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WEB CONTENT QUALITY MODEL FOR MASSIVE OPEN ONLINE COURSE

AHMAD WIRAPUTRA BIN SELAMAT

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WEB CONTENT QUALITY MODEL FOR MASSIVE OPEN ONLINE COURSE

By

AHMAD WIRAPUTRA BIN SELAMAT

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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I dedicate this thesis to:

My late father

The Great Revolutioner

Almarhum Selamat
Ahmad Kamal Alang

My loving mother

Hajah Zaleha Baseri

My beautiful wife

Fetty Azlina Nor Hashim

My lovely children

Putri Kasih Amanda

Ahmad Rayyan Rizqi

Ahmad Riyadh Rifqi

Ahmad Raif Aysar

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the Degree of Doctor of Philosophy

WEB CONTENT QUALITY MODEL FOR MASSIVE OPEN ONLINE COURSE

By

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March 2021

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Faculty : Computer Science and Information Technology

Despite its popularity and acceptance since introduced in 2008, the Massive Open Online Course (MOOC) has faced a number of criticisms regarding its content weaknesses such as lack of clarity, unstructured, poor design and ignorance of learner's diversity. This is due to the lack of understanding among content providers about the quality aspects that contribute to web content. There are number of previous efforts to improve the quality of MOOC, but none were focused on the web content quality from the view of content providers or experts. As a result, most of the internal quality factors were neglected while the operational definition for the MOOC content quality factors is not well-defined. Therefore, this research proposes a web content quality model for MOOC to be referred by the content provider to develop quality MOOC content. In addition, it is as guidance to determine the quality of a MOOC web content. The model which is based on 7C's Model for Learning Design Framework was initially developed with the determination of quality factors derived from content analysis involving systematic review on literatures, quality factors combination and categorization. The model was then validated by content providers and experts, which involved content validity test, pretesting and survey on acceptability. Data was analyzed using the Rasch Model on its ability to simplify measurement by converting ordinal data to intervals, besides anticipates data fitness statistically. The analysis showed that 52 quality factors along with nine categories were accepted in determining the web content quality for MOOC. In order to measure the model acceptance in a real-world application, the tool which automates the analysis and evaluation of the web content quality for MOOC based on the quality model was developed named MOOC Content Quality Assessment Tool (MOCQAT). MOCQAT was utilized by 42 stakeholders in UPSI as a case study before their acceptance was confirmed through the technology acceptance test. As a contribution, this research produced a comprehensive web content quality model for MOOC along with the definitions and measurement attributes from the perspective of content providers and experts, which is the first to be developed. The acceptability of the model by stakeholders is also proven by the development and technology acceptance test of MOCQAT.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

MODEL KUALITI KANDUNGAN WEB BAGI KURSUS ATAS TALIAN TERBUKA DAN BESAR

Oleh

AHMAD WIRAPUTRA BIN SELAMAT

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Pengerusi : Wan Nurhayati Wan Ab. Rahman, PhD
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Di sebalik populariti dan penerimaannya sejak diperkenalkan pada tahun 2008, Kursus Atas Talian Terbuka Besar (MOOC) turut berhadapan kritikan berkaitan kelemahan kandungannya seperti ketidakjelasan, ketidaktersusunan, kelemahan reka bentuk serta pengabaian terhadap aspek kepelbagaian pelajar. Perkara ini disebabkan kurangnya pemahaman terhadap faktor kualiti yang menyumbang kepada kandungan web. Pelbagai usaha dan kajian telah dilaksanakan untuk meningkatkan kualiti MOOC, tetapi tiada yang menjurus kepada kualiti kandungan web dari perspektif penyedia kandungan atau pakar MOOC sendiri. Akibatnya, kebanyakan faktor kualiti dalaman telah diabaikan, selain definisi operasi yang tidak ditetapkan dengan baik. Oleh yang demikian, kajian ini mencadangkan sebuah model kualiti kandungan web bagi MOOC sebagai rujukan kepada penyedia kandungan dalam membangunkan kandungan web MOOC. Selain itu, ia menjadi panduan dalam menentukan kandungan web MOOC yang berkualiti. Model yang berasaskan kepada Kerangka Reka Bentuk Pembelajaran 7C ini dikembangkan dengan penentuan faktor kualiti hasil dari proses analisis kandungan yang melibatkan tinjauan sistematik terhadap literatur, kombinasi faktor dan penetapan kategori. Model ini kemudian ditentusahkan oleh penyedia kandungan dan pakar MOOC, yang melibatkan proses-proses seperti ujian kesahan kandungan, pra pengujian dan tinjauan penerimaan. Analisis data dibuat menggunakan Model Rasch yang terbukti mempermudah pengukuran dengan mengubah data ordinal kepada interval, selain penentuan kesesuaian data secara statistik. Hasilnya 52 faktor telah diterima sebagai penentu kepada kualiti kandungan web bagi MOOC yang dibahagikan kepada sembilan kategori. Untuk menguji penerimaan model ini dalam persekitaran sebenar, sebuah aplikasi yang bernama Alatan Penilaian Kualiti Kandungan MOOC (MOCQAT) telah dibangunkan. Alatan ini diujicuba oleh 42 pihak berkepentingan di Universiti Pendidikan Sultan Idris sebagai kajian kes, sebelum penerimaan mereka dinilai melalui ujian penerimaan teknologi. Model kualiti kandungan web bagi MOOC dari perspektif penyedia kandungan dan pakar adalah yang pertama dibangunkan. Sumbangan kajian ini adalah

