questions and a five-point Likert-scale questionnaire. Their responses were gathered through the open-ended questions to obtain deeper insight into their experiences, as well as to explore their relationships with their peers, the lecturer, and the technologies they were exposed to.

Table 2 Means of survey items on teamwork & collaboration

Items in the survey (N=78)		Mean (M)	Std. Deviation (SD)
1	My teammates have worked hard for the group	4.346	0.6412
2	My teammates have performed well as a group	4.154	0.7572
3	My teammates have worked responsibly so the group will reach the goals and perform the tasks	4.256	0.6920
4	My teammates have organised and coordinated themselves efficiently	4.064	0.7786
5	My teammates have prepared their share of the work successful in meeting the desired result	4.167	0.6530
6	My teammates have encouraged each other in carrying out the tasks	4.026	0.7891
7	My teammates have positively solved the conflicts and problems in the group	4.051	0.7542
8	My teammates have accepted criticism and suggestions positively	4.346	0.7355
9	My teammates have collaborated simultaneously in the performance of the tasks	4.179	0.7515
10	My teammates have cooperated with each other in the performance of the tasks	4.295	0.6858
Cronbach Alpha = 0.948			

As shown in Table 2, students were measured on their perception of their group teamwork spirit in carrying out their project, their willingness to work with each other, as well as their perception of the overall quality of their collaboration. Many of the students reported that they have performed well as a group (Item 2, M=4.154, SD=0.7572). Many of them reported that their group members have worked well together in terms of organising, coordinated, and completing their tasks successfully in meeting the desired

result (Item 4, M=4.064, SD=0.7786; Item 5, M=4.167, SD=0.6530). Results also showed the majority of the students agreed that they can work with their respective team members (Item 10, M=4.295, SD=0.6858) and many of them encouraged each other in the team (Item 6, M=4.026, SD=0.7891). The students also reported that they handled issues such as problems, conflicts, criticism, and suggestions, in a positive manner (Item 7, M=4.026, SD=0.7891; Item 8, M=4.346, SD=0.7355).

Table 3 Students' comments on teamwork and collaboration

Selection of students' comments
On collaborating with group members: "Pretty Good, easy to understand each other" "I think it is good to work together as a team." "We get along very well and solve the problems we face together." "We both get along with each other because we did work together as a group during our diploma time and everything went pretty good." "very well cooperated" "Appreciate for my group members and my instructor who willing to help us in experience sharing also logical thinking that we must go through within it." "I like my member and the instructor. We have done the project together well and the instructor has given suggestions on the project." **On what has been learned in collaborating with group members:** "Cooperation among group members is very important. We should approach the lecturer or do research when there is something we confused to or do not understand with." "Planning and teamwork is very important" "Learned to overcome issues by working together." "Communication. Having good communication will create good teamwork." "The importance of teamwork and how to get along with group mates." "Teamwork and conversation are important." "Learned how to lead a team and planning" "Learned how to communicate with each other and the importance of voicing suggestions and ideas." "Time management is very important."

The findings of the open-ended questions showed that students were able to meet the learning objectives through the collaboration and interaction process with the lecturer and their peers. Overall, many of the students reported that planning, communication, time management, and teamwork plays an

important role for them to complete their project successfully. These were supported in their comments as shown in Table 3.

Discussion and Conclusion

Overall, there are very optimistic perceptions and attitudes of the learning environment and the process of project development based on the results obtained from the analysis. This provides positive support for the use of dialogue and conversations with project-based activities in technology-based learning environments on improving students' collaborative learning. Results showed that the lecturer had a significant role in the learning environment, a role where the lecturer was that of a mentor, facilitator, consultant or coach to the students. This includes giving out clear instructions to students, facilitates collaborations between students and their team members, and encourages students' learning by providing feedback and support to student learning in f2f sessions and online interactions, monitors the student's learning process through the use of blogs and provide formative assessments as well as to evaluate the performance of the students during the project development. Similar to what other studies found, there were students who were unaware of the values and strategies that make effective group-based collaborative learning. It was mainly due to the lack of interpersonal and teamwork skills among the students. Another common issue found in the study was that students at the low-competence level were demotivated in participating actively in the group tasks as they felt they are not good enough. Therefore, educators need to be aware of how factors such as students' lack of collaborative skills, issues on free-riding, student's perceived competency level, and friendship between students play an important role in fostering the quality of student collaboration.

In conclusion, this study showed that Laurillard's Conversational Framework (2012) is an effective framework for designing a learning environment that would foster better collaborative learning experiences among students. The incorporation of project-based activities in technology-based learning environments motivated students to work together and interact with each other, as well as allow them to enjoy the learning process. However, it is absolutely important for educators to develop both the technical skills and facilitating skills in guiding students on their collaborative learning through the use of LCF to facilitate PBL. It is significant for the institution to train its lecturers to develop both the technical skills and supervising skills. These skills would help to reinforce educators' facilitating skills, and enhance educators' collaboration and communication skills to nurture students' creativity and problem-solving skills.

Although the study did reach it's objectives, there were some potential limitations that should be noted. First, the study was carried out on a student sample limited to second-year bachelor degree multimedia design students. First-year bachelor degree students and diploma students were excluded. Second, the study was carried out over a period of a semester in a university. In future, it is recommended that the study to be expanded to involve more students from different faculties and programmes as well as over a longer period of time. Nevertheless, the study results indicate positive support for educators who seek to improve student interaction in a technology-based blended learning environment to improve their collaborative learning experiences.

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Educating Gen-Z: Developing a Teaching and Learning Ecosystem in a 21ˢᵗ Century Learning

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Abstract

Fostering a teaching and learning ecosystem is vital in the 21st century teaching and learning process to determine student's positive impact on social academic outcomes. This paper proposed a teaching and learning ecosystem for Gen-Z students and the researchers developed RICES concept and Fish approach to support their ecosystem. This study will investigate and explore the implementation of RICES (Relationship & Role, Introduction, Communication, Educate and Structure) strategy to build and foster the teaching and learning ecosystem. The ecosystem will ensure educating this generation will be more holistic whilst enabling the learning-centred approach to be effectively used. The paper is concluded with the approach and impact of RICES. A descriptive research method was conducted with the tertiary students. The result revealed that RICES strategy shows a significant relationship among of each element. Students also shows positive academic result and learn to communicate better.

Keywords Gen Z; Ecosystem; 21ˢᵗ century teaching and learning; Education

Introduction

The term ecosystem is describing as all of the residing things in a place and the way they affect each other (dictionary.cambridge.org). In this study, the researchers justify that the learning process and relationship between students, lecturers, universities and technologies need to be available as one ecosystem. Learning

ecosystem is related closely to classroom management and teacher-student relationship. These factors will lead to an effective classroom management. A quality and great teacher-student relationship can develop positive attitude. This will also encourage student engagement in class (Bear, 2015). In recent years, educators worldwide face challenges to attract and motivate Generation Z (Gen Z) because of their characteristic. The ecosystem can leverage on students' strength to succeed if lecturers are able to understand and strategize accordingly to the learner's characteristics. Subsequently, education should not evolve around a relationship where teachers solely lecture in a one-way delivery, while expecting students to merely listen and memorize. (King, 2012). Today's learner is different because Gen Z learns across all environment. Therefore, educators need to switch to a more interactive learning ecosystem that suit the 21st century learning trends (Elizelle, 2017).

Problem Statement

This paper intends to highlight that Gen Z students always face difficulties on certain types of subjects (theories and calculation subjects). They face problem in understanding and memorizing the content and formula. When student face such problem, they will generally lose interest and attention in class because they have no interest to learn the subject.

This situation deteriorates when they start to skip classes and eventually failing the subject. The impact of this attitude is that students will focus on what they like and ignore what they dislike. By the end of the trimester, students will simply voice out that they prefer calculation subject compared to theory subject or vice versa. Subject preferences by students depend on how they can understand and memorize the content of that subject. Students from this generation is knowledgeable because they can access everything through multiple online sources (Elizelle,2017). Because of this kind of thinking, students will think there is no problem if they are unable to understand in the classroom because they can search through google. This issue if not taken care of it will affect the ecosystem; when students loose interest in a subject their focus will absolutely not be there. They will be disconnected from the ecosystem, which means the link to the ecosystem is not there.

Research Objective

The ecosystem is mainly built to have a more immersive teaching and learning environment. This is in line with Malaysia's education aim in Halatuju 2, which enforces on student-centred learning.

Research Question

i.   How can blended learning help to solve all issues highlighted?

ii. What are the best strategies and approaches to be included in teaching and learning ecosystem?

iii. Which element between 'R, I, C, E and S' play an important role for teaching and learning ecosystem?

Literature Review

Generation Z

Generation Z (Gen Z) who were born in the 1990's is exposed with the web, internet, smart phones, laptops, freely available networks and digital media (Tulgan & Rain maker Inc.,2013). This generation of students are unique and definitely different compared to other generations, from the way they communicate, respond and understanding of instructions (Kelley, 2016). Gen Z students in universities are from a generation that demand for more fun and interactive environment in the teaching and learning process (Münevver Çetin, 2019). Educators need to understand their characteristic in order to identify issues that will occur in the classroom. Some of their characteristic, to name a few, includes lack of attention span, underdeveloped social skills, high consumers of technology and pragmatic. Generation Z (Gen Z) is unique and definitely different compared to other generations (Kathleen, 2017). In order to capture the attention of this student, the lecturer must focus on teaching and learning strategy that focuses more on student-centred. This is to make sure that students focus in class (Philip & Garcia, 2013).

Gen Z is the latest generation that will be going to universities, so it is important for educators or the education sectors to focus on designing and delivering the content which will match their learning style. (Wiedmer, 2015).

Every student has their own learning style and behaviour; compared to previous generation, the way they respond to their lecturer is totally different. (Kelley,2016). In order to make sure an effective and engaging teaching and learning ecosystem is in place, educators need to make sure they understand the Gen Z characteristic well. Below are some of the characteristics:

(i) Know-How generation

Students from this generation is knowledgeable because they can access everything through multiple online sources. They expect interesting of education process to gain more information. (Elizelle,2017).

(ii) Technology usage

Children from this generation is connected to the world via technology. Therefore, they demand more activities that are technology based (Rothman,2016).

(iii) Banned traditional teaching method

Students from this generation still demand for traditional contact session (face-to-face) with the lecturers but they really ban the traditional teaching method. They prefer creative classroom that can blend in lecturing with some activities that are related to the syllabus (Elizelle, 2017).

(iv) Short attention span

This generation shows a low focus and attention span when it comes to complicated or problematic questions. As a result, they tend to lose focus and lost interest in the activity or subject (Kelley D, 2016).

(v) Visual ability

Auditory learning by having traditional lecture and power point slide is 'so yesterday' and they do not like this kind of teaching style anymore. Collaborative activities, role modelling, gamification and others which are new to them are much appreciated by these students (Rothman, 2014).

Classroom Ecosystem

An efficient and impactful teaching and learning process in a classroom only happens when educators manage to join the dots of all the components involve in the process while creating a transformative teaching and learning ecosystem. The ecosystem in a lecture class should be well researched, well organized and well delivered (Carol H. Sawyer, 2010). Managing classroom in this ecosystem requires a more student-centric learning rather than a teacher–centric way. With this, the focus is now on students' involvement in the learning process.

Developing a constructive relationship between the educator and students is a fundamental factor in building a high standard of teaching and learning experience. A partial research in Malaysia has found that students who held positive attitudes towards the cheerfulness in the classroom have higher student satisfaction (Afzal, Ali and Hamid, 2010). When the class is fun, students are happier and more enthusiastic about their study, thus resulting in higher performances. Students engaged and involved in class activities will create positive feelings and become autonomous. Activities lead to students potentially learning and at

the same time have fun (Garn and Cothran, 2006). Hence students will have a positive impact on their feelings by the involvement to educational life.

With these common issues happening in the classroom, lecturers need to change their strategy and develop a teaching and learning ecosystem. This ecosystem will be supported by classroom management and 21st century learning content. The ecosystem should be filled with positive energy. In order to create a more diverse ecosystem, educators need to empower their students to create the relationship between ideas, theories and competencies that they learn in class to their personal experiences. Educators need to foster a teaching and learning ecosystem, as this ecosystem connects issues, solution, teachers and students with one another. Identifying and learning the Gen Z characteristic is vital in developing a solution to make sure the class is managed well. This is when the RICES strategy comes into place.

RICES Strategy
Relationship and Role

In order to develop a teaching-learning ecosystem, a relationship between lecturer-student must be developed in the early stage. This relationship is related to "closeness", and with established trusting relationships, they will put more effort in classroom (Driscoll & Pianta, 2010).

