FUZZY ANALYTIC HIERARCHY PROCESS APPROACH: UNCOVER THE MOTIVATING GAMIFICATION ELEMENTS FOR MASSIVE OPEN ONLINE COURSES (MOOCS)

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Bachelor of Science with Honours (Cognitive Science) 2017
UNIVERSITI MALAYSIA SARAWAK

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Final Year Project Report ☒
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FUZZY ANALYTIC HIERARCHY PROCESS APPROACH: UNCOVER THE
MOTIVATING GAMIFICATION ELEMENTS FOR MASSIVE OPEN ONLINE
courses (MOOCS)

LING NIE HUI

This project is submitted
in partial fulfilment of the requirements for a
Bachelor of Science with Honours
(Cognitive Science)

Faculty of Cognitive Sciences and Human Development
UNIVERSITI MALAYSIA SARAWAK
(2017)
The project entitled “Fuzzy Analytic Hierarchy Process Approach: Uncover the Motivating Gamification Elements for Massive Open Online Courses (MOOCs)” was prepared by Ling Nie Hui and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfillment of the requirements for a Bachelor of Science with Honours (Cognitive Science)

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Date: 16 June 2017

Grade

A
ACKNOWLEDGEMENTS

Throughout an intensive two semesters, now is the moment to write this note of thanks as the finishing touch on my thesis. Writing this thesis has had big impact on me which not only provided a learning opportunity in the scientific arena, yet also on a personal level. Knowledge indeed the key acquisition from writing this thesis, but the skills in time, zeal, and passionate managing were the biggest rewards as well. Thus, I would like to reflect on the people who have helped and supported me academically and mentally throughout this period.

First and foremost, I would like to express my highest gratitude to my most respected supervisor, Associate Professor Dr. Chen Chwen Jen for all the dedicative guidance and constructive comments for aiding me in this thesis writing. Apart from that, I would like to thank again my supervisor for always being the way she is which constantly acting as my inspiration whenever I felt the overloading tiredness when conducting this study. This is an indescribable inspiration that how amazing a woman could be so all-rounded in terms of her brilliantness, wonderfulness, and beautifulness. Also, thank you for all the ever-said impressive words towards me regardless whether in the Computer Graphic and Research Method classes previously taught by her or the period that under her supervision. All these were developed my inner strength to extent my best for this study.

Additionally, I would love to thank my family and friends who supported me unconditionally along the journey of my study. For my family, I would like to thank my beloved parents for offering the emotional and financial supports for me to conduct the study. Without them, I am not be able to pursuit my studies especially to complete this study. For my friends, I would love to appreciate Daniel Sim Yang Yii, Jessica Yang Hueh Yeing, Pearly Oh Bei Qing,
Lim Sing, Ling Mee Yien, and Wong Wan Ting for always lending their unconditional helping hands to me during conducting this study and taking care of me when I was too devoted in my thesis writing.

Apart from that, I would like to thank all the participants involved in my study. Thank you so much for the willingness to spend the time with me during the data collection phase of the study. Without them, I would not be here to write this finishing touch on my thesis.

Last but not least, I would like to appreciate all the other lecturers, batchmates, and staffs of UNIMAS to help me throughout the way of accomplishing my thesis.
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ABSTRACT

The evolution of education in this digital age has made educational technology especially distance education to be tremendously prevalent. From this perspective, Massive Open Online Courses (MOOCs) have arisen as popular trend in educational technology. Yet, many studies found that this new trend of education delivery has shown outlandishly low retention rate. Accordingly, there are large-scale of studies have conducted to examine the reason of this occurrence but most of the researchers have overlooked the motivational affordances which are one of the main contributions to the learner retention rate in distance learning. This study intends to uncover the motivating gamification elements for MOOCs by assessing four different ARCS dimensions which namely as Attention, Relevance, Confidence and Satisfaction. Fuzzy Analytic Hierarchy Process Approach (FAHP) was implemented as the methodology of this study. This study conducted with 120 participants. The study revealed that the top three most attentive gamification criteria are named as acknowledgement, avatar, and time limit; the top three relevance-driven gamification criteria are namely level, badge, and acknowledgement; the top three most confidence-driven gamification criteria are known as point, badge, and cooperation; and lastly the top three most satisfaction-driven gamification criteria are called leaderboard, opponent, and badge. In sum, discussion has made on the results and subsequently the guidelines for developing a gamified MOOC are constructed in each respective section.