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penghasilan sebuah model kualiti kandungan web bagi MOOC yang komprehensif, selain dilengkapi definisi operasi serta atribut pengukuran. Kebolehterimaan model oleh pihak berkepentingan juga dibuktikan melalui pembangunan MOCQAT serta ujian penerimaan teknologi ke atasnya.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

CMOOC	Connectivist Massive Open Online Course
FCM	Factor-Criteria-Metrics Model
IEC	International Electronically Commission
ISO	International Organization of Standardization
MNSQ	Mean Square
MOOC	Massive Open Online Course
MOCQAT	MOOC Content Quality Assessment Tool
PDCA	Plan-Do-Check-Action Model
PMC	Point Measure Correlation
TAM	Technology Acceptance Model
XMOOC	Extended Massive Open Online Course
ZSTD	Z Standard

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CHAPTER 1

INTRODUCTION

1.1 Background

Massive Open Online Course (MOOC) has become a popular online teaching and learning medium of instruction since its introduction in 2008, hence considered by education experts as a “revolution in education”. As a platform that allows people around the world to access varieties of learning materials on a large scale, the concept has been trusted by a number of higher learning institutions and organizations in delivering and disseminate knowledge with barely minimum cost, yet ubiquitous and comprehensive (Gaebel, 2013). The main philosophy of MOOC is to provide participants with learning materials from any institution or organization through online access. Learners are not only capable to enhance their knowledge through the concept of lifelong or informal learning, but also formally by obtaining certification or recognized credentials (Hone and El Said, 2016). As of 2019, the number of MOOC participants has reached 101 million with 11400 courses worldwide. Google Trends shows that the peak for MOOC was in 2013 and the popularity pattern has been consistent to date as shown in Figure 1.1.

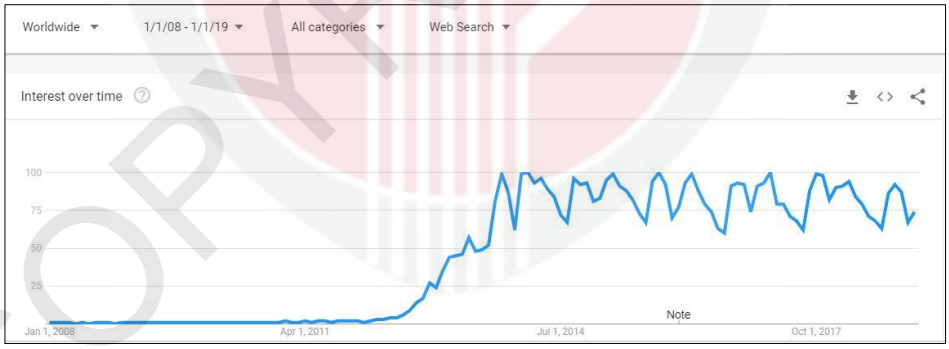

Figure 1.1 : The Popularity of MOOC by Year (Google Trends)