The ecosystem is built on this trusting relationship, which makes the lecturer themselves playing an important role in shaping the ecosystem by showing good attitude and motivating their students. In order for the teaching-learning ecosystem to work, both lecturer and student need to have positive attitude.

Importantly, developing a strong relationship and collaboration with teaching-learning process takes the common set of values, goals and shared commitment by both learner and teacher. At the end of the day, a good relationship with the educator links with student's motivation to learn (Wentzel, 2010).

A positive teacher-student relation can bring to a sense of attachment towards the educator and the subject. This is important to support the ecosystem and directly solve issues highlighted in this paper where students tend to get bored by the subject they dislike. Because they have developed a strong level of confidence to experiment and succeed in an environment that is created by the educator where they are not restricted by fear of failure. At the same time educators will play the role as motivator to motivate them to strive harder if they fail to meet their objective. Students will affirm and support educator's effort and try

their best to achieve good results. Based on the research by Hamre and Pianta (2001) stated that students that are close with their lecturers will be more self-motivated and develop strong passion in pushing themselves over the limit to gain knowledge and achieve better grades in examination. With this, students will willingly participate in any of the activities done in and off-class.

Student in this generation sometimes are overly attach to their mobile phone. It will be a disturbance if they do not focus in class by playing mobile phone games in class. It will disrupt the class because the lecturer has to stop lecturing and advice the students. But when students–lecturer have a strong bond together they are less likely to behave that way. Students willingly and readily accepting the rules set by the lecturer. It an article by Gunn (2019), positive teacher-student interaction can stop the cycle of misbehaviour in class and change the dynamics of the environment. This will directly support the entire teaching and learning ecosystem.

Teachers in this new era of education not only play the role as a teacher but as a facilitator, a resource, a guide, a coordinator, a motivator and a mentor. There are a few questions that we must ask ourselves as an educator or lecturer. For example, what is my role as a lecturer? What is my effort in bridging the interaction with students? What is my contribution to my students' achievement and learning process? Each of this is answered by seeing myself playing many roles. Based on Sawyer (2010), she sees herself as a professor and specific subject matter expert. But I believe in order to develop a teaching and learning ecosystem a lecturer should play more than their initial role.

Introduction

Students tend to disconnect or not interested to take part in blended learning or activities in class because they do not understand the objectives of the activities. Many lecturers fail to implement blended learning due to not introducing the activities in a proper manner. According to Blake (2009), students will feel demotivated and will not participate in any of the activities if they have lack of knowledge in using the blended learning tools or it is not clear with the instruction of the activities. With a proper introduction of the activities, students will understand and be more willing to do it. Based on Hoy and Wettstein (2006), students and teachers are the 'central participants in classroom interactions', so it is important that lecturer introduce some details of the subject such as learning outcomes, instructions or guidelines of the activities and the benefits of the activities.

Educators must be aware of the need to engage with their students. Therefore, providing an effective instruction to use and learning tools is essential. This is true, if we refer to the findings of Arthur (2003), where he found out that successful introduction of activities comes with a few steps which includes defining the activities, explaining the aim, explaining the benefits, where, when and how it will be used. Those steps will be supported and guided by the lecturer. Without clear information, students will not understand what they are doing thus losing interest in participating in the activities.

Communication

Lecturing covers the biggest portion in the teaching-learning process, so it is vital that the lecturer deliver and communicate the information clearly and precisely. This is because your voice and the way you use it is probably your most important tool as a lecturer. If you get it right, your students will understand better. Educators should also avoid from delivering a monotonous and "un-creative" lecture, because students often demand for a visual, fun and creative way of teaching process. Managing the class will be easier and smoother if the communication is engaging and interactive. This is important because a well-managed classroom need to have a clear and proper communication. Communication can also lead to building relationship with everyone involved in the teaching and learning process. Educators have to be like entrepreneurs, they need to consider the method of transferring information, as an added value to their service.

Teaching methods are closely related to how a lecturer communicate in class. Teaching method is important to make sure there is fun and meaningful teaching and learning experience. During lecture, the information should be communicated by using simple, fun and easy to understand. Sometimes educators need to consider the best method and approach in order to help students achieve their best results. Like entrepreneurs in business, educators must be unique in their performance, which includes the subject they teach, their knowledge and personality. Creativity in its essence is noticeable and causes a reaction because it is different from 'habitual', so visual creativity if we instil it in our delivery of lecture, it can and will attract audience's attention and causes attitude and reaction from the students.

Educate

Educating Gen Z requires a learner-centric environment, rather than lecture-centric environment. Therefore, as lecturers, they should make sure that the importance of each task or activity is being delivered and guided in a very clear manner (Twenge, 2013). Generation Z wants to see what they do benefits them and the importance of doing it. If a lecturer educates them on the purpose and benefit to participate in the

activities and at the same time the materials used is useful, students will be willing to do it. This is to ensure they are encouraged to be involved in reading and downloading the contents (Holtzblatt & Tschakert, 2011). Students who are not willing to participate in the activities in class, because they don't see the benefits of it, will automatically distort the fostering of the ecosystem. This is because participation of students in the activities is one of the core components that link to the teaching and learning ecosystem. In order to educate them on the benefits of the activities, educators must be able to understand students' needs and wants.

Structure & Strategy

In order to ensure the flow of the ecosystem to be executed smoothly, lecturers need to be very decisive. A proper structure of the classroom teaching plan should be developed. A mix of blended learning and non-tech activities are strategies that can ensure that students' focus is retained during the entire period of class. Lecturers in this new era should not only must know how to implement technology in their classroom but also need to know the right time to use it. Besides that, constructing a structure for classroom management has to be diversified, 'student-centric' and fun. Based on a research by Afzal, Ali and Hamid (2010), student who held positive attitudes toward fun and enjoyed the teaching-learning in the classroom were having higher student satisfaction. Activities lead students to potentially learn and at the same time have fun (Garn and Cothran, 2006). Hence student will have a positive impact on their feelings by the involvement to educational life.

By applying blended learning, students will have more flexibility in learning, and this motivates them to participate in the activities or tasks from anywhere they are (Senffner and Kepler, 2015). This directly will motivate the students to interact and engage in the learning process. When students are motivated to participate, it contributes and strengthens the teaching and learning ecosystem, as it will solve the issue of gen Z student not being able to focus in class.

Each and every student in a classroom has different characteristic in terms of understanding and acceptance level when it comes to studies. Therefore, by using active learning techniques it may engage different types of learners and help some student more than others (Emerson and Taylor, 2007; Durham et al., 2007).

In a study by Ja'ashan (2015), it was found that people who have high satisfaction in blended learning, believe that this approach can improve the teaching and learning experience in class. They also see an improvement in interaction between the lecturer and students. This is vital when dealing with gen Z students whose attention span is very short and they tend to get boring fast if the lecture is boring. Thus, educators need to quickly learn and use different types of teaching tools and strategy in order to capture students' focus and encourage them in their learning process.

By building a well prepared structure of class, students will have diverse experience in class. A classroom that has an engaging, fun and flexible environment, tend to give positive attitude towards the students. In instances where fun is everyday occurrences, student will feel happier and more enthusiastic about their study, thus resulting higher performance (Afzal, Ali and Hamid, 2010).

FISH Approach

Feedback. Student in this generation value lecturers that gives feedback. Therefore, lecturers need to make sure to give continuous feedback to them. Students who show interest or who are willing to participate in class like to receive feedback from their lecturers. Based on Gee (2018), it is clearly stated that lecturer's feedback shows a positive relationship with student's satisfaction. With encouraging and helpful feedback, students will enhance their knowledge in the learning environment.

Interest

To gain their trust and attention, as lecturers we should show our interest on their effort in all the activities and tasks given to them. This will give them the confidence in the subject and continue to accept any blended learning and activities introduced in class. Educators who have interests not only provide knowledge to their students but also making them explore their creativity and inspire their imaginations (Guillory et al., 2016, p. 165). This can only happen if educators show their enthusiasm and excitement when they are teaching. Students will have more trust and confident to lecturers that care more than just their examination results. In a study by Xiao and Wilkins (2015) shows that if the lecturer shows no motivation in conducting their class, there is a high chance that the students will also have less motivation in learning and participating in class.

Support

In this 21st century learning, lecturers need to play multiple roles in classroom. Supporter is one of the major roles to play. It is crucially needed in the ecosystem to enable Gen Z student to continue develop positive behaviour towards the subjects and class. Educators who build a supportive classroom environment will provide a base where students are encouraged and motivated to grow both academically and personally. Honour. As a lecturer, we need to honour every single success or failure students make in class. This is part of motivation for them. They will feel appreciated and feel the sincerity of the lecturer. Academic reward can be used as one of the ways to honour the student's effort and achievement. Rewards are great motivation to induce hard work or commitment to participate in activities in class. It is a creative way to support the transformation of knowledge. This will solve students issue of disengagement in class. Hence strengthen the bond in the ecosystem.

Research Methodology

This study investigates Generation's Z from MMU regarding the best strategy to be applied in class in order to have win-win situation between lecturers, students and university. To achieve the objective of the study, the researcher conducted online questionnaire which has been distributed to Diploma Business Administrations students in MMU Melaka. Sample size of 60 out of 152 respondents were taken to represent the population.

This questionnaire consists of 23 questions including questions about respondent's background information, relationship, introduction, communication, educate and structure.
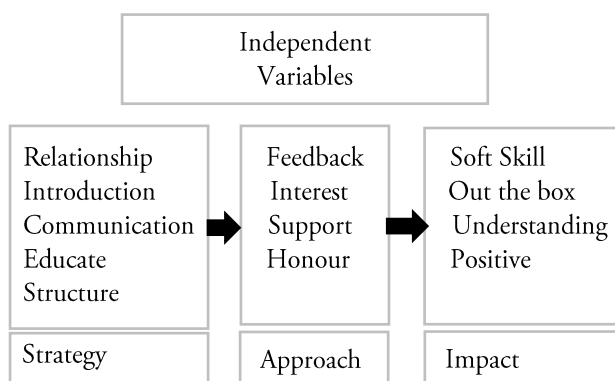
The Research Framework

Independent Variables		
Relationship Introduction Communication Educate Structure	Feedback Interest Support Honour	Soft Skill Out the box Understanding Positive
Strategy	Approach	Impact

Figure 1 A Descriptive Framework of Teaching and Learning Ecosystem

Results

General questions about Blended Learning (Tech and Non-Tech) has been asked to the respondent.
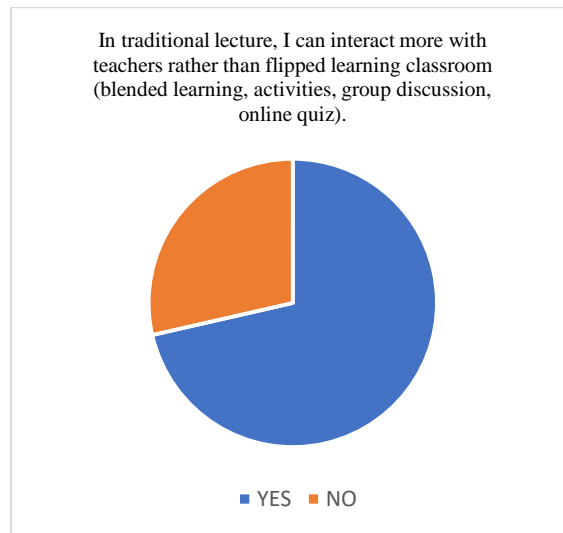

Figure 2 Question 1

Most of the educators understand that blended learning is purely about technology-activity-based. Result above showed that, in whatever activity conducted, two-way communication is still needed by Gen Z. The information transferred to the students need to be clear and precise.
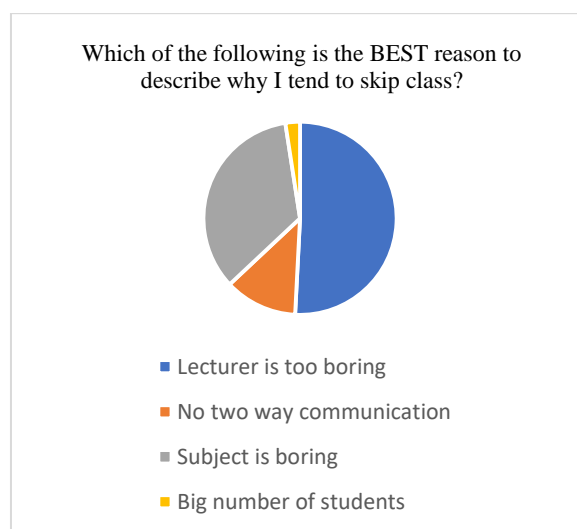

Figure 3 Question 2

The researcher next investigated the main factors of why students keep on skipping few classes. In this study, most of the Gen Z agreed that 'lecturer is too boring' is the main reason why they tend to skip

classes. Additionally, many of the respondents also agreed that, the other main reason why they tend to skip class is because of the subject is too boring. Results showed that, attractiveness in class is the main indicator to solve the main problem of this generation.