Keywords: Massive Open Online Courses, Motivation, Gamification, Fuzzy Analytic Hierarchy Process Approach, Attention, Relevance, Confidence, Satisfaction model
ABSTRAK

CHAPTER 1
INTRODUCTION

Overview

The purpose of this study is to uncover the motivating gamification elements for MOOC via Fuzzy Analytical Hierarchy Process (FAHP) approach. This chapter overall discusses about the background of the study, research problem, aim and objective, research questions, research hypothesis, definitions of terms, conceptual framework, significance of the study and scope of the study.

Background of the Study

The rapid co-evolution of technology in learning provides a new manner to represent knowledge, new educational practice, and new global community of learners (Goodyear et al., 2004). For instance, the learning material today is able to present in various ways such as electronic written text document, electronic diagram illustration, tutorial video, augmented reality 3D animation demonstration and so on. To describe this phenomenon, the umbrella term of Technology Enhanced Learning (TEL) is then announced.

Recent, an innovative way of TEL has been introduced - Massive Open Online Courses (MOOCs). MOOCs is a well-known acronym that justifies the virtual learning courses that are open, free to access, consist of wide range of open curriculums and promote interactive social learning (Kesim & Altinpulluk, 2015). Similarly, the studies of Cormier and Siemens (2010) and Kop and Carroll (2011) defined MOOCs as the web-based courses available for free to any intended learner regardless their geographical location and time boundary. Furthermore, Abeer and Miri (2014) stressed that although MOOCs offer free enrollment for learners yet the learning materials are undeniably certified and adhered to high quality in which the materials are retrieved from elite universities. Particularly, the
representative universities that offer MOOCs are Monash University from Australia, Duke University from United States, Shanghai Jiao Tong University from China, Georgia Institute of Technology from United States, Yonsei University from Korea, Yale University from United State, Stanford University from California, and a lot more.

MOOCs are contemporary scenario and also a hot topic since year 2008, it begins from the first developed MOOC by Stephen Downes and George Siemens and today, there are more than two billion MOOC participants in this world (Miller, 2015). It is unquestionably that MOOCs have gained a lot of attention in the field of education or in TEL in which MOOCs have been declared as the most promising form of teaching in this digital age (Bousbahi & Chorfi, 2015). Besides, the commentators stated that “Nothing has more potential to lift more people out of poverty… Nothing has more potential to unlock a billion more brains to solve the world’s biggest problems… than massive open online courses (Christensen et al., 2013, p.2).”

Other than the bright sides, it also emerges a lot of doubts and critics toward MOOCs. The most profound downside of MOOCs is regarding to its consistently high drop-out rate, which is consistently as higher as 90 percent (Jordan, 2014; Parr, 2013; Rivard, 2013). This figure would be astoundingly high for a traditional course and also has been used to cast doubt on the promise of MOOCs (Rivard, 2013). This situation seems to be hesitated because the courses provided in MOOCs are free of charge, not compulsory in the enforced prerequisites for enrolling the MOOC and not limited in the physical and social boundaries. Consequently, many related studies were conducted to investigate the factors that affecting MOOC retention.

