InSIDE: A model for interactive and immersive synchronous media in MOOC courses

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ABSTRACT

MOOC or Massive Online Open Course is increasingly adopted by Universiti Teknologi MARA as one of the e-learning methods. It is estimated that 900 courses will be offered by end of 2018, in line with the Malaysian Government's push for better utilization of Information and Communication Technology (ICT) in education. This creates an opportunity to introduce MOOC as a legitimate full alternative to lecture classes. However, learners in a MOOC setting are at a disadvantage when compared to conventional classroom in learner-learner and learner-instructor interaction. There is a huge temporal gap that exists by nature of how the courses are conducted. InSIDE is developed as a model that introduces synchronous interactivity and immersive component within MOOC. To facilitate interaction in this setting, InSIDE suggests a dedicated moderator to accompany the lecture. The model also utilizes a "go high and fail gracefully" approach to overcome the devices, connectivity and infrastructural challenge. In pursuant of the creation of a model that can be used in UiTM, interviews with UiTM's MOOC facilitators and lecturers were conducted to gain insights on the behind-the-scene processes of creating and managing a course. In order to ensure that the model is feasible within existing infrastructure, a Proof of Concept was conducted with an actual lecture. InSIDE was also presented to three experts on MOOC in UITM. From the qualitative data obtained, 2 out of 3 experts agree that the InSIDE have the possibility to improve MOOC delivery, while one expert agree with reservation in regards required hardware and infrastructure required.

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1. INTRODUCTION

MOOC, or Massive Open Online Course is a platform that for distance learning over the Internet. MOOC typically multimedia contents from various sources [1]. It is possible to complete a whole course within MOOC. MOOC also encourage interactivity. Distance learners can discuss or join in other discussions using the tools available. This can be in the form of a forum-based, or a chat room. UiTM is one of the pioneers of MOOC in Malaysia. Since the first pilot class in 2015, it grew to 4 courses in the same year and 15 courses in 2016 [2]. It grew to 450 in 2017, and UiTM plans to have at least 900 courses by the end of 2018 [3].

1.1. Problem Background

The process utilized by UiTM to produce MOOC contents has a high dependability on the Department of E-Learning, Institute of Neo Education (iNED) as the both gatekeeper and content producer. This could cause a bottleneck especially when UiTM have plans to do a credit transfer pilot project, where a course can

be taken via face-to-face classroom, MOOC, or a mixture of both. [4]. In current MOOC platform, the only means of interaction is via the chatroom/discussion forum, and no suppport for synchronous interactivity. In distance learning, retention is higher when interaction with the instructor is higher [5]. Current discussion methods are not integrated tightly [6]. Traditional MOOC, which delivers content via conservative methods of static video, audio and text scripts, is certainly not sufficient to hold on the students. [7].

1.2. Research Questions

From the preliminary study and interview with a MOOC facilitator, it is apparent that the current implementation of MOOC while sufficient for a self-paced asynchronous learning, may be inefficient to be used as a total replacement of a face-to-face class. Therefore, how can a MOOC lecture be synchronous, so that distance-learning students attending during the actual lecture may interact with the class? And how can live-streaming 360 videos be used to improve the delivery of synchronous interactive MOOC lecture?

1.3. Research Objectives

In order to improve MOOC, a synchronous and immersive component can be introduced to it. To achieve that, a model for a synchronous lecture with interactive features needs to be developed, together with an immersive component to a synchronous interactive MOOC lecture.

1.4. Scope and Limitations

This research looks into the creation of a model that enables the use of immersive multimedia in a MOOC setting, specifically within UiTM. The model to "start high and fail gracefully" to cater for the various technological challenge. The research does not look into the cultural and societal impact or effect of the model and is based on a local (Malaysian) setting, tackling issues that may affect local education setting, but not others.

1.5. Significance of Study

This model has the possibility of improving MOOC in a way that it could benefit most, if not all of its stakeholders. The introduction of synchronous component will benefit current generation of students and soon, lecturers, who are part of the "in the know, in the now" generation. Synchronous components in MOOC can also reduce the time need to create MOOC content, since it's being recorded and streamed live. A typical MOOC class can take from several months to a full year to develop. Immersive technology has been proven in numerous researches on helping those otherwise bound to a geographical position – be it because of financial, health, or even war – to travel around. With the integration of immersive component into the model, this can help immobile students, or perhaps stuck and incapable to come to class to use immersive technology instead of face to face.