Figure 4 Mean for R, I, C, E and S

In the last section of the survey, the researcher intends to determine which RICES strategy is the most impactful to capture their attention in class. By using SPSS, mean for each independent variables were tested in order to know which element gives highest rating to the strategy.

Mean value for all strategy is above 3.50. Based on the result, C (communication) is the highest mean. It shows that communication is the core element in the ecosystem, where else by looking into the other components in RICES strategy, communication is link to every component.

Conclusion

This study also proved that it is vital to have a teaching and learning ecosystem in order to teach the Gen-Z students. By having and implementing the RICES strategy lecturers can manage their class in a more engaging and interactive way. The issues that arise from the characteristics of this Gen Z student can be solved if there is proper classroom management and positive ecosystem.

For educators, successful classroom management is when all students can focus their attentions, give feedback and participate in class. Meanwhile, students will give their best when they are attached to classroom's positive ecosystem. Researchers believe that by developing RICES concept and with the support of the FISH approach, a more transformative teaching and immersive learning can be developed.

Limitation

The sample size of the study is very limited because of time constraint. This study was conducted at the end of the semester. It was very challenging to collect the respondents because it was on study week and students were not around campus.

Another limitation is that the students involved in the study were only diploma in business administration students. Thus, it would be beneficial to conduct a similar case study with other faculty and courses to find out whether it's the same opinion or a different one.

Recommendation

This study only covered independent variables. It would be more beneficial to conduct a study to investigate the relationship between RICES and a dependent variable. Therefore, more tests using SPSS can be done. Researcher suggests to conduct a similar study to secondary school's students so that educators can be prepared of new generation's style of learning.

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Material Thinking: How to Develop a Student's Artistic Voice

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Abstract

The approach to education so far has placed the focus primarily on theory; practice becomes a secondary function which serves to drill in the theory. Theory-based approach may be suitable for subjects like Math and Science, which are fact-based, where knowledge is exact and explicit. However, Art is highly subjective, thus what would be the best approach to teach subjective knowledge? The traditional art class places high value on technical perfection where the goal is for the student to regurgitate exactly what they see, which is to copy reality. But with the invention of Photography, is this the goal of Art - to replicate exactly what one sees? Thus, what is the goal of Art Education now and what is the best way to teach Art to students?

Keywords Material thinking; Immersive Environment; Practical Knowledge; Heuristic Learning

Introduction

Art, unlike Science or Math subjects, has a strong subjective element. Math and Science subjects are based on cold hard facts and produces black and white results based on unbending principles, which are objective. The memorization and regurgitation method for teaching Math and Science subjects are thus suitable to drill the theories through repeated similar practice, to yield a black and white result. Much of the requirement in creating an artwork is based on non-objective qualities like emotion, personal experience and other subjective concerns. Because of the vast difference in the nature of these subjects, one must assume that the method of teaching cannot also be the same.

Learning Gap

The traditional method of teaching Art since the old Academies is to copy and recreate what the eye sees according to the exact visual similitude, because that has been the role of art since ancient times- to faithfully record and document things, events and persons according to what the eye sees.. However, with the invention of Photography, (Benjamin, 1935) it has replaced that role of Fine Arts as a more truthful and faster way of documenting reality and the role of Art has since been questioned and changed. For teaching Math and Science, the knowledge is explicit and exact, thus it can be told and taught through writing or verbally spoken to transfer the knowledge from teacher to student, not unlike how one memorizes a name or phone number. However, there is no exact or explicit knowledge in art, just as there is no one perfect art, or one perfect way to make art. The knowledge in art is tacit, which means it cannot be transferred from teacher to student by verbally telling or writing. Thus, a new approach to teaching Art needs to be applied that is appropriate to stimulate an emotional, personal and subjective response, not based on how a teacher teaches exact and explicit knowledge but on developing tacit knowledge.

Literature Review

Beyond faithful copying, there are many aspects of art that are far more important and useful in life that is not taught with the traditional academic training. With the traditional academic training of copying, does it mean a student understands the meaning of composition, or design? Can a student learn the principles of art and design that is applicable beyond the field of Fine Art, to other areas of life? As an artist, the most important lesson would be to discover and develop your personal style and vision. How can a teacher bring out that personal unique vision within each student?

Material Thinking

Traditional teaching of Fine Arts follows the rigorous method of a detailed and faithful replica of what one sees. In the example of a Still Life drawing, a student typically follows the steps of looking at the still life display, copying as faithfully as possible the visual likeness to draw out and create the tones and volumes of the objects in display in perfectionistic academic rigor. That has always been the goal of Art since Renaissance period in formal Academic Training, to create a truthful replica of what the eye sees. However, being able to replicate only means a student can copy and regurgitate well. If the goal of Art is to copy or replicate, then repetition through regurgitation is a suitable teaching method for imparting exact and explicit knowledge. However, the goal of Art is not to impart exact objective knowledge but a personal, subjective tacit knowledge, and this knowledge of Art will in turn develop each student's subjective personal

voice. The question of how to develop this tacit knowledge in Art has thus been the exploration of my teaching.

As opposed to the objective one size fits all approach in teaching Math and Science subjects, a subjective approach is thus appropriate due to its innovativeness to draw from a student's life experience, as it will result in a richer artwork with multiple possibilities that may not even have been expounded in theory. In Paul Carter's *Material Thinking* (2004), he expounds on how to develop the artistic process, which is not through a universal or decontextualized framework, but rather the opposite which is to reach in to the personal aspects of the creator to draw out the subjective and relational aspect in Art creation. Just as one cannot learn swimming by reading about it, a student can only learn Art by making art physically. It is through this ongoing process that *Material Thinking* happens, which is a record of the thought process where knowledge builds after a constant production and engagement with the material through art-making (Bolt, 2004). Bolt continues with Martin Heidegger's theory (1966), who believed that new knowledge can only come about through the creator's engagement with the materials in the world.

Heidegger argues that we do not come to "know" the world theoretically through contemplative knowledge in the first instance. Rather, we come to know the world theoretically only after we have come to understand it through handling. Thus the new can be seen to emerge in the involvement with materials, methods, tools and ideas of practice.

Heuristic Learning Approach

In *Being and Time*, Heidegger (1966) argues that the new cannot come from merely a representation of an old idea nor can one achieve it through trying to be original, but it can only emerge from a process of constantly doing or working with the material, method and tools; and only through this material thinking can "new" knowledge emerge from the artistic process. One cannot put the cart before the horse and say we will arrive at this "new" knowledge because firstly, this "new" knowledge cannot be known in advance and secondly, this knowledge is not merely a head factual knowledge (Ihde, 1979) but a hands-on experience knowledge known through material handling or Material Thinking.

In Math and Science subjects, theory is primary and practice is secondary to serve the primary focus in teaching. However, Ihde (1979) argues that "new" knowledge in Creative Arts through praxical engagement is primary, while the theoretical-cognitive engagement becomes secondary (Ihde, 1979). Thus,

knowledge in Creative Arts education should focus on praxical engagement as that knowledge is not merely head logic and rational ideas but rather its own personal tacit knowledge developed through material handling.

Methodology

I am teaching The Static Image Class, which is basically a painting and drawing class at Foundation Level in Faculty of Cinematic Arts. The course objectives are: to give the students basic competency in drawing and painting, so that they can express an idea; to understand the importance of design principles, to apply design thinking to create a powerful image, and to enjoy, have fun and appreciate the power of Fine Art as an expression. The Static Image course is part of the three major studios, and this Foundation course prepares the students for their degree programme in Cinematic Arts. So my objective in this class is not to demand technical perfection from the students but it is more important to teach them the basic principles of Art. Do they know to apply composition? Do they know how to use colour? Do they know how to use light? Do they know how to design a space? The design principles that they learn, will be applicable to them not just as filmmakers, but to any field of art.

Immersive Environment

As Art is subjective and the knowledge is tacit instead of exact and explicit, within Art there is also a huge aspect of innovation that is dependent on the relationship between the student's experience and the subject matter given. Thus I propose a solution that is subjective. My approach is to create student-centred learning spaces using creative presentation of subject matter in art, as a means to encourage interaction and inspiration. Using three genres of art, the class is structured from Still Life, Portraiture, Landscape and Experimental, each is designed to be increasingly immersive and engaging.
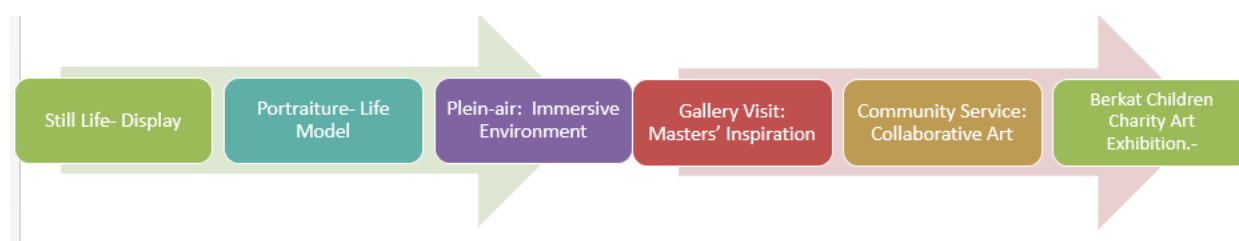

Figure 1 Increasingly Immersive Environment

My approach is to use problem-based learning in the genres of Fine Art, which are Still Life, Portraiture and Landscape, and to use situated enquiry with increasingly immersive environments to inspire the students to make great art.

The first half of the classes are indoor, the second half are all outdoor classes. The traditional classes are entirely indoors, but my plan is to create a learner-centred environment, where the classroom is constantly evolving and constantly engaging the students to make learning challenging, exciting, interactive and experimental. By changing the learning space, I facilitate to students' different learning styles.

Figure 2 Indoor Still Life

For indoor learning, there's a variety of spaces: the class arrangement is changed to facilitate the type of discussion or learning that we are having. I also engage student in cyber-space learning through engaging them in social media and having the students create learning vlogs.

The class first begins with the Still Life genre using Charcoal medium. This is the easiest level in Drawing in terms of difficulty, as each student only need to learn to compose a picture using tones and values, without the element of colour. I have created a huge variety of objects for display as interesting subject matter where the students can draw inspiration from.

The next section of the class is the portraiture genre. With the presence of a life model who is chosen by the students based on his popularity, the students' interest and engagement with their art subject increased. The difficulty level of this section is harder as drawing human anatomy and facial likeness requires a higher level of technical skill and the addition of the element of colour and introduction to acrylic painting as a new medium is introduced at this point. Students have to move on from just the challenge of composition and values to learn how to use colour. However, the immersive level of the subject matter is

greatly increased in section two due to the human aspect of the subject matter, which results in greater passion and interest from the students.

Figure 3 Indoor Portraiture

The third section of the class is landscape and from here on I bring the students out of the classroom to do plein-air outdoor sketching. The benefits of outdoor learning are immense. I bring the students outside campus to all the various locations in the city. We have plein-air class, which is outdoor drawing, outdoor sketching. With outdoor classes, the students' learning is enriched through a variety of environment with different historical background with different contexts that stimulates different engagement levels and many interaction possibilities.

Figure 4 Outdoor Plein-Air Sketching at Heritage Street

Figure 5 Outdoor Plein-Air Sketching at Landscape Park

I also bring the students to National Gallery of Singapore, where they see art of the masters and they feel inspired, "Wow, this is what people can do? This is what art looks like? These are the techniques I have explored!" Standing before real art, they feel art is relevant to society. Art can be fun. These plein-air art classes, not only make problem-solving real but also exciting and interactive. It enhances students' understanding of the community, as they are immersed in the environment. And it forces them to interact, to touch, see, feel and communicate and to reflect, in order to think about what is the art that they want to make.

Figure 6 Overseas Excursion to National Gallery of Singapore

Contemporary Art is very important, using experimental techniques, forces the students to push the medium, in terms of what it can produce. What are the creative limits? What are the potentials of the medium in terms of expression? I believe in creating a student-centred environment, and I believe in the possibilities of bringing the students outdoors to make learning engaging and fun. I bring the students to

various locations outdoors and they really get very excited. I bring the students to collaborate with the Berkat Children's Home and they love it. The students enjoy going to Berkat Children's Home where they make collaborative drawing with the children. Their conversations with the children, inform their drawing and result in a more meaningful and creative artwork. All the different stages of art learning is designed based on Paul Carter's (2004) process of Material Thinking by combining hand, eye and mind to produce tacit knowledge.