In the context of learning, motivation acts as an important criteria to facilitate the learning processes, to accomplish learning goals, and to keep moving towards self-directed learning (Lin & McKeachie, 1999). Accordingly, various ways have been introduced to
promote learner's motivation. Gamification is one of the ways to deal with the problem of learner's motivation. In general, gamification refers to a process of improving practices with the aid of motivational affordances as to raise gameful user experience in non-gaming context (Hamari, 2013; Huotari & Hamari, 2012). Therefore, various studies suggested that the implementation of gamification elements into MOOC is a potential solution to address the high drop-out rate in MOOC (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011; Dicheva, Dichev, Agre, & Angelova, 2015; Muntean, 2011). For a learner to successfully accomplish the full sense of motivation, Keller (1987) proposed an instructional model known as ARCS model described that there are four crucial components as the main contribution for full sense of motivation: Attention, Relevance, Confidence, and Satisfaction. These four components play their alternative roles to offer a useful assistance to both instructional designer and teacher for systematically developing learning motivation.

Particularly, Chang and Wei (2016) highlighted that the selection of appropriate gamification elements is a multiple-criterion decision-making (MCDM) problem. Apart from that, previous studies regarded the analytic hierarchy process (AHP) is an ideal methodology to solve the MCDM problem (Kim & Nevo, 2008; Kousalya, Reddy, Supraja, & Prasad, 2012). AHP approach was introduced by Saaty to solve a complex decision problem by using multilevel hierarchical structure of objectives, criteria, sub criteria, and alternatives. Then, the decision maker compares the importance of each criterion of the problem in pair-wise manner which is organized in matrices. In fact, AHP method not solely facilitates arriving at the best decision, yet also offers a clear rationale for the choice made (Ali, Sabri, Noor, & Ismail, 2012). Therefore, the decision maker also can use the computed rationale to rank the choice's sub-criteria. Yet, the complex problem such as MCDM often deals with uncertainty and vagueness which are a common scenario happens in human judgment. Hence, fuzzy
logic technique is introduced to associate with AHP approach to act as a powerful tool to solve the MCDM that consists of human fuzziness.

On the whole, it will be intuitive to explore the motivating gamification elements for MOOC via fuzzy AHP approach.

**Problem Statement**

Education transformation happened in recent decades brings the higher educators and learners to pay a great attention on MOOCs. Yet, many recent studies claimed that this MOOC fever seems to be cooling, and it has been reflected from the constantly high drop-out rate in MOOCs in recent years (Gamage, Fernando, & Perera, 2015; Hone & Said, 2015; Yousef, Chatti, Schroeder, & Wosnitza, 2014). Similarly, Reich (2014) also pointed out that there are 2 to 10% rate of completion captured steadily throughout these recent years in MOOCs. Therefore, the reason of this phenomena is worth an additional investigation as to ensure MOOCs is an applicable teaching and learning platform in higher education.

Learning motivation is indeed a crucial factor that contributes to the retention rate in MOOCs (Chang & Wei, 2016; Keller, 1987; Xiong, Li, Kornhaber, Suen, Pursel, & Goins, 2015; Willems, et al., 2014). There are many empirical studies studied about the pedagogical challenges in MOOCs (Yousef, Chatti, Schroeder, & Wosnitza, 2014) and the technological issues in MOOCs (San Jose State University, 2016; Yousef, Chatti, Schroeder, & Wosnitza, 2014). These studies emphasized on different external aspects that can be potentially affected the retention rate in MOOCs. Yet, the internal motivation aspect of the MOOCs learners rarely being investigated in depth.

On the other hand, few studies suggested that the incorporation of gamification elements in MOOCs could be a useful mechanic to enhance learner’s motivation (Deterding, Sicart, Nacke, O’Hara, & Dixon, 2011; Dicheva, Dichev, Agre, & Angelova, 2015; Muntean, 2011; Skiba, 2013; Willems et al., 2014). Yet, this fundamental idea of gamification has not
been explored in depth since the appropriate motivating gamification elements for MOOCs have not been clearly identified. In fact, MOOC developer also tends to overlook the role of gamification in learning motivation when participating in MOOCs.