2.   LITERATURE REVIEW

2.1. MOOC in Malaysia

In Malaysia, MOOC is being developed alongside the 11th Malaysia Plan (2016-2020) [8], The National Economic Model Economic Transformation Programme and the Malaysia Education Blueprint (2013-2025) [1]. The government is looking into leveraging the ICT to scale up quality learning in Malaysia by encouraging the use of ICT for distance and self-paced learning [9]. This interest is further strengthened by the initiatives by local universities to offer MOOCs courses to its students since 2013 [10].

2.2. Online Distance Learning Delivery Vehicle

The inclusion of Information Communication Technology (ICT) into education, has impacted the instructional content development, leading to the evolution of new concepts and innovative teaching techniques in the instruction-learning process, focusing on learning, rather than on teaching [11]. These students engaged in problem-solving on design projects, collaborated on blogs and actively engaged in interactive multimedia [11].

2.3. Benefit of Immersive Systems in Education

Simply reading from a book and being confined in a classroom is no longer something that's enough for the learners. Improvisation of teaching in steady smaller steps will be critical in alleviating the challenges of working with the demands of a new generation [12]. Virtual reality (VR) offers unique learning experiences due to its ability to provide real-time three-dimensional visualization and afford various types of interactivity within virtual learning environments [12]. The assumption underlying the rapid rise in the use of desktop-based

virtual reality technology in instruction is the unique affordances that it offers in enhancing learners' cognitive skills [12].

2.4. Issues with Current Implementation of MOOC in UiTM

UiTM tasks iNED to manage all of the MOOC contents, which will reach 900 courses by end of 2018 [2]. The centralized operation is needed to maintain the video contents meet the predefined standard [14]. It does however cause a bottleneck when all of the initial contents need to go through a single chokepoint. Lecturers – or a team of lecturers, depending on the course – handle all of the asynchronous interaction with the learners on their own. No administrative staff were provided to handle this interaction [16]. This separation results in inactive participants. Apart from the lacking learner-learner and learner-instructor interaction in MOOC, the content delivery has also been deemed insufficient to hold student's attention [7]. In doing the literature review for this research, it is noticed that there's no overlap between in immersive technology and synchronous distance learning. These two fields have almost always being discussed exclusively with each other.

2.5. Theoretical Background

In developing this model, the variety of learning method offered by distance learning frameworks is either based of or adheres to the Constructivist Theory. MOOC, and the proposed model, adheres to this philosophy in offering various means of learning from a MOOC-enabled class, and not limited to sitting in a lecture passively. The pedagogy used in MOOC classes also varies from lecturer to lecturers. Therefore, the Proof of Concept, uses Gagne's Model to plan the activities needed in the teaching process.

2.5.1. Constructivist Theory

Constructivist Theory refers to the concept that there is no one known meaning in the world. Instead, there exist many means to obtain information [20]. It is a philosophy, not a strategy, of seeing the world. This includes notions about 1) the nature of reality, 2) the nature of knowledge, and 3) the nature of the human interaction [21].

2.5.2. Gagne's Model of Instructional Event

One of the more popular frameworks for designing learning contents is the Gagne's Model of Instructional Event [22]. The framework posits that learning occurs in a series of learning events. Gagne correlated the Nine Events of Instructions with the associated internal mental processes and formulated these events as elements of a good lesson which promote effective learning [23]. These events must be accomplished before the next in order for learning to take place, and the instructional events should mirror the learning events. [22].

3.　RESEARCH METHODOLOGY

3.1.　Introduction

To develop this model, several research approaches have been looked into to determine which would be the best fit for this research, using a variation of the Waterfall model.

3.2.　Requirement Analysis

3.2.1. Preliminary Study

The research is the fruition of an observation of the implementation of MOOC classes. Several MOOC classes were attended and functionality of the platforms were observed.

3.2.2. Literature Review

To confirm this observation, related literatures revolving around the distance learning model and the Massive Open Online Course model were sought after and researched. These includes implementations of immersive technology in education such as Augmented Reality and Virtual Reality.