Many institutions and organizations started to adapt MOOCs in their curriculum and strategic planning (Onah, Sinclair and Boyatt, 2014). Malaysian Ministry of Education (MoE) for instance places MOOC as education premier agenda by fully recognizes its credentials and certification by the year 2025 (KPM, 2013). Indian government looking forward to MOOC implementation by the launch of Study Webs of Active-learning for Young Aspiring Minds (SWAYAM), which provides an integrated platform and portal for online courses, covering all higher education, high school and skill sector courses (Kanjilal and Kaul, 2016). On the

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other hand, the MOOC platform FutureLearn is partnering with British Council to offer free or premium certification of achievement for learners in 36 developing countries. This measures reflect the trust of certain government's bodies and organizations in the MOOC to enhance the knowledge and competitiveness of their people. In other words, MOOCs have prompts a broad discussion on the use of technology-based modes of teaching and learning in formal higher education and continuous professional development (CPD), as well as initiatives to open up education along with the encouragement of lifelong learning (Jansen, Rosewell and Kear, 2016).

Despite widespread acceptance, MOOC also faced number of criticisms related to course delivery weaknesses, poor learner-instructor communication and other technical concerns. However, the main issue identified in the last five years is leaning towards MOOC web content's lack of quality (Jansen, 2016) (Goh, Ayub, Wong and Lim, 2018) (Salmon, Pechenkina, Chase and Ross, 2017). The importance of MOOC web content have been highlighted by Hone and El Said (2016) and Markova, Glazkova and Zaborova (2017), which proved that structured and clear-design content contributes to the learner's retention in the platform. Web content is also the main element that keep the learner's trust in the MOOC credibility (Costello, Brunton, Brown and Daly, 2018). Besides, Espada, Rodriguez, Garcia-Diaz and Crespo (2014) state that content personalization is one of the major attractions that motivates learners to join MOOC, where they have the capacity to choose the material they want to access and learn. This is strengthened by the fact that course completers are interested to engage with the course content, along with their engagement in discussions or forums (Sunar, White, Abdullah and Davis, 2016). Uppal, Ali and Gulliver (2018) point out the web content quality is a non-temporal and non-perishable product, which need to be protected.

Various quality models have been proposed to fulfil the gap such as 7C's Learning Design Framework by Conole (2016), OpenupEd Quality Label (Jansen et al., 2016) and MOOCs Quality Reference Framework (Stracke et al., 2018). Nevertheless, such efforts proved to be insufficient as MOOC required more detail and structured works, besides taking into account the quality assessment in the context of software development. This is somewhat missed in the previously proposed model, as most of the quality criteria and assessment comes from the aspect of pedagogy. Clash of diverse technologies, different technological frameworks and designs due to the user's uniqueness require more specific quality development (Hood and Littlejohn, 2016). Hence, the quality model particularly for MOOC web content is demanded despite the number of existing MOOCs quality models, suited with the philosophy of "one size does not fit all" (Jasnani, 2013). Defining and measuring quality factors certainly assist content developer to understand the right facet of quality which subsequently improves the MOOC web content.

Therefore, this research proposes a web content quality model for MOOC from the perspective of content providers which takes into account both aspects of quality, external and internal. MOOCs learners and instructors definitely

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understand the functional external quality, but content providers have a better understanding of the internal qualities which is required during the development phase. Model development is customized according to standards in software engineering started with concept building, factors proposal, validation and real-world implementation.

1.2 Problem Statement

The issue of ill-developed MOOC web content has been raised by a number of researchers as depicted in Figure 1.2. For instance, Rushby and Surry (2016) and El Said (2016) pointed out that most of the existing MOOC content were unstructured and lack of clarity in term of objective and conceptual. While Jansen (2016) and Ayub and Yue (2017) are concerned about the existing content's poorly designed. Moreover, the web content for MOOC claimed to be lack of usability features, which caused by poor textual and graphical design (MOOC-Maker, 2016). Liu et al. (2016) added that most of it developed with "one-size-fits-all" principle, which ignore the diversity of participant in term of their educational background, locality and language. Despite the problems, there is a lack of research pertaining to the factors or criteria to define the quality of MOOC in the context of web content. The operational definitions (OD) and the quality dimension of MOOC web content are also not well-defined as mentioned by Girelli and Limon (2016). In addition, the existing proposals of MOOC quality dimension is too general and deviated from the context of content development (Xiao and Pardamean, 2016).