Apart from that, there are emerged many types of gamification elements, but some of these elements are only suitable for non-educational field. Willems and his colleagues (2014) asserted that the challenges for developing a gamified online learning environment is to select the appropriate elements in beneficial way since the wrong selection can potentially harm the learning experience or even demotivate learners. Since there is no one-size-fits-all solution so the selection of appropriate and motivating gamification elements should be taken into consideration. Hence, it would be insightful to uncover the motivating gamification elements for MOOCs.

Objectives

General Objectives

The main objective is to uncover the motivating gamification elements for MOOC.

Specific Objectives

1. To derive the motivating gamification elements that are appropriate for MOOCs.
2. To incorporate the fuzzy analytic hierarchy process (FAHP) approach to examine the relative ARCS motivational aspects of the gamification elements for MOOCs.
3. To propose guidelines for implementing the motivating gamification elements for MOOCs based on the evaluation of the gamification elements determined by FAHP approach.
Research Question

1. What are the suitable gamification elements for MOOCs?

2. How can the FAHP approach be incorporated into the process of determining the relative ARCS motivational aspects of the gamification elements for MOOCs?

3. What are the guidelines for choosing types of motivating gamification elements for MOOCs?

Conceptual Framework

![Diagram](image)

Figure 1. Conceptual Framework.

Significance of the Study

The implication for this particular study is that this study will produce a list of guidelines for selecting appropriate motivating gamification elements based on FAHP approach which regarding to learners' preferences. Consequently, the guidelines are significant to MOOC designers and developers, particularly for those who intends to develop motivating gamified MOOC by incorporating the gamification elements. As a result, the guidelines of motivating gamification elements for MOOCs also act as a tool to assist the MOOC designers and developers in developing a gamified MOOC.
Scope of the Study

Due to the time and geographical constraints, this study was conducted on the MOOC learners with accessible characteristics which was only limited to undergraduate students in Universiti Malaysia Sarawak (UNIMAS). Apart from that, this study was attempted to access the MOOC learner’s perception on the motivational affordance of the gamification elements based on solely the gamification elements derived by the researcher in the earlier stage of the study. Therefore, the results obtained cannot be generalized to beyond the context of this study.

Definition of Terms

Conceptual:

**Massive Open Online Courses (MOOCs)** literally illustrate the courses which allow to undertake large number of participants, in this case, massive number of learners to access at anywhere that has internet connection. Additionally, learner that participates in the MOOC has no restrictions on their entry educational background and qualification, it is open for those knowledge hunter, lifelong learner and even physical disabled people to take complete course for free (OpenupEd, 2015).

**Gamification** demonstrates an application that utilizes the game concept in a non-gaming context (Willems et al., 2014). This application is majorly incorporated in business and education as to motivate high productivity in either employee or learner. The implementation of gamification elements in non-gaming context is to enhance user experience (UX) and user engagement (Deterding, Sicart, Nacke, O’Hara, & Dixon, 2011).

**Motivation** in Turner (1995)'s point of view is the attribute that promotes a living entity to do or not to do something.
Attention, Relevance, Confidence, and Satisfaction (ARCS) Instructional Model

was proposed by Keller (1979) in response to a desire to look for effective way of promoting learning motivation. This model basically comprises of four important motivational-related dimensions which are namely Attention, Relevance, Confidence, and Satisfaction. By stimulating these four dimensions, a full sense of motivation can be systematically be generated.

Multiple-criteria Decision-making (MCDM) is a process of identifying or choosing alternatives described in terms of goal-related evaluative criteria and sub-criteria. This process can be done by ranking the evaluated criteria and sub-criteria (Ali, Sabri, Noor, & Ismail, 2012).

Fuzzy Analytic Hierarchy Process (FAHP) emerges as the solution to solve the MCDM problem which is a hybrid technique of fuzzy logic and analytic hierarchy process. Fuzzy analytic hierarchy process decomposes a complex MCDM problem into hierarchy structure that consists of decision elements such as goal, criterion, sub-criterion, and alternatives of the MCDM problem, computes the local and global weights of the criterion and sub-criterion, and adopts human fuzziness to deal with uncertainty in human judgment (Ali, Sabri, Noor, & Ismail, 2012).