Figure 7 Collaborative Art with Berkat Children's Home

Heuristic Learning Approach

The traditional art class typically requires the student to regurgitate exactly what they see, to copy. But my approach, is not to dictate to the students exactly what art is, but through personal guidance, to develop each student's unique vision, aesthetic and sensibilities in art.

In line with Ihde's (1979) argument of Praxical engagement above Theoretical-cognitive engagement in Creative Arts, my primary focus is to give the students complete freedom within the framework of the Fine Arts genres and to make sure they get as much material handling and experience the artistic process intensively (Heidegger, 1966). The traditional class ends, after a student finishes making an art, and regurgitates exactly what they see. I focus on action and reflection learning; where after they make the art, we discuss what they have done, why do they make it that way, and how can they make it better. Through this way I hone their design thinking skills. I teach art through Praxical knowledge (Bolt, 2007) that is a knowledge-giving process that comes through doing and not by following instructions or regurgitating. I give personal coaching to each student, to develop their own skills as unique designers and unique artists. The key to the success of the class is Student-centred learning (Crumly, 2014) through the

personal coaching and guidance I give after each of their artwork, by tracking their progress, comparing their previous and current work, troubleshooting on the problem areas. I arrive at a learning catered personally to each student's level, temperament, interest and strengths in order to hone their artistic voice that is uniquely their own.

Figure 8 Heuristic Learning through Praxical Knowledge

Results

Still Life Reflection

The Still life section is the beginning and introductory section in this class, thus the framework is kept simple, which is through the medium of pencil and charcoal. This limits the scope of challenge to only line, values and composition.

In each Still life class, the students were given a huge variety of objects, with different sizes and textures to stimulate their interest. The students were not told what to draw but they were told to discard the tradition of academia, where the Still life art must be in wide-shot to include all the elements in view and at a full frontal angle. They were encouraged to focus on composition that fulfils the aesthetic principles of line, space, rhythm and balance in an artwork. They were also encouraged to play with their materials to create as many different possibilities on line and mark making as they wish.

Still Life 1

Teacher's Comments on Figure 9:

The student used a Mid-shot, top-down, high angle view for this artwork. He also depicted the objects at an angle, so that the objects are aligned along an imaginary diagonal axis. Using perspective technique, he

places the hat in the foreground and making it bigger in scale in comparison to objects in the background like the jacket and bags. This layering of objects creates a sense of space and the further variation of textures and dark and light tone make this final work a dynamic art piece. Though not technically perfect, the student understands how to apply principles of art in this work.

Still Life 2

Teacher's Comments on Figure 10:

The student used a wide-shot, high-angle view for this artwork. Although only simple few main objects are used and the composition is symmetrical, the student's placement of objects along the diagonal axis and varying the sizes on each side adds visual interest and variety to what otherwise would be a boring piece. The contrast of the soft smudge textures created by his charcoal shading is contrasted by the use of strong hard lines that blends perfectly to create a successful art piece.

Still Life 3

Teacher's Comments on Figure 11:

In this Still life, all the objects are partially cropped. The student's focus was on creating a strong composition and the simple use of geometric lines lean the art towards abstraction. The repetition of the square shape through the depiction of files, box, frames and table creates an interesting play of space. The smooth rendering of shading also adds an ambiguity between the solid form and the transparent form, overall resulting in a dynamic and intriguing piece.

Figure 9 Still Life 1 – Hats and Bags by John Yee (Charcoal on paper, 21 cm x 29.7 cm)
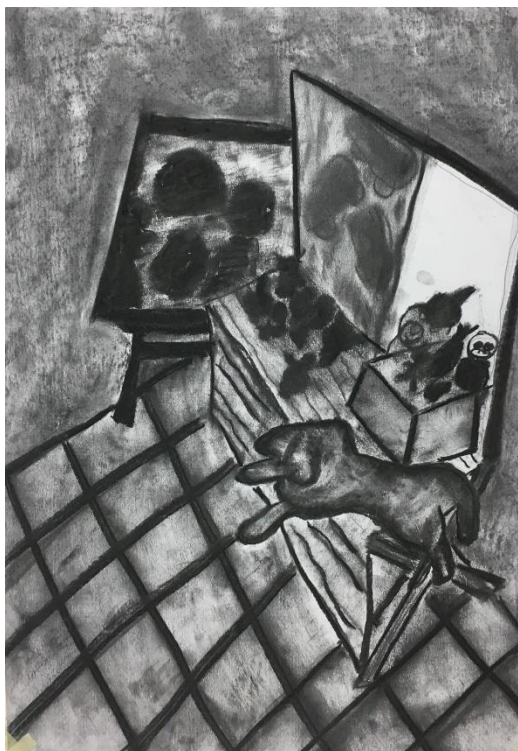

Figure 10 Still Life 2 – Dressing Table by Hazirah Shahrin (Charcoal on paper, 21 cm x 29.7 cm)

Figure 11 Still Life 3 – Frames by Afif Irfan Rashid (Charcoal on paper, 21 cm x 29.7 cm)
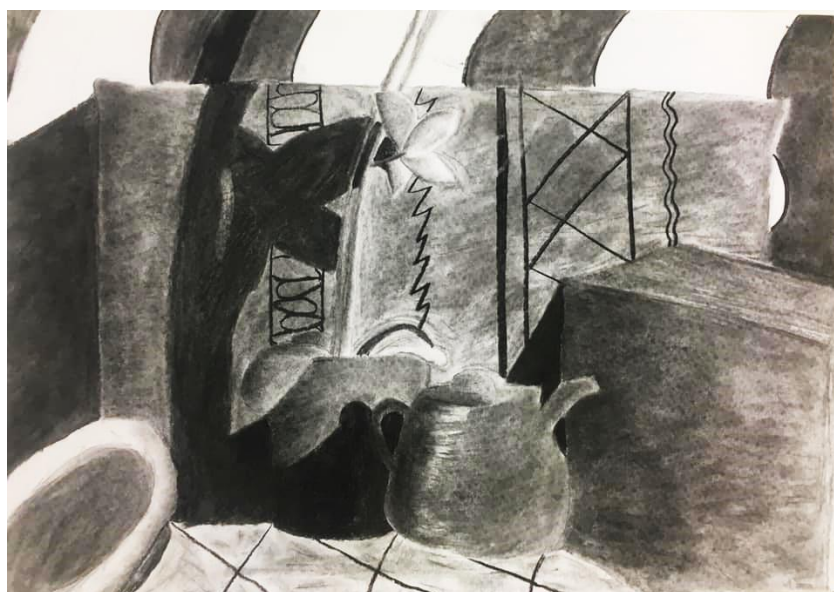

Figure 12 Still Life 4 – The Orchid by Intan Sakinah (Charcoal on paper, 21 cm x 29.7 cm)

Still Life 4

Teacher's Comments on Figure 12:

In this Still life, though it is a simple symmetrical layout, the student successfully added a sense of space through addition of objects in the foreground and successful treatment of the background. Through the

use of tones, she has clearly brought the emphasis to the orchid plant though a contrast of darkest to the lightest parts of the drawing. The addition of patterning through the play of shadows, table cloth design and pillow patterns, has added an interesting contrast between the 2-dimensional and 3-dimensional form. The integration of the forms, tones and ambiguity of space is successfully achieved in this artwork.

Portraiture Reflection

In the second section of the class, which is Portraiture, a model is invited into the studio where the students can be inspired to create an artwork. With a human model as subject, the interaction is stronger and thus more immersive in order to achieve a stronger response from each student.

Figure 13 Portraiture Class

Portrait 1

Teacher's Comments on Figure 14:

Inspired by the life model, Student Hazy chooses a mid-shot of model focusing on her face and the expression of her gaze. She chooses pastel colours to portray the feminine gentleness of the model. She uses the clothes patterns and textures of the wall and trees to create interesting textures and gives the whole painting depth through layers of space. The composition is ideal as the main subject is at the one third space following the one-third rule in composition. The Wayang Kulit is partially obscured to give the viewer visual interest as we follow her gaze to look to the Wayang Kulit and beyond, which adds tension to the piece.

Portrait 2

Teacher's Comments on Figure 15:

Student John chooses a wide-shot to depict the model. In his portrait, the viewer can look upon the main subject, which is the girl in the painting and also the spaces around her, which is the Wayang Kulit, Kuda Kepang, and soft cushion, chairs and view behind the windows. Keeping to the theme of Malay Culture, John chooses a style similar to folk art painting, where simple geometric shapes and repeat patterning is used to enhance the Malay Culture aesthetic. Along with the use of primary colour, the strong square, triangles and line patterning is enhanced for folk art effect. The posture of the model portrays a gentle charm.

Figure 14 Portrait 1 – The Gaze by Hazirah Shahrin (Acrylic on watercolour paper, 21 cm x 29.7 cm)

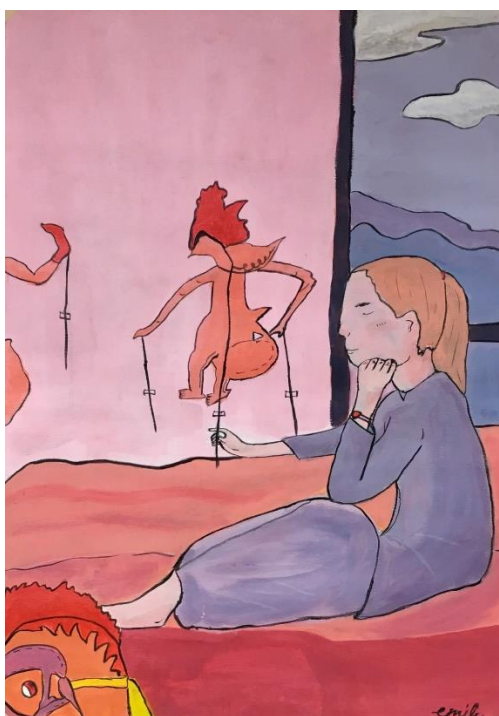Figure 15 Portrait 2 – The Puppeteer by John Yee (Acrylic on watercolour paper, 21 cm x 29.7 cm)

Figure 16 Portrait 3 – Purple Skies by Emily (Acrylic on Watercolour paper, 21 cm x 29.7 cm)

Portrait 3

Teacher's Comments on Figure 16:

Student Emily chooses a medium wide shot of the model. She depicts the model with eyes closed and set the art in portrait. The Kuda Kepang and Wayang Kulit are cropped partially to suggest an extension of space but a lot of negative space is portrayed in this art to suggest its importance to the intention of the artist. Emily keeps the colour palette restricted to pinks and purples to evoke a sense of peace, happiness and imagination. The model's clothes are purple, just like the purple sky outside, which implies though the model is in the interior space, she is closing her eyes, day-dreaming about a bigger and freer space, beyond the interior walls, outside to the mountain and sky. With its simple, intuitive lines, and the use of colour purple to express her desires and dreams, the art is successful compositionally and in its choice of colours to bring out a sense of poetry.

Through accessing the three different results from students' artwork, we can see that although the Students were given the same subject matter, same poses by the model but each gave a different interpretation and mood in their final artwork. They each developed their own uniquely different style according to their personal vision.

Landscape Reflection

The following paintings 1.1, and 1.2 were inspired by the class's plein-air outdoor painting at the heritage street of Tan Hiok Nee district. Inspired by the streetscape of Johor Bahru old Town, the students created this landscape of the JB City.

Heritage Street 1

Through the student's plein-air class, he walked through the busy streets of Tan Hiok Nee district. Afif's concept was to express the busy streets through travelling. Every day, people commute in and out of town spending much time travelling. Quote:

> *"But travelling isn't just about visiting new places or trying something new or different. It's also about enjoying beautiful views or scenery that we have never seen in our place."*

Through the use of the top part of a building at the background and a cafe at the centre, Afif creates the perspective of a tourist walking around the streets looking for a beverage shop. He includes many elements of the tower, cars, restaurant, street food shop etc. to show how busy and crowded the place was.

Teacher's Comments:

Afif is one of the weaker students in terms of drawing skills, and yet in this artwork he has demonstrated that he understands the principles of design to successfully express a concept. Through the simple overlapping of elements, he managed to create the impression of crowded complex space through another technique other than the conventional perspective which is rather difficult to achieve without good technical drawing skills. The composition in this artwork is also strong through the successful use of the overhead bridge as framing device and the combination of diagonal lines creates an exciting dynamism of a busy fast moving street. The use of negative space by leaving the paper blank also creates an emphasis to important elements while leaving new possibilities in the unsaid in "Looking Through Something".