3.2.3. Problem Formulation

From the literature review, none of the models and methods investigated enables synchronous interaction between learner and instructor, while allowing an immersive experience. There is also the difference in how a learner interacts with the class and the instructor while physically in class and how the interaction is when in MOOC settings. This difference can be seen clearly when assessing how Gagne's model mapped temporally into how each type of classroom is conducted, as illustrated in Figure 1.
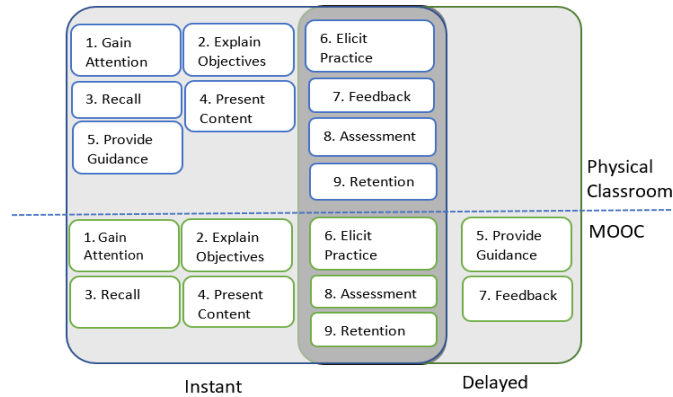
Figure 1. A Venn diagram showing the temporal gap in interaction between learners in physical class and distance learners in MOOC

Therefore, the research aims to reduce this gap. The model that is being formulated is designed to allow the learner to experience the class in an immersive manner, at the same time as the class is being conducted. This allows the learner to be able to interact in almost real time.

3.3. Extended Literature Review

An extended literature review was made in order to make sure this research look into all aspects of an Online Distance Learning; further reading was conducted into understanding how Constructivism and Gagne's model can be used as a base for this model.

3.4. Design and Conceptualization

The research aims to develop a model that enables MOOC to utilize immersive technology and become synchronously interactive. The model this research suggests is based on the thinking of Constructivism, giving the reign of the class partly to the learner, and increase interactivity.

3.5. MOOC Expert Interviews

Interviews were done with lecturers who use MOOC. A thematic analysis on these interviews show that they need a significant amount of time to create the pre-recorded content or to curate existing content. This creates a temporal gap in the learning experience between learners in a physical class and distance learners. While this delay allows for self-paced learning, having an option to experience the class as it happens allows for flexibility in the implementation of MOOC classes. This is where a synchronous component is could be useful in making MOOC more than simply a repository of educational videos and reduce the temporal gap between physically available learners and distance learners.

a) The model has to empower distance learners as close to those who are able to physically attend the class.
b) The model has to have fallbacks and be able to "go high and fail gracefully".
c) The maximum failure threshold in this model is up until the class is only able to stream at least the visual aid and audio.
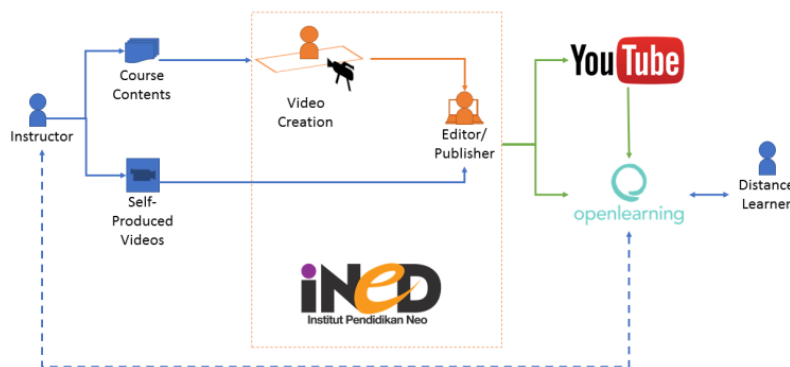

Figure 2. How MOOC operates within UiTM

The development starts with creating a visual representation of the current MOOC model as implemented by UiTM. During the creation of this high-level base model, shown in Fig.2 below, the facilitators and experts were consulted to make sure its accuracy. iNED provides necessary tools and skills such as recording studio, cameraman, and graphic artists. Lecturer can opt to create their own content using the prepared template or provide the content to iNED and then uploaded to Youtube, an online video hosting site, as the selected online repository, and embeds the content into OpenLearning, a distance learning platform. The progress of accessing these contents are recorded by OpenLearning as being a part of a class.

3.5.1. Model Development – Phase 1: Synchronous and Interactive Elements

With the base model ready, the next step is to augment it with synchronous and interactive elements. The base model is mapped with Gagne's Model of Instructional Events. This was then analysed to find out which events weren't able to be done in a synchronous fashion. The platform used in current MOOC was looked into as whether it supports the augmented components. UiTM is using OpenLearning which supports synchronous interactivity via its chatroom. The synchronous component is then introduced to the high-level base model.