Gamified MOOCs are a combination term of “gamification” and “MOOCs”. This phrase has been coined in recent decades and aimed to stimulate motivation and engagement of MOOCs’ participant (Willems et al., 2014).
Summary

This chapter described about MOOCs and gamification elements are the main area of the study and Fuzzy Analytic Hierarchy Process methodology will be the main methodology implemented in this study. Additionally, the significant of the gamification elements in MOOC learner’s also being emphasized. Lastly, the definition of terms that are used in this study also being listed.
CHAPTER 2
LITERATURE REVIEW

Introduction

In this chapter, past similar studies and findings will be discussed in terms of eight major themes which are namely Massive Online Learning Courses (MOOCs), Challenges of MOOCs, Gamification, Gamification and Learning, Gamification, MOOCs, and Types of Interactions, Attention, Relevance, Confidence, and Satisfaction (ARCS) Instructional Design Model, Fuzzy Analytic Hierarchy Process (FAHP), FAHP Methodology, and Attention, Relevance, Confidence, and Satisfaction (ARCS) Motivational Instructional Model.

Massive Open Online Courses (MOOCs)

Indeed, there is no doubt to mention that information and communication technologies (ICTs) have influenced a wide scope of landscapes in this generation. One of the most ICTs-influenced landscapes would be today’s educational landscape (Kesim & Altinpulluk, 2015). There are numerous educational technologies existed over the decades, in which it started from a very simplified keyboard invented by August Dvorak as to facilitate the process of learning until nowadays’ well-established open learning platforms (Mikropoulos, Sampson, Nikopoulos & Pintelas, 2014). Spyropoulou, Demopoulou, Pierrakeas, Koutsonikos and Kameas (2015) highlighted that Open Learning intuitively works out in education such that it not only opens up opportunities to the collaboration among higher institutions, instructors and learners, yet also promotes self-regulated learning and life-long learning.

In particular, Massive Online Learning Courses (MOOCs) considered as the most remarkable movements within distance and open education, in which it literally brings the concept to describe a platform as “to offer free and open access courses for massive number
of learners from anywhere all over the world” (Yousef, Chatti, Schroeder & Wosnitza, 2014, p.44). MOOCs also been announced as a new technology enhanced learning (TEL) approach in higher education these years and gained a lot of attention around the globe (Yousef, Chatti, Schroeder, Wosnitza, & Jakobs, 2014).

Generally, the acronym MOOC mainly refers to xMOOC, which means the professor-centric massive courses which illustrate a “sage-on-the-stage” instructional design. Basically in MOOCs system, instructor involves in video presentation to teach the course while student enrolls in that particular course follows their coursework schedule at their own learning pace (Mangelsdorf, 2012). The MOOCs permit the participants to enroll in any course they seem interesting, conduct assignments and quizzes, also recommend a period of time to complete their course after them signing in as a member of the course. The pedagogical design of MOOCs is highly influenced by the cognitive-behaviorism and involved partly in social constructivism (Rodriguez, 2012). Moreover, MOOCs are very similar to traditional university courses which these courses transformed virtually into MOOC. Yet, the main objective for the learner to enroll in MOOCs is to learn the subject matter rather than attain credits or recognitions since the completion of the course does not offer any formal diploma or degree certification (Masters, 2011). Although all the MOOCs courses shared a lot of similarities, yet different MOOC sites have distinct operation strategies (Kesim & Altinpulluk, 2015). This is revealed by enrollment of course in Coursera, the learner should follow the sequence of pre-determined schedule but for Udemy platform, it does not have specific restriction. Therefore, there are existing studies pointed out that MOOC pedagogy cannot be evaluated as a genre, but each of them required to be investigated individually (Daniel, 2012).