Figure 17 Looking Through Something by Afif Irfan Rashid (Acrylic on Watercolour Paper, 21cm x 29.7cm)

Heritage Street 2

Inspired by the streetscape of Johor Bahru old Town, the student created this Landscape of the JB City. The student also interviews a teenager to get his reflection of what the town means to him. John quotes:

> "*He has a good and bad view about JB town area, he says he can buy what he wants here but at the same time, his friend was robbed here, so he wishes that the JB town area can be more safe and clean and beautiful.*"

Figure 18 John's Photo of River along Jalan Wong Ah Fook

Figure 19 John's Study Sketch 1 of the Site

Figure 20 John's Study Sketch 2 of the Site

John's concept was to create a "Dream Town" by contrasting the reality and the dream. In the painting, the warm colours used reflect harmony and peace. The red and dark blue in the sky creates the magic hour during sunset and shows the beautiful combination of the city and nature. The huge tree on the left-hand side follows the idea of the "Garden City" Concept in Singapore, where the purpose was to balance the man-made in the city with nature and fresh air. From the reflections on the river, the student shows how clean the river is, but in reality, the river is sadly far from beautiful. Through the use of vibrant colours, the student aims to create light everywhere is in the painting to express his wish that one day in the future, Johor Bahru will become one of the brightest city in the world.

Teacher's Comments:

The students walk all over the Heritage Street area, through a series of drawing studies and photos, he takes a photo of the river beside Jalan Wong Ah Fook. He was saddened by the dirtiness of the river and hopes for a better future for the city. He successfully depicted that by showing not the exact replica of the reality of cityscape, but through irony, he depicts a "dream" city that is opposite of reality and expresses his own vision of the beautiful city through bright colours to depict hope and rich textured brush strokes to depict his love for the city. Through the experience of walking and walking the city, John did 2 study sketches; one was more realistic- Sketch 1, and in the other- Sketch 2, he made the sky and the river red to depict his

feelings towards the place. From there, he has selected the second strategy and enhanced it with even brighter colours at the end product to achieve clarity of his emotion.

The students were able to look and observe the city's actual circumstances and clarifying through drawings and photos his own feelings towards his city and then proceed to create an inspired art where the context of the city integrates completely with his personal feelings and vision through the use of the principles of art and design.
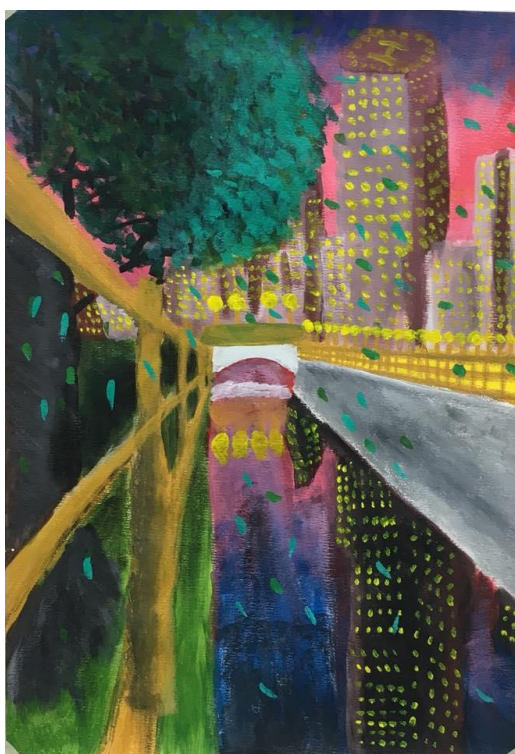

Figure 21 Dream City by John Yee (Acrylic on Watercolour Paper, 21 cm x 29.7 cm)

Scenic Park 3

The following painting was inspired by the class's plein-air outdoor painting at Taman Merdeka Park. Inspired by the nature of the scenic park, the student created this landscape painting. Student Aiman walks through the different areas in the park which was built to commemorate the war by our independent fighters. He came across a series of arches and through his walk, he was inspired to create this painting.

Teacher's Comments:

Aiman was successful in the creation of this artwork to express a strong emotion of desolation and loneliness through this work. Compared to the rest of the class that depicted the park as a happy, peaceful, and joyful

place of retreat into nature, Aiman's depiction was the only one that showed a sadness in its tone and mood. He is successful in depicting through a repetition of the park's existing skeletal arches a mood of sadness. The series of arches in the park was open and airy, but in Aiman's depiction of space he has narrowed them together to force a trapped and enclosed claustrophobic feeling which not only mirrors his own personal emotions but also his understanding of Taman Merdeka or Independence Park. Through the use of colour purple, Aiman further pushes the sense of loneliness and isolation by depicting a dark and near lightless sky, with a sole silhouette in the middle, as if trapped in an endless tunnel, unable to reach the sky. Aiman was able to express his powerful emotions through the painting "Desolate", despite his weakness in drawing.

Figure 22 Taman Merdeka Photo

Student Aiman was one of the weakest students at the beginning of the semester. He comes to me often at the end of the class and apologises for being the weakest in his batch. Below is a sample of his work in week 1.
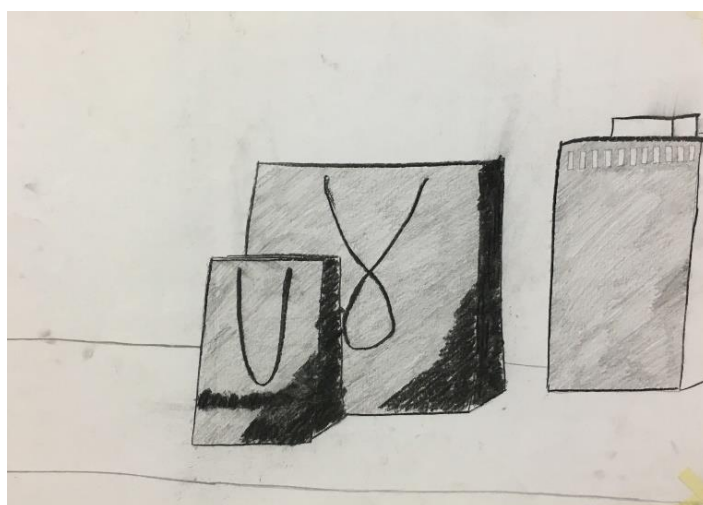

Figure 23 Aiman's Week 1 Drawing

However, through weekly guidance and encouragement, Aiman has developed self- confidence and was able to successfully create this work "Desolate" by the end of the semester. This shows the importance of Practical Knowledge and Heuristic Learning application, where it can help in a student's development of character and confidence by bringing out his own individual voice instead of forcing down a mindless, non-individualistic approach in academic training to regurgitate and copy. Through this work, Aiman clearly demonstrated his understanding on how to use design principles of composition, colour and emotive space to evoke a strong emotion.

Figure 24 Desolate by Aiman Nur Asraf (Acrylic on Watercolour Paper, 21 cm x 29.7 cm)

Harbour 4

The following painting was inspired by the class's plain-air outdoor painting at Puteri Harbour. Student Hazirah takes multiple photos and sketches as she absorbs her environment and eventually decides to paint this painting as a summary of what she feels.

Teacher's comments:

Many students return from this outing with depictions of boats from the harbour, but this student created a simple painting and titles it "Jalan Kaki" referring not only to her walk at Puteri Harbour that day but also her own personal "walk" or journey in life. Looking at the warm use of colours, we see her sensitive and positive view of her future. She chooses to depict her walk in bare feet against the cold hard bricks,

expressing not only her desire to experience life to the full but also her vulnerability to the joy and pains in life. Instead of looking at the far journey ahead, her view is at her feet, where we observe the fallen leaves. This creates a poetic symbolism of not just the abundance of life through the surrounding trees but also the temporality of nature through the fallen dead leaves.

Hazirah is one the strongest painters technically in class but I am happy to see her develop in terms of engagement in content to clarify her emotion to depict her personal vision through composition, line, rhythm, colour and subject matter, a sensitive yet powerful artwork in this piece "Jalan Kaki".

Figure 25 Jalan Kaki (Walking) by Hazirah Shahrin (Acrylic on Watercolour Paper, 21 cm x 29.7 cm)

Berkat Children's Home Reflection

Rabeka, in Figure 26, was inspired by the class's visit to Berkat Children's Home as part of their Collaborative Art Experimental class and also as a contribution back to community to share the joy of drawing with an orphanage. Through an afternoon of interaction and uninhibited collaborative painting, the students interacted with an orphan and through that experience create their final project. In student Yasmine's final project, she was asked to create a portrait of the Berkat child chosen in an A1 scale with acrylic paint as the main medium. Her portrait subject was a child who was forced to shave her head by her poverty-stricken parents in order to save money. Below is an excerpt from Yasmine's research:

> *"After a few minutes of conversing with the 9-year old muse behind this painting, Rebekah popped a simple, but heartful question… "Do you cry? At night, before you sleep?" Rebecca was having trouble fitting in as a new kid on the block. She often talks about escaping the Orphanage."*

Yasmine's Painting "Rabeka" portrays the bald Indian 9-year old girl, sitting with her basket of flowers. This imagery came about after an in depth talk with the child, and how she said she'd rather escape her dreadful situation. Yasmine drew Rebekah in a blue singlet, expressing the sadness that she feels inside. Rebekah misses her mother, although her mother is abusive to her, just like her father. Her parents had sent her there as they cannot afford to raise her, thus the "who wants to be a millionaire" posters and she had innocently let me know that her father used to lock her up, and starved her for long hours. Her pants are green, as they symbolize growth. The background is yellow, taking a dip into a daydream, a happier place I'd rather believe she's in.

Teacher's assessment:

This portrait is highly successful as it achieves my goal as a teacher to teach students that art is not a photographic, mindless copying or outward likeness, but it comes from understanding of the subject. In this artwork, the student did not copy, but through personal and experiential interaction with the subject, the student was able to understand the subject, her problems and situation, which resulted in a strong love and compassionate feeling towards the child, which inspired the final artwork.

To further depict the hopelessness of Rebekah's situation, the student was also able to integrate in the artwork, her personal touches of imagination and poetic irony in the get-rich dream through re-contextualizing the subject in the game of "Who wants to be a Millionaire". The student has also added elements of poetic symbolism through the use of flowers to symbolize hope and bright colours to express the in depth desire for the poor child's desire for Happiness. Through this work, the student execution in terms of subject matter, mix media collage and brush stroke textures all combine successfully to create a unique artistic style that is uniquely the student- Yasmine's own personal vision.

Figure 26 RA BE KA by Yasmine Lazuli (Acrylic on Watercolour Paper, 59.4 cm x 84.1 cm)

Discussion and Conclusion

Art is not a mechanical process of just creating exactly what you see; Art is an internal, individual, creative response and expression of the way that you see the world. The situated enquiry in this class requires each student to actively engage to find their own solutions in art, the student learn through action, and reflection of the action they have done and thereby produce their own personalised tactic knowledge in art (Freitas, 2002). The Static Image class is designed where the students learn heuristically (Kiss, 2006), which is through self-discovery learning.

Figure 27 Action and Reflection through Personalized Coaching

Knowledge comes after practice. After the students make their art, during our reflection time, that is where I connect the art that they make with the theory. Each student's learning is subjective, so I tailor my coaching on a very personal level where I know each student's strengths and weakness at the back of my hand and I cater learning to each student's abilities. Even the weakest student had grown in confidence in his use of art to create a powerful image and the strongest students are pushed beyond their comfort zone to make their best work. Thus the situated enquiry in learning successfully unites problem, context and solution.

There are two main limitations in this process; one is time, as the students are only experiencing the material handling process in a period of either seven weeks, if they enter during the short semester or only fourteen weeks if they enter during the long semester. The other limitation is that the teacher student ratio has to be kept small. The ratio should not be more than 1:15 for this personal mentorship studio to be successful.

So far, from the students' artwork, the process is successful. The purpose of this research was to develop a new approach to teaching art that defers from the traditional approach of just regurgitating what one sees. As the "new" knowledge in Art that needs to be imparted to each student is not exact and explicit, we cannot use a theory based, universal one size fits all approach to like how we teach factual based subjects such as Math and Science. Thus a subjective approach that focuses on creating increasingly immersive subject matter is used to tap into the subjective and personal aspects of the student's life experience to encourage a heuristic self-discovery learning through material thinking.

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Acknowledgements

Authors' Bio

Megan is the Head of the Foundation Programme in Faculty of Cinematic Arts, Multimedia University. With a background as a Film Editor, she is an Artist and Filmmaker. Her distinctive animation *Study of a Singaporean Face* was commissioned for the opening of the National Gallery of Singapore in 2015. Her debut animation *LIBERTAS* won the Best Screenplay at the 6th Indonesian Film Festival 2011 Short Film competition and was a finalist for Best Short Animation at the prestigious AFI Fest 2011, Los Angeles. Her debut short film *Woman at Home* was in competition at Seoul International Women's Film Festival in 2017. Megan graduated with a Master in Arts (in Drawing) from College of Fine Arts, University of New South Wales, Sydney, Australia.