3.5.2. Model Development – Phase 2: Immersive Component

The proposed model also has an immersive component. Similar to the asynchronous interactive component, the immersive component is introduced to the high-level base model, and then to the detailed model. Next, is to test the model against the "go high and fail gracefully" concept. With reference to the known issues of current IT infrastructure in Malaysia generally and UiTM specifically, elements from the model is removed one by one, until the maximum failure threshold is reached. Finally, the model is presented to MOOC experts. The experts were chosen from MOOC Moderators from several faculties, including the Deputy Director of iNED. From the interview transcript, a thematic analysis on their feedbacks was conducted.

3.5.3. Proof of Concept

The Proof of Concept (POC) was conducted in one of the classes for CTW 523 - Interactive Multimedia in Faculty for Film, Theatre and Arts, Universiti Teknologi Mara. The class was conducted with one lecturer, acting as both instructor and moderator, and 28 students. The chat function is used for any discussions.

a) Facebook was chosen for its closed groups, immersive video support, and live chats.
b) Both the lecturer and the students were not in the same room.
c) Due to the hardware limitation, the class was not conducted in 360° but the visual aid was streamed alongside the lecturer's audio by using Facebook's screen-sharing function.

The POC took 2 hours 40 minutes, with 166 chat messages during the class. A quiz was conducted at the end of the class for retention purposes, in line with the Gagne's model of Instructional Design. A survey was conducted to obtain insight on the students' view of the POC. More than half of the students were accessing the class using a mobile device. The rest were using laptop or desktop PC. Most of the students accessed the POC in public areas or at home. One student accessed the class from within a travelling vehicle. Most of the class feel that the content is similar to what they would have received in an actual class while 20.9% believe they are receiving less than 50% relative comprehension. This number correlates with the number of learners using mobile devices. The small mobile phone screens and ergonomics of holding the phone in prolonged period may be a factor affecting comprehension. After experiencing the POC of an online streaming class, 25% were on the fence on this, while 29% have a more positive preference. 12.5% prefer physical class to streaming. The learners commented that they felt excitement since it's something new but a lot of distractions. They found it hard to interact with the class with only text chat. It is a good alternative if a class in unable to be conducted physically. It is also suggested that the instructor's face remains visible and lecture content handouts be given prior to the class.

4.   ANALYSIS AND FINDINGS
4.1. MOOC InSIDE: Interactive Synchronous Immersive Distance Education Model

MOOC Interactive Synchronous Immersive Distance Education, or InSIDE is an updated model of MOOC with an additional layer of synchronous, interactive and immersive components as illustrated in Figure 3. These components are complimentary but not compulsory, and able to scale down or "fail gracefully" if needed.
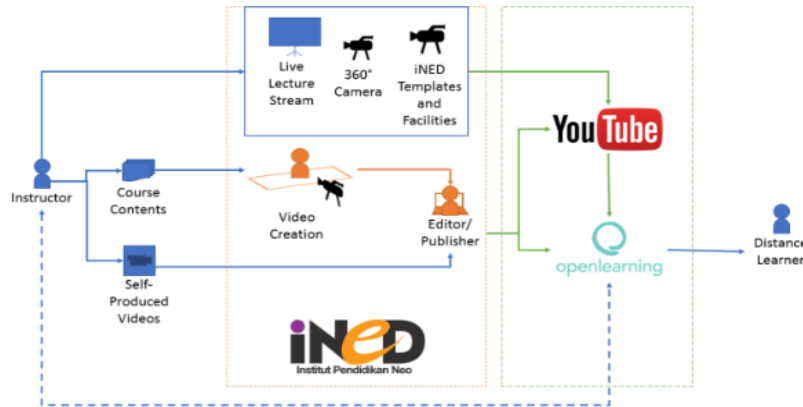
Figure 3. InSIDE: Addition of Immersive and Synchronous Component in Existing MOOC

4.1.1. MOOC InSIDE: Interactive, Synchronous and Immersive Component

Current MOOC implementation already have interactive component, but it is asynchronous. Ideally the interaction can be synchronous or real-time in the form of a moderated live chatroom, preferably with discussion threads. The MOOC class can be held at relatively at the same time as the physical class is being conducted. The immersive component allows the learner to be immersed virtually in the class.