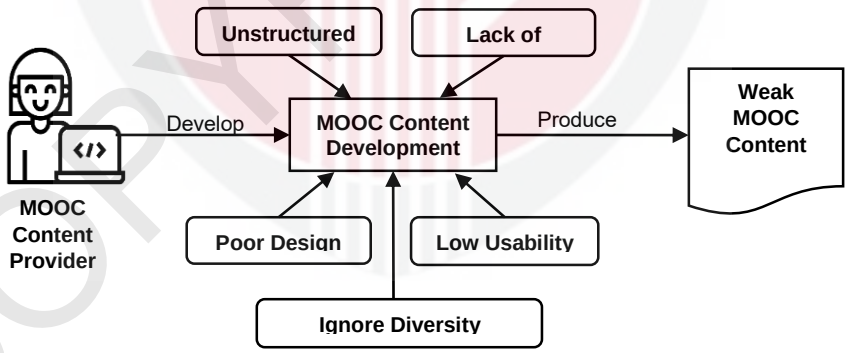

Figure 1.2 : The Issue of MOOC's Content Weaknesses

There have been enormous efforts to improve the quality of MOOC through the development of frameworks and models such as proposed by Jansen et al. (2016), but none were focused on the development of a web content quality model as supported by Joksimović et al. (2018). Lederman (2019) added that existing MOOC models ignored the openness and democratization of MOOC content, while Hood and Littlejohn (2016) concern about the lack of emphasizing

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on the diversity of MOOC stakeholders. Besides, the previous MOOC's quality models developed mostly from the learner's perspective and less from the view of the content providers and experts (Margaryan, Bianco and Littlejohn, 2015). As a result, most of the MOOC content quality proposals focused on the external quality factors, while internal factors such as maintainability and portability are less emphasized.

There is also a lack of research pertaining to the acceptance measurement for the existing MOOC models and frameworks in the real-world environment, particularly in web content quality. Most have not been practically tested and their acceptance among users has never been evaluated. Moreover, the absence of tools developed by theoretically proposed quality factors causes difficulties to the MOOC stakeholders in measuring web content quality as supported by Olsina and Rossi (2002).

1.3 Research Question

In order to solve the mentioned problems, these are the questions that need to be answered in this research:

RQ1: What are the factors and categories that determine a web content quality for MOOC?
RQ2: How the developed model can be validated so that it covers all the web content qualities required for MOOC?
RQ3: What is the level of acceptance among stakeholders to the model in real-world application?

1.4 Research Objective

The main objective of this research is to introduce a web content quality model for Massive Open Online Course (MOOC) from the perspective of content providers and experts. The specific objectives are as follows;

i. To determine the web content quality factors and categories for MOOC
ii. To validate the proposed web content quality factors and categories for MOOC along with its definitions by content providers and experts
iii. To measure the stakeholder's level of acceptance to the model in the real-world application through the development of MOOC content quality assessment tool.

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1.5 Research Scope

The aim of this research is to develop the web content quality model for MOOC from the perspective of content providers and experts. Besides, the definitions are also defined along with the measurement attributes for each quality factor. A study on the quality factors that refer to the MOOC web content was made on related research papers between 2010 to 2018. For the validation of the quality model including its definitions, there were 59 respondents who were mostly from Malaysian academics involved in the Content Validity Test. For the survey on acceptability, 47 respondents were selected and involved in structured interviews, conducted among content providers and experts from Malaysian higher learning institutions and platform developers. The validation process was carried out over a period of six months, which was between February to August 2019.

In order to measure the acceptance level of the model, a tool named MOOC Content Quality Assessment Tool (MOCQAT) was developed using throwaway prototyping model, along with the Model-View-Controller approach. Once developed, it was utilized by 42 stakeholders in UPSI as case study, which was conducted among content providers, instructors and learners. UPSI was chosen due to its reputation as a local educational university that develops and manages its own MOOC and e-Learning platforms, besides contributing a lot to the expansion of Malaysian MOOC courses. These factors justify them as having a clear experience and understanding of the MOOC concept itself. The purpose of case study approach is to gain a deeper understanding in particular types of cases and not to generalize the findings. The case study selection is also taking into account the researcher's limitation of resources, time and workforce.