International Journal of Creative Multimedia

Designing Lesson Plans for Adaptive Learning Using Moodle LMS Platform

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Abstract

This paper presents a research study in developing lesson plans for differentiated learning or adaptive learning using 'Lesson' on Moodle LMS platform. The lessons are to provide learning paths based on inquiring category from Laurillard Conversational Framework. The design of various learning paths provide teaching methods used in class such as videos, quizzes and reading tasks. This lesson when planned using flowcharts would guide the instructors to link the topics and assessment in any order that would promote students' self-paced and self-learning experience.

Keywords Adaptive learning; Differentiated learning; Lesson plan; Moodle

Introduction

Differentiated or adaptive learning is described as "the delivery of custom learning experiences that address the unique needs of an individual through just-in-time feedback, pathways, and resources (rather than providing a one-size-fits-all learning experience). The mechanism of how technology can be used to adapt to students' learning phases can either use designed, or algorithmic adaptivity (SmartSparrow, 2019). As the definition may vary, the framework can be categorized into three main fields: (1) adaptive content, (2) adaptive sequence, and (3) adaptive assessment (EdSurge, 2019).

Generally, an adaptive learning platform is associated with predictive analytics and algorithms. Adaptive learning is an educational technology that can respond to a student's interactions in real-time by automatically providing the student with individual support. Nevertheless, using educational technology

to design differentiated lessons for students is demanding. It requires instructors to possess a conceptual framework for differentiation. In addition, Bower (2012) identified that "the curriculum material must be broken apart into its component levels or skills". Besides this, instructors must be able to design formative questioning to enable diagnosis of student understanding to facilitate adaptivity.
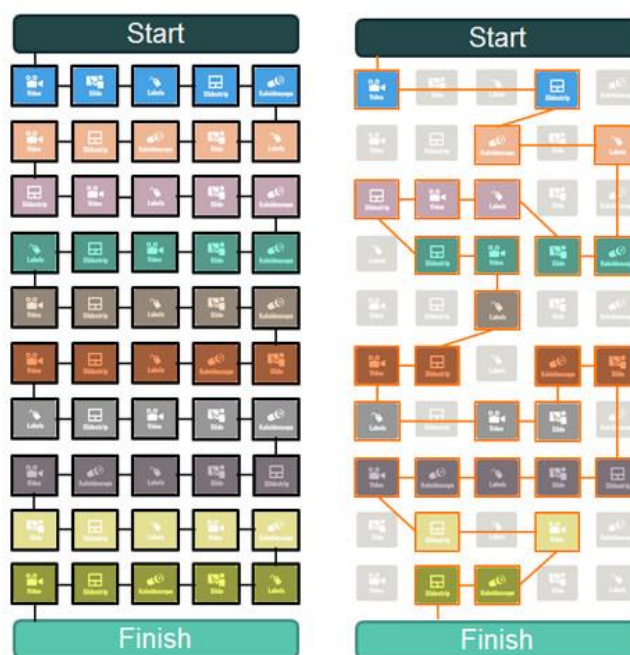

Figure 1 Learning Route: Conventional versus Adaptive Learning (Posner, 2017)

Consecutively, Posner (2017) presented an example of adaptive learning as illustrated in Figure 1 that shows individual learners following through the content in a conventional and linear setting on the left. Every learner must come across every piece of content. However, the one on the right shows that with adaptive learning, a learner only goes through necessary content. Moreover, Milosevic (2006) stated that lacking of personalization of learning is one of the main problems in designing suitable and targeted lesson plans. In this research, designing suitable and targeted lesson plan is carried out in Moodle, a learning management system (LMS). Therefore, a structured design for adaptive learning helps students to learn more meaningfully and systematically. The next section elaborates the research methodology on adopting a framework and the LMS involved in the study.

Research Background

This research is carried out to first identify differentiated/adaptive learning framework and the best practices. The learning framework is aligned to the six learning types of how students learn based on Laurillard Conversational Framework (Laurillard, 2016).

Laurillard Conversational Framework

The Laurillard Conversational Framework was introduced to assist students' learning. The framework details a model of how students learn effectively via the six learning types derived from the framework. Teaching and learning process is a highly complex activity that demands effort in lessons targeted for various students' background. The learning types are then mapped to the lesson plan according to the student's level of understanding. Figure 2 depicts the learning types that are categorized into:

- Acquisition (acquiring),

- Collaboration (collaborating),

- Discussion (discussing),

- Investigation (inquiring),

- Practice (practicing), and
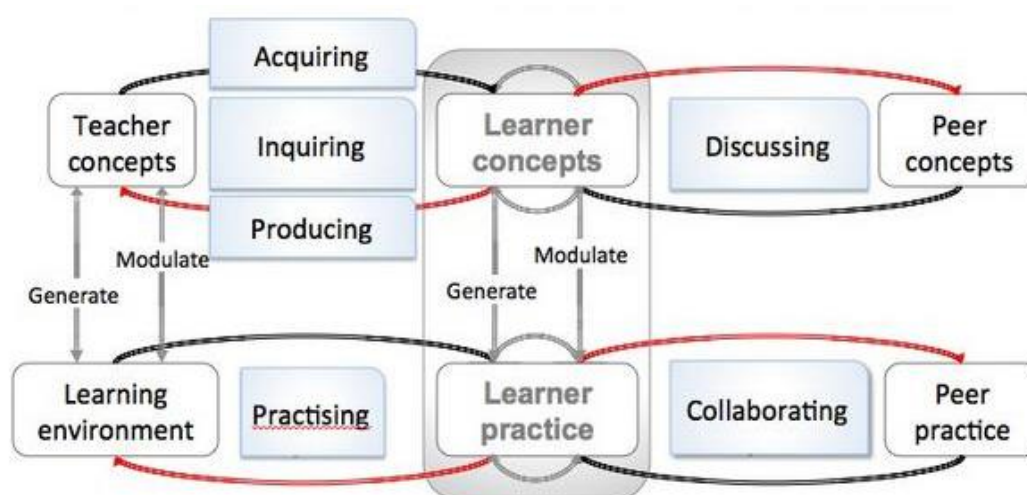
- Production (producing).

Figure 2 Laurillard Conversational Framework (Laurillard, 2016)

Thus, the adaptive learning aligns to Laurillard's "inquiring" category. The students would first inquire themselves on the concept, and later apply it in the given questions after acquiring the solving skills. Through the "inquiring" process, students would adapt to own path of learning.

Moodle Learning Management System (LMS)

Modular object-oriented dynamic learning environment, or Moodle, allows for covering and fitting learning environments using community-sourced plugins. The Learning Management System (LMS) provides robust, safe and unified system to create personalized learning environments. It can be downloaded into a web server to cater for holistic course repository. In a Moodle course, activities are features suitable to design assignments and assessments (Activities, n.d.). Typically, an activity promotes student to student, or student to instructor interactions.

One of the activities that recommend differentiated or personalized learning is 'Lesson'. The adaptive learning takes place with lessons designed with flowchart of intended topics, and the advancement to preferred topics would be created using page 'jumps'. The pages need to be linked systematically to ensure students can experience meaningful and adaptive lessons. According to Couëdelo (2018), the lessons once validated would reasonably create the differentiated or personalized learning as students have options to pick his or her learning path independent of others. Based on early findings, the learning sessions can be tracked by the LMS built-in analytics.

Lesson Plan Design

A lesson plan is described as "the instructor's road map of what students need to learn, and how it will be done effectively during the class time" ("Lesson Planning", 2019). Only when the learning activities are designed appropriately, it would develop strategies to obtain feedback on student learning. In addition, a successful lesson plan contains three objectives: learning objectives, learning activities, and assessment to check for student understanding.

The adaptive learning structure is used within the Moodle activity selection. The "Lesson" activity subscribes to a structured lesson plan arranged by topics. The next section details the design of the lesson plan in an engineering course in Moodle.

Methodology

The first adaptive learning module for EECB423 Data Communication and Network course is designed for IP addressing. One of the course outcomes of this module is to master the IPv4 addressing technique. The students are to apply calculation skills in network design. The topics include introduction to IP address, applying conversion from binary to decimal (vice versa), determining network class, network address, host address and subnets. The lesson plan flowchart is outlined in Figure 3.

Next, the lesson plan is then translated into Moodle Lesson activity with required content page jumps to associate the learning adaptivity and mastery levels. The flowchart requires a decision to link to the next content after fulfilling some requirements based on the course outcomes. Table 1 details the page numbers, contents, activities, and page jumps. Generally, the Lesson consists of pages with contents prior to assessments to allow students to proceed to the next level. Some of the activities that can be included in the Lesson page are reading materials, watching videos, and listening to Podcast.

The various activities should cater to various students' learning type. Subsequently, the next page hosts questions on the materials covered earlier. The assessment may include multiple choice questions, and short answers. Based on right attempts, the students would progress to the next page. On the other hand, students with incorrect answers are directed to the previous page for another try. This number of tries however can be limited to a few attempts to avoid being at the same page.
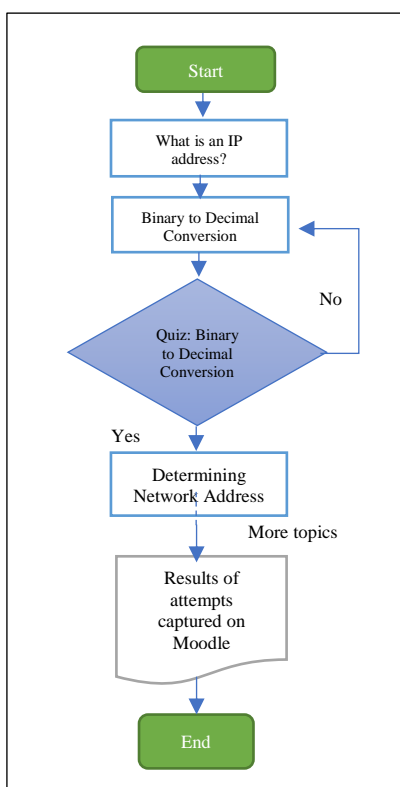
Figure 3 Flowchart for Lesson Planning

Table 1 Page outline to create Lesson in Moodle

(BL – Inquiry) IP Addressing

Page	Content	Activities	Jump to (OK)	Jump to (NOT OK)
1	What is an IP Address?	Read, Watch video	Page 2	NA
2	Binary to Decimal Conversion	Read	Page 5	Page 2
3	Determining Network Address and Host Address	Read, Watch video	Page 6	Page 3
4	Determining Subnet and Host Numbers	Short Answer	Page 7	Page 4
5	Quiz – Binary to Decimal Conversion	Multiple Choice Quiz	Page 3	Page 2
6	Quiz – Network Address and Host Address	Short Answer	Page 4	Page 3

| 7 | Quiz – Subnet and Host Numbers | Multiple Choice Quiz | Page 5 | Page 4 |
| 8 | Conclusion | Read | Complete | Score |

Results and Discussions

The lessons discussed in the previous section is elaborated here. The steps to create the lesson are shown in the following order. The "Lesson" is selected to create the pages containing topics to be learned. Next, Figure 4 shows the lesson in the activities tab.
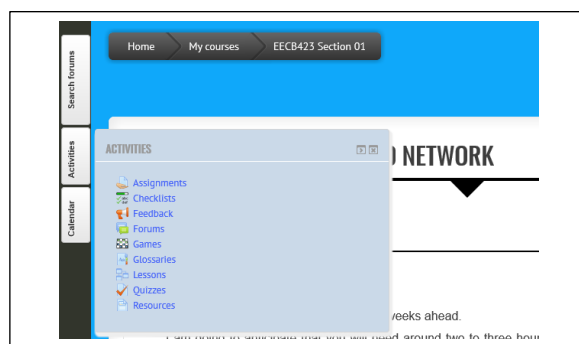

Figure 4 Lesson Activity in Moodle

Figure 5 depicts the page for lesson plan containing tabs for preview, edit, reports, grade essays, collapsed and expanded. Below the general tabs, there are options to import questions from other page, add a content page and question page. From the figure, the first topic has been entered as a content page as introduction to IP addressing.
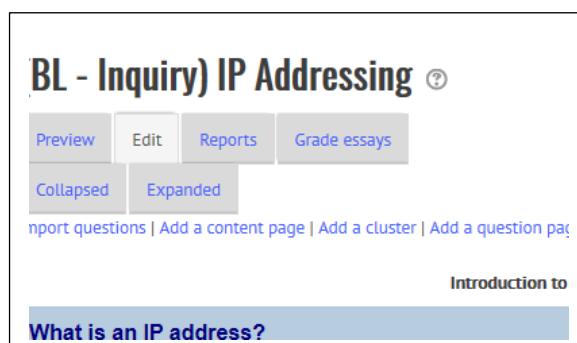