4.1.2. MOOC InSIDE: Go High, Fail Gracefully

This concept allows MOOC InSIDE to still be able to operate, even if some of its components removed. In an ideal situation, the components work together alongside with the existing MOOC platform.

4.1.3. MOOC InSIDE: Ideal Implementation

As shown in Figure 4, ideal implementation of MOOC InSIDE enables the physical class to be conducted normally, while allowing the distance learner to join in online. The instructor could focus on delivering the instruction to the learners, while being recorded and streamed by a 360° camera. directly over the internet to the MOOC portal and its chosen video services. Discussions should be handled by moderators and escalates it to the instructor if needed. The video and discussions are also being recorded by their respective platforms.
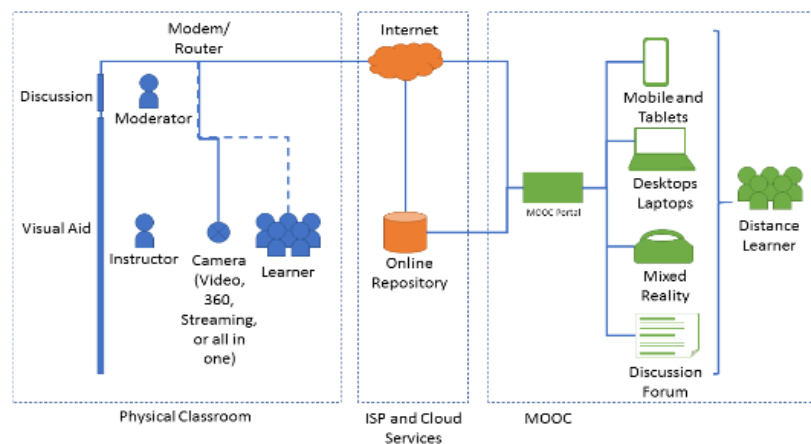

Figure 4. MOOC InSIDE - Ideal Implementation

4.1.4. MOOC InSIDE: Non-ideal implementation A

If a moderator is not available, the role of the moderator is passed to the instructor as shown in Figure 5. This can be done in intervals, where the instructor can take time off to check the discussion board.
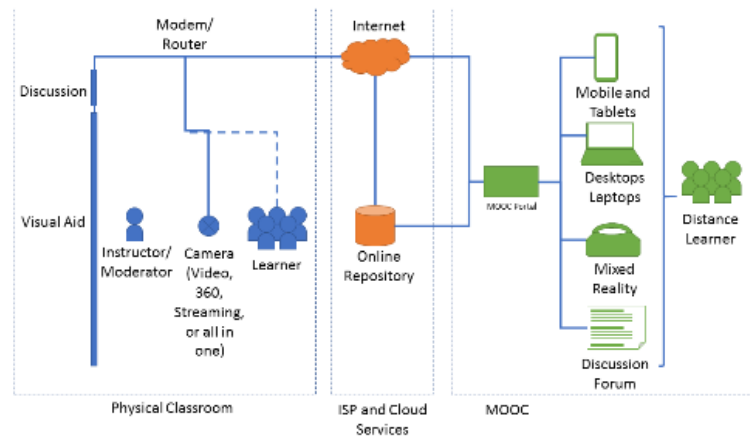
Figure 5. MOOC InSIDE: Non-ideal Implementation A

4.1.5. MOOC InSIDE: Non-ideal implementation B

In this non-ideal implementation, the moderator and the immersive component is not available. The class is still accessible via other mediums such as PC and mobile devices, as shown in Figure 6.
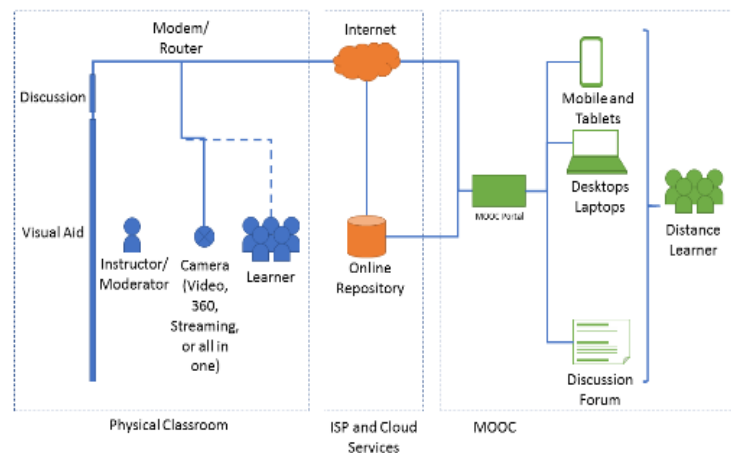

Figure 6. MOOC InSIDE: Non-ideal implementation B

This is quite the norm in many streaming presentations today. While Mixed Reality is gaining acceptance nowadays, it's still considered niche.