1.6 Research Contribution

The main purpose of this research is to introduce a quality model required to develop a web content for MOOCs, which has never been proposed as stated in the problem statement. Therefore as a contribution, this research produced a comprehensive web content quality model for MOOC along with the definition and measurement attributes from the perspective of content providers and experts. It consists of quality factors gathered from the content analysis methods including systematic review, combination and categorization inspired by 7C's Learning Design Framework. The quality factors and categories were then validated by content providers and experts through the process of content validity test, pretesting and survey on acceptability. The model validation indicates that the 52 quality factors along with nine categories were accepted in determining the web content quality for MOOC.

The other contribution of this research is the MOOC Content Quality Assessment Tool (MOCQAT), which automates the rating and evaluation of MOOC content quality. The tool utilizes the factors and categories in the web content quality

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model for MOOC and developed through the throwaway prototyping model. Technology Acceptance Model (TAM) proves that the tool is acceptable among the MOOC stakeholders, as the probability of acceptance is between 98.92% to 99.88%. This test is implemented at UPSI as a higher learning institution that actively applies MOOC in teaching and learning as a case study. The test confirms the applicability of the tool and a model in the entire MOOC stakeholder's environment, not limited to the content providers and experts.

1.7 Thesis Organization

This thesis comprises seven chapters, including this chapter which covering the background of the study, problem statement, research objective, scope and research contributions.

Chapter 2 reviews literatures on the definition of quality, the importance of quality in web development, research related to software quality, web content quality and explanations that relevant to model to meet the research main objective, which is to develop the web content quality model for MOOC.

Chapter 3 describes the research methodology that comprises two main phases namely: (1) Phase 1: The development of web content quality models and (2) Phase 2: The development of a tool representing the model itself to test its acceptance among content providers, instructors and learners.

Chapter 4 explains the development of web content quality model for Massive Open Online Course (MOOC) in details.

Chapter 5 explains the development of MOOC Content Quality Assessment Tool (MOCQAT) in details.

Chapter 6 discussed the finding and result of model validation along with Technology Acceptance Test. Finally, chapter 7 present the conclusion and future works of this research.

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BIODATA OF STUDENT

Ahmad Wiraputra Bin Selamat was born on 19th March 1981 in Mentakab, Pahang Darul Makmur as the second child of four siblings. His father Selamat Ahmad Kamal Bin Alang and his mother Zaleha Binti Baseri both served as school teachers until their retirement. Ahmad Wiraputra received his primary education at Sekolah Rendah Abu Bakar (ABS), Mentakab before continuing his studies at Sekolah Menengah Kebangsaan Agama Tengku Ampuan HajjahAfzan (SMKATAHAP), Jerantut. After obtaining exquisite SPM result, he proceeded to Matriculation at Sekolah Menengah Tengku Muhamad Faris Petra Kelantan, before receiving an offer to Universiti Kebangsaan Malaysia (UKM) to pursue his Bachelor Degree in Computer Science.

After graduating in 2003 with Honours, he served as an Information Technology (IT) lecturer at the Kolej Teknologi Timur Sepang for four years, before moving to the Universiti Pendidikan Sultan Idris (UPSI) Tg Malim as an IT Officer from 2007 to now. He was then sponsored by UPSI to pursue his Master Degree in Software Engineering at Universiti Putra Malaysia (UPM) and graduated in 2012.

As the Head of E-Learning Unit at UPSI ICT Centre from 2010 to 2016, he was involved in planning, development and maintaining of e-learning system named MyGuru and university student information system. He has also led a number of development projects, one of it is UPSI's Massive Open Online Course (MOOC) platform called Open4Learn, besides actively involved in the development of courses, training and roadshows related to MOOC and e-learning at UPSI.

In 2016, he received sponsorship from the Ministry of Education Malaysia under Federal Training Award (HLP) to further his studies in Doctor of Philosophy (Ph.D.), specializing in software engineering at the Faculty of Computer Science and Information Technology, UPM. His research interest includes MOOC, e-learning management, software quality, software measurement and the implementation of Rasch Model. Married to Fetty Azlina Nor Hashim in 2007, Ahmad Wiraputra is now a happy family man with his three sons and only daughter. He believes that a good scholar must have a sincere heart and a delicate soul, without expecting a worldly reward for what they contribute.

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LIST OF PUBLICATION

Wan Ab Rahman, W. N., Zulzali, H., Ishak, I., & Selamat, A. W. (2020). Quality Model for Massive Open Online Course (MOOC) Web Content. *International Journal on Advanced Science, Engineering and Information Technology*, *10*(1), 24–33.

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