Figure 5 Creating Content Page for the First Topic

Subsequently, the content page provides the page jumps for the students to attempt. Based on the table discussed in the earlier section, a few content pages were created and the page jumps were linked to the 'Next Page'. In Figure 6, the contents were assembled in order and labelled as 'Content 1: Binary to Decimal Conversion' and 'Content 2: Classes of IP Addresses'. The pages jumps labels are 'Jump 1: Next page' and 'Jump 2: Next page' respectively. The jumps must be sequenced correctly to provide the learning experience required for adaptive learning.
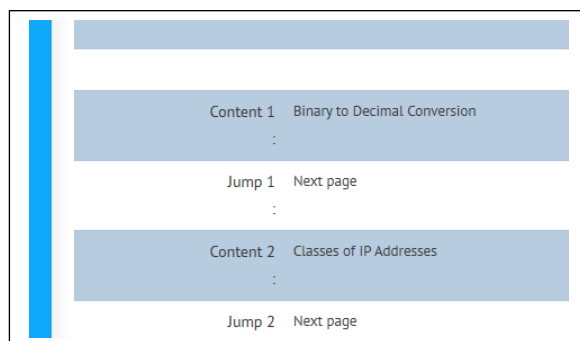

Figure 6 Creating Content Page for the First Topic

Following the list for content and jump pages, the summary of the changes and links can be seen from Figure 7 depicting the pages and jumps created. The 'Action' section contains the list of actions required to amend to adjust the order of the pages.
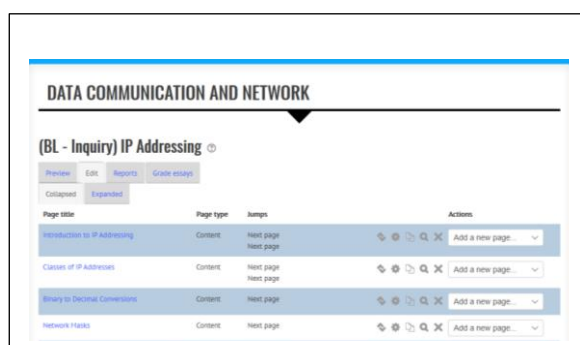

Figure 7 Summary of Lesson Pages

Next, the Lesson statistics reports on students' performance and progress for the particular tasks. The instructor receives feedback instantly to gauge students' understanding of the given topics.

Figure 8 Lesson Statistics Report

The preparation to design the Lesson in Moodle can be time consuming but using a standard lesson plan approach may address the issue. In addition, a clear outline of the topics ensures that the students follow the contents and have the assessment done accordingly. Subsequently, the instructor has to run the lessons a few times to ensure its reliability, as there is likelihood of the pages not being linked in order.

Conclusion

Adaptive learning can be designed to accommodate various learners according to their learning types. The lesson plans for adaptive learning are designed appropriately to meet the course's learning outcome using Moodle's Lesson. Though the preparation process takes longer time, a successful learning experience is captured through a systematic lesson plan aided by the Moodle content and assessment pages. As students can adapt to the Lesson, a comprehensive approach to the lessons allows differentiated learning or adaptive learning to take place.

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Acknowledgement

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Exploring the Potential of Online Tutorial Websites for Developing Technological Skills among Senior Citizens

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Abstract

Most social media platforms nowadays are designed for intuitive younger users and senior citizens might face difficulties in developing their social media skills. There are several factors that may inhibit senior citizens from learning how to use social media such as lack of suitable platform and mobility limitation. Learning process may occur differently among senior citizens compared to the younger learners due to the digital divide. Senior citizens encounter cognitive and physical declinations throughout the aging process which may affect their learning activities. Hence, the learning platform for senior citizens should be designed in a way that could help them to maximise their learning; an online tutorial website could be one of the alternative platforms. This study is conducted to explore the potential of the existing free online tutorial websites in developing social media skills among senior citizens. Instructional strategies for teaching senior citizens via online tutorial websites are also developed based on previous studies. Three existing online tutorial websites are analysed based on the proposed instructional strategies to gain more understanding regarding online tool in the context of technology learning among senior citizens. Supported by the three cases-in-point, criteria that are crucial in ensuring senior citizens have positive learning experiences via websites are drawn.

Introduction

The design of social media is mostly dedicated to the digital natives where they can easily grasp the features offered by using their intuition (Chou, Lai & Liu, 2013). As digital immigrants, senior citizens tend to face difficulties in adapting to the social media applications as their ability to understand how social media works differ from the younger users. In this paper, technological skill is being defined as skills that could be acquired by senior citizen learners to use the digital tools and resources effectively. To date, there are free online tools and platforms that could help them gain understanding of the digital skills in order to use social media applications safely and effectively. This paper attempts to propose a set of instructional strategies for teaching older adults via websites based on suggestions by previous researchers, and explore the potential of the free online tutorial websites in developing social media skills among senior citizens so that they could participate actively in the online society.

The study is presented in three separate sections. The first section discusses overview of senior citizen population in Malaysia and the importance of learning technological skills for active ageing. The second section focuses on the review of instructional strategies for senior citizens and the third section focuses on the evaluation of free online tutorial websites in assisting older adults to learn. Qualitative content analysis is performed on three online tutorial websites namely (1) WikiHow, (2) Lifewire and (3) GCF LearnFree, based on instructional strategies for senior citizens proposed by researchers in the field (Jones & Bayen, 1998; Uechi, 2010; Ahmad et al., 2013; Wolfson et al., 2014).

It is found that although studies that address the digital gap among senior citizens in Malaysia do exist, there are limited studies that focuses on teaching technology skills to older adults and assisting them via online tools such as free tutorial websites. Furthermore, previous study that emphasizes on teaching technology to senior citizens, focus on in-class teaching or workshop and not learning websites (Ahmad et al., 2013).

The following research questions are developed to guide this study:

1. What are the instructional strategies that should be considered when designing an online tutorial website for senior citizens?

2. To what extent do free online tutorial website potentially support the learning process of senior citizens?

Literature Review

Senior Citizen and Social Media Skills

According to the World Population Prospects by United Nations (2017), the total number of the senior citizens is estimated to be 962 million and it compromises of 13 per cent of the global population. In Malaysian context, based on the 'Portal Rasmi Jabatan Kebajikan Masyarakat Malaysia' website, the age range for senior citizens in Malaysia are those who in the age of 60 and above. Malaysian Communication and Multimedia Commission (MCMC) in their 2018 Internet User Survey reported that senior citizens who use internet comprise of 6.5 per cent of Malaysian population for the internet usage. The survey shows that the number of senior citizens who use internet is higher compared to 2016, where senior citizens who use internet are only 2.6 per cent. Besides, the survey also states that visiting the social media platform is the second highest online activity by Malaysian internet users. This indicated that senior citizens in Malaysia are slowly adapting to the usage of the internet and social media.

Social media could still be too complicated to be used by senior citizens. Based on the study by Chou et al. (2013), comprehension gap is one of the reasons why senior citizens find it is difficult to learn how to use social media. The gap includes the jargon terms used in social media and their unfamiliarity with the concept of social media. Indeed, the learning capabilities of senior citizens are different from the younger leaners due to the declination in their physical ability. Senior users also hope that they could participate in their children's life through internet. By being able to use social media platform appropriately, senior citizens could also easily communicate and engage with their family, friends and community (Carley, 2015). However, it might be challenging for senior citizens to grasp how the social media applications work since the design for the platforms is specified for the digital natives. The changes in seniors' physical and cognitive have affected their ability to understand how social media work (Meymo & Kenn, 2017).

Instructional Strategies for Senior Citizens

Senior citizens may take a longer time in adjusting to the current website features due to the declination in vision, hearing and cognition since it will affect cognitive process that involves short term memory (Rusdi, Sahari, & Noor, 2017). Due to the biological factor in human, their vision and cognitive abilities decline throughout the aging process (Pliatsikas et al., 2019). The younger users may not have a problem in using current technologies in their daily life, however, it is difficult for senior citizens to learn current technologies due to cognitive declination (Wolfson et al., 2014). The cognitive declination also affects the performance of the working memory when the information is presented in a big chunk (Heaggans, 2012).

Therefore, instructional strategies play an important role in in helping older adults learn independently and strategically. Based on the study by Ahmad et al. (2013), they found that most of the available websites are developed in way trying to fit all the age levels, however, certain websites are always failing to fulfil senior citizens' need. To date, learning strategies for senior citizens do exist (Ahmad et al., 2013; Jones & Bayen, 1998; Uechi, 2010; Wolfson et al., 2014), but none of them is specifically tailored for aiding older adults via online tutorial websites. Hence, we developed a set of instructional strategies that could potentially help senior citizens learn effectively via online tutorial website based on findings from the existing literature. We looked for the most popular criteria in the domain of teaching older adults to acquire knowledge and skills. The proposed learning strategies contains three main criteria: Instructions, Content to be Learned and Application.

The instructional strategies are then set out as a guide for qualitative content analysis of the selected online tutorial websites (Table 1).

Table 1 Instructional strategies for teaching senior citizens via online tutorial website

Criteria	Strategies
Instructions	• The instruction should be simple and meaningful where unnecessary information will not be included and to minimize the amount of reading needed. • Include clear and explicit learning objectives. • Provide a clear flow for the learning objectives prior the instruction. • Use language that can be easily understood by senior citizens and avoid jargon terms.
Content to be Learned	• Break down the instructional content into small meaningful units with specific goals. • Incorporate guiding images or videos to assist the learning process. • Choose appropriate font styles and size with appropriate background contrast that are easy to read.
Application	• Provide practice for each unit of the instructions.

Methodology

The search for the existing online tutorial websites was firstly conducted by using a group of pre-determined keywords on the Google search engine. The Google search engine was selected since it holds the largest percentage of the worldwide search engine market share. The keywords used include "free learning website for senior citizen", "social media tutorial for senior citizens" and "online tutorial for older adults". The search result led us to recommendations for online tutorial websites from reputable websites such as Makeusof (MUO), Huffpost and Medicare. Besides that, some of the online tutorial websites were directly suggested by the search engine.

Selection of Existing Online Tutorial Websites

We screened through the existing online tutorial websites and selected three websites for the purpose of this study. The selection criteria were: (1) The website must be open to public for free and (2) The website contains tutorials on how to use social media applications. However, these websites are not meant to represent other websites, but to provide further understanding on such online tool in the context of technology learning among senior citizens.

Qualitative Data Analysis

Qualitative content analysis is performed on the three different websites as the first step towards exploring the potential of such websites in bolstering learning process of older adults. A qualitative approach is selected because it could provide in-depth data for this study (Gay, Mills & Airasian, 2012). The data analysis is conducted by investigating the selected websites that could be potentially be used as free online tutorial websites in assisting older adults to learn social media skills. The websites are analysed in terms of the instructional strategies used in delivering the tutorial. Several measures are implied during the data analysis to maintain objectivity and minimize authors' personal biases.

The measures included:

1. The websites are closely analysed based on the instructional strategies for senior citizens suggested by previous researchers in the field (Ahmad et al., 2013; Jones & Bayen, 1998; Uechi, 2010; Wolfson et al., 2014).
2. Three websites are selected to establish comparison case in discovering similarities and differences to ensure different perspectives were demonstrated (Noble & Smith, 2015).

3. Multiple people are involved in the process of coding the data. The coding team consisted of three researchers in the field: two postgraduate students and one senior lecturer. The data coded are then cross-checked and grouped into three factors: instruction, content to be learned and application.

4. Our findings are then reviewed by experts from the instructional strategy field.

Guided by the second research question and learning strategies illustrated in Table 1, the contents on each website are carefully observed and evaluated. Screenshots are taken and captured as evidences of the learning strategies adhered. We then conducted the cross-case analysis at the end of the study in an attempt to identify the similarities and differences between the cases.

Results

WikiHow

WikiHow is a wiki-style learning website where the users can collaboratively modify the content of the website through the web browser or mobile application. According to the statistics from WikiHow's website, there are 2,006,173 registered users and 205,057 content pages up to 2019. Users can easily access the free how-to articles in many categories such as technology, health and education. There is no need for a registration if the users want to access the articles.