4.1.6. MOOC InSIDE: Non-ideal implementation C

In this non-ideal implementation, the moderator, immersive and streaming component is not avaiolable, illustrated in Figure 7. While the video is recorded live, the distance learner accesses the recording, similar to current implementation of MOOC, only that the recording of the video is done instantaneously as the physical class.
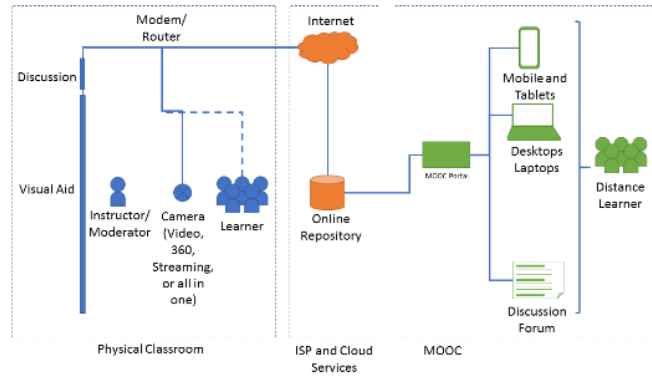
Figure 7. MOOC InSIDE: Non-ideal implementation C

4.1.7. MOOC InSIDE: Non-ideal implementation D

In this non-ideal implementation, only the visual aid is being streamed and recorded as video. The audio is also being streamed to accompany the visual aid as shown in Figure 8.
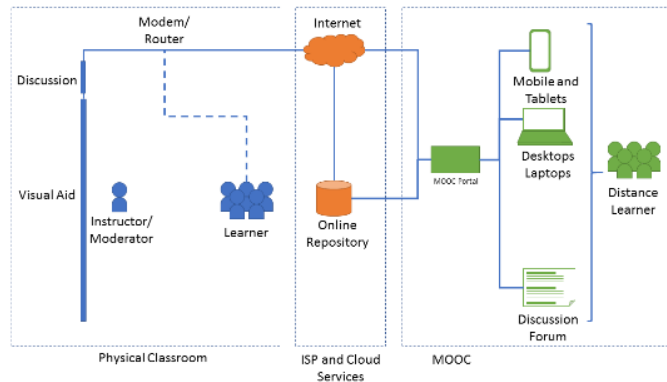

Figure 8. MOOC InSIDE: Non-ideal implementation D

4.2. Expert Validation

To validate this model, several experts were approached, and briefed on the model. The experts are chosen from enablers of MOOCs. 2 out of 3 agree that MOOC learning and teaching experience can improve with adding live streaming (synchronous) content. One have concerns about existing infrastructure. All experts agree that having a moderator to handle the online interactions improves both learning and teaching experience. Only 2 agreed online interactions during class can improve learning and teaching experience while one of them have reservations. The experts agree with reservations on adding immersive videos to MOOC implementations. One notes that it will bring additional value to the MOOC itself. All agree that the suggested addition to MOOC is in line with the visions and aspirations of the Ministry of Education and UiTM for MOOC. One also believes this could increase the value of the whole MOOC endeavour. However, they all feel that the underlying infrastructure still needs to be upgraded. As for the inclusion of 360° videos, experts believe it depends on the course itself, as some course does not improve whether it's displayed on a 360° video or not.

5. CONCLUSIONS AND RECOMMENDATIONS

MOOC is a very valuable tool that democratizes education. UiTM has shown keen interest in developing MOOC, with the rapid expansion of the courses offered. There is even intention to have MOOC as not only an additional learning method, but as an alternative to a normal class altogether. However, from the literature review, interviews and proof of concept, especially taking into consideration the future plans for MOOC in UiTM, there is a potential for MOOC to be improved with interactive synchronous and immersive contents.

This thesis has a limited scope, only looking at UiTM's implementation. Other educational institutes may have their own specific issues. Cultural and societal impact was also not taken into account. Should this model is chosen to be adopted or considered; these elements should be looked into within the new parameters.

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