Instructions

There is no consistent length range on the information for each step. Since there are a lot of articles within WikiHow, some articles have short instructions, and some articles have lengthy instructions. The inconsistency of the instruction lengths will burden senior citizens' working memory or they need to perform extra task to browse and select the articles with shorter instructions.
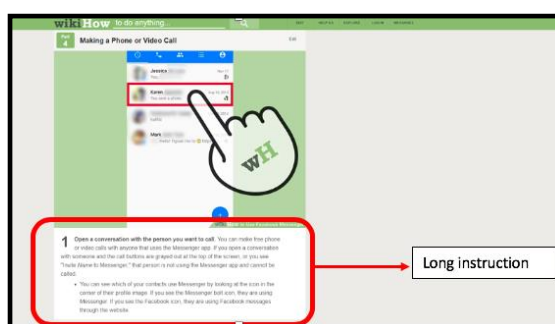

Figure 1 Instruction Length on WikiHow

The language used in WikiHow is a standard English that can be understood by most of the generations. Besides, the explanation is usually synchronised with the guiding images, hence, the misunderstanding in any ambiguous term can be avoided.

Content to be Learned

WikiHow incorporates guiding images for all of the articles as it is one of the standard formats. The font style used in WikiHow is Helvetica and the size are 11. The font style used is appropriate since the framework suggests that Sans-serif font is easier to be read. In term of the font size, it is quite small, and senior citizens might need to zoom the page to enlarge the text.

Application

Some of the articles within WikiHow provide a practice for each unit or for the whole instructions by incorporating the quiz section. However, some of the articles did not provide practice for users. Hence, senior citizens can only practise what they had learned if the articles that they view provide the practice section.

Lifewire

Lifewire is a learning website that provides advices on technology. The website has more than fifty technology professionals who produce articles in many categories such as software development, website design and education. Lifewire states that their article consists of informative visual and straightforward instruction. Currently, Lifewire holds 17,000 articles that are continuously refined for the past 20 years. Apart from that, Lifewire states that their website does not include jargon terms within the articles to ensure that everyone can learn about technology.

Instructions

It is found that there are inconsistencies on the length of instructions on Lifewire. Some of the instructions within the articles are straightforward and not too wordy where unnecessary information is not being included. This could minimize the amount of reading needed. However, some of the articles are lengthy (as shown in Figure 2)
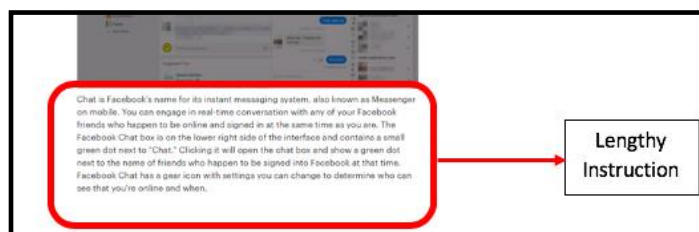
Figure 2 Instruction Length on Lifewire

Some of the articles provided divide the instructions into smaller parts and the goals are clearly stated. However, some articles present the instruction in a paragraph under one learning objective. The flow for each learning objectives prior the instruction lacks clarity.

Content to be Learned

Lifewire justified that their website does not include jargon terms and the information is always straightforwardly delivered. Lifewire also includes informative visual to help users understand the content better. The font style used in Lifewire is Helvetica and the size is 11. The font style used is appropriate since the study suggests that Sans-serif font is easier to read. The font size used is considered quite small and senior citizens might need to zoom the page to enlarge the text.

Application

Lifewire does not provide a practice section for the articles since the website is more like a blog-style platform.

GCF LearnFree

GCFLearnFree.org (GCF) is a free learning website that focuses on technology, job training, reading and math skills. The GCF website is accessed by a wide range of people from senior citizens who want to learn technology to professionals who want to polish up their skills. Besides that, GCF is also used by some organisations such as K-12 schools, community centres and correctional facilities. According to the website, the production team in GCF consists of software developers, graphic designers, instructional designers, curriculum coordinator and many others who are responsible in developing the content within the website. There is no registration needed to access the self-paced tutorials within GCF.

Instructions

The tutorials within the website consistently provide a simple and brief explanation for the steps and there are some longer explanations for the information that involves the concept explanation. Hence, GCF minimizes the amount of reading needed during the instruction as what is suggested by the framework.
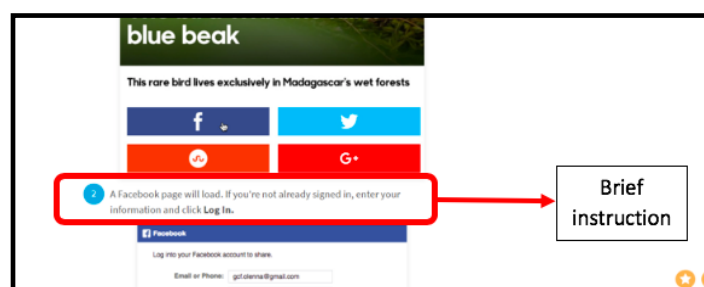

Figure 3 Instruction Length on GCF

For each tutorial in GCF, the instructions are broken down into smaller units as what is suggested by the framework. Users will first see the list of objectives and goals before proceeding with the tutorial. Besides that, the objectives also obey the instructional strategy from the framework which suggests that the learning objectives should be clear and explicit. Furthermore, GCF provides a clear flow for the learning objectives prior the instruction. By looking through all the objectives before starting the tutorials, senior citizens can anticipate what they are going to know by the end of the tutorial.
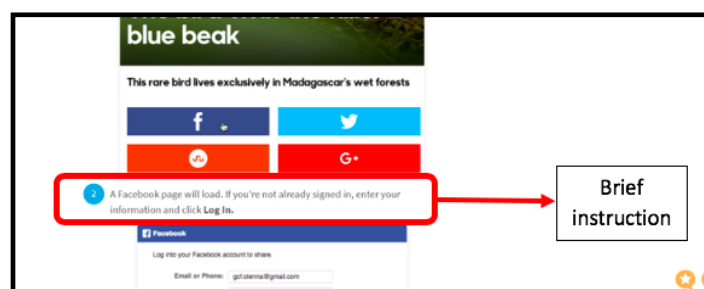

Figure 4 Learning Objectives on GCF

Content to be Learned

GCF provides clear images to help the users understand the explanation better. Besides, GCF also provides videos for a more interactive information presentation. The language used within GCF is straightforward and no jargon terms are included within the instruction since the target users for GCF are people from various ages and backgrounds. Hence, the language is used as explicit as possible to

ensure everyone can understand the instruction. The font style used in GCF is Source Sans Pro and the size is 14.5. The font style used is appropriate since the study suggests that Sans-serif font is easier to be read. In term of the font size, it is quite large and appropriate for senior citizens.

Application

Senior citizens should be allowed to practise what they had learned from each unit to ensure their information retention. However, GCF only provides quiz by the end of the tutorial and not after each unit within the tutorial. Nevertheless, the tutorial format in GCF is consistent where every tutorial has the quiz section by the end of the tutorial, hence, senior citizens are still able to practise what they had learned.

Summary

Based on the qualitative content analysis, we found out that GCF adhered to most of the instructional strategies for teaching senior citizens via online tutorial website. The instructions on GCF are brief and comprehensive as it minimize the amount of reading needed while WikiHow and Lifewire have inconsistent length format. Furthermore, the instructions on GCF and WikiHow are broken down into smaller units and steps but Lifewire only did on certain articles. Plus, compared to WikiHow and Lifewire, GCF displays all the learning objectives prior the instructions. Despite that, the objectives provided by all the websites are clear and explicit. All the websites provide guiding images and videos for the instruction, nevertheless, GCF had an advantage by incorporating interactive guiding images. The language used for all the websites are straightforward and no jargon terms are included, hence, the language used is understandable by most of the people. The font styles used are also appropriate for all of the websites; however, WikiHow and Lifewire do not use suitable font size according to the strategy. Lastly, GCF consistently provides a practice session at the end of the instructions compared to WikiHow and Lifewire.

The table below summarises the comparison for the online tutorial websites.

Table 2 Summary of online tutorial website comparison

Criteria	Strategies	WikiHow	LifeWire	GCF
Instructions	• The instruction should be simple and meaningful	Inconsistent length format	Inconsistent length format	Yes
		Yes	Yes	Yes

	• Include clear and explicit learning objectives.	No	No	Yes
	• Provide a clear flow for the learning objectives prior the instruction.	Yes	Yes	Yes
	• Use easy language and avoid jargon terms.			
Content to be Learned	• Break down the instructional content into small meaningful units with specific goals.	Yes	Only for certain articles	Yes
	• Incorporate guiding images or videos to assist the learning process.	Yes	Yes	Yes
	• Choose appropriate font styles and size with appropriate background contrast that are easy to read.	Appropriate font style but with small text size	Appropriate font style but with small text size	Yes
Application	• Provide practice for each unit of the instructions	Only for certain articles	No	Only for the whole topic

Discussion and Conclusion

Instructional strategies play an important role in ensuring the success of the instruction. Suitable instructional strategies should be integrated within the instructional programs that are dedicated for senior citizens. Previous study by Jones and Bayen (1998) recommended specialised instructional strategies for teaching senior citizens computer skills since most of the older adults are prone to cognitive declination. Besides this, result from another study by Nahm and Resnick (2008) showed that by incorporating some of the instructional strategies suggested by Jones and Bayen (1998), the senior citizens were more comfortable in using the computer or web-based learning platform. A study by Duay and Bryan (2008) explored senior citizens' perspective on the instructional strategies in learning technology; the result showed that the participants found some of the strategies proposed by Jones and Bayen (1998) could facilitate them

in acquiring technology skills. Furthermore, there are more recent studies which referred to the recommendations by Jones and Bayen (1998) in coming out with their own suggestions on instructional strategies for senior citizens in learning technology (Heaggans, 2012; Raistrick, 2016; Wolfson et al., 2014). Therefore, previous studies showed that the instructional strategies for senior citizens may help them in learning technologies despite of their cognitive and physical declination. However, most of the previous studies only focus on the instructional strategies' recommendation for in-class teaching and there are little current studies regarding the instructional strategies for online tutorial website. In addition, there are also little study in identifying the effectiveness of the instructional strategies for senior citizens in term of learning technological skills.

Since the focus of this study is to explore the potential of the free online tutorial websites in developing social media skills among senior citizens, we developed instructional strategies for the online tutorial website taking into consideration the strategies suggested by previous researchers. The online tutorial websites are seen as an effective tool that could help to overcome barriers faced by senior citizens such as the limitation on face-to-face training, mobility and cost (Heber et al., 2017). Besides the conveniences offered by the website, it is also crucial to consider incorporating instructional strategies that could cater senior citizens' needs so that they too could learn effectively from the online tutorial websites. The instructional strategies for this study focused on three main criteria namely instruction, content to be learned and application. Our findings demonstrated that the strategies suggested could potentially determine whether an online tutorial website is useful and appropriate for senior citizens' use.

Our findings also suggested that there are existing online tutorial websites that could potentially facilitate senior citizens in developing technological skills. Based on the qualitative content analysis for the potential online tutorial websites, we found that GCFLearnFree.org incorporated most of the instructional strategies that we had developed. However, an improvement could be made on the practice included within the tutorial to ensure that senior citizens could consistently practise what they had learned. Despite that, the instructions within the tutorial were presented in a way that could accommodate senior citizens' learning process. Hence, the existence of free online tutorial website such as GCFLearnFree.org could potentially facilitate senior citizens in developing technological skills.

The instructional strategies proposed in this study are hoped to provide an insight for future developers or instructional designers who wish to develop an online tutorial website for senior citizens. They

could also provide a discernment on the instructional strategies that could be implemented into the websites. Nevertheless, this study has its limitations. Although the suggested learning strategies could serve as guidelines for developing a free online tutorial website for senior citizens especially for learning technological skills, external considerations should be taken into account. Factors that could limit the ability of senior citizens such as Internet accessibility, devices with adequate processing power, and knowledge and skill support should be considered. Our future goal is to expand this study to acquire further insights from the senior citizen community towards design and development of websites with better educational feasibility and value. We intend to investigate and explore the use of free online tutorial website as a learning tool among senior citizens.

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Acknowledgements

Authors' Bio

Tan Yun Yi is currently a Senior Lecturer at Universiti Sains Malaysia. She obtained her Bachelor degree in Digital Media (Hons) from Multimedia University in 2009. She was later awarded the fellowship award to further her postgraduate studies. In 2018, she received her Ph. D in Educational Technology from The University of Hong Kong, Hong Kong. Her area of specialisation includes educational technology, social based learning, multimedia design and technological creativity. Her research interest is also driven by her curiosity in creative media and technology, and also how they could be used to enhance learners' learning experiences.

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