

INITIAL RECOMMENDATIONS OF MOOCS CHARACTERISTICS FOR ACADEMIC DISCIPLINE CLUSTERS

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ABSTRACT

Massive Open Online Courses (known as MOOCs) have been introduced as an extensive and pervasive learning style in order to increase students' performance. Many academics and students in Malaysian higher education institutions have begun to show their interest in applying MOOCs to deliver course material or conduct distance education in an innovative way. However, there are no guidelines available to assist the application of MOOCs; in particular, there are no guidelines to help academics develop their own MOOCs based on their area of expertise. In the education domain, usually these areas of expertise are arranged according to certain groups referred to as academic discipline clusters. This study investigates existing MOOCs characteristics and recommends specific characteristics in relation to academic discipline clusters. Content analysis was carried out by exploring MOOCs characteristics implemented successfully in six universities worldwide. This included an examination of the platforms used and the courses that applied MOOCs. Based on the results, the desirable characteristics of MOOCs are recommended with regard to academic discipline clusters, with the Universiti Teknologi Malaysia used as a case study.

Keywords: *Massive Open Online Courses, MOOCs, Malaysia HEIs, Learning style*

1. INTRODUCTION

The use of information and communication technologies in education has become one of the leading trends in the delivery of knowledge. Numerous styles of learning, mainly for distance learning purposes, have been introduced such as e-learning, m-learning, Open Educational Resources and Bring Your Own Device. These various distance learning methods provide convenience to students and academics to access relevant materials, conduct assessment and deliver learning. The development of distance education methods has engaged with communication technology such as social networking, radio, video, recorders and home computing [1]. Moreover, they are made attractive through the integration of PDAs, iPods, personal computers and mobiles. However, as technology is continually changing, a new phenomenon has emerged and quickly become a popular learning style within higher education institutions (HEIs), namely, Massive Open Online Courses (MOOCs) [2].

MOOCs are learning tools that are delivered via an online connection with several features. The concept of MOOCs was formed in the West where a greatest proportion of the population experiments with novel learning solutions and pathways [3]. In Malaysia, the adoption of MOOCs is an important part of the national plan, with MOOCs adoption identified as the 11th big idea in the Malaysian Education Blueprint between 2015 until 2025 for Higher Education [4]. The Minister of Education, Datuk Seri Jusoh, declared that Malaysia was the first country in the world to utilize MOOCs in public universities, starting from October 2014 [5].

However, since MOOCs is still at an emerging stage in Malaysia, many questions remain regarding their value, relevance and ability to deliver quality, useful educational content and learning experiences [6]. As mentioned by [7], there are several issues regarding the MOOCs characteristics including the varying layouts, quality and structures of courses offered by public universities and the need to be implemented closely with the digital services available in Malaysia. These issues affect the

learning material access especially the access requiring high bandwidth.

Furthermore, limited studies have been conducted to gather empirical evidence on MOOCs from the Malaysian HEI perspective. In order to improve the quality of MOOCs in Malaysian HEIs, University Teknologi Malaysia (UTM) was chosen as a case study. According to UTM Deputy Vice Chancellor (Academic and International), Professor Dr. Rose Alinda, the quality of UTM MOOCs still needs to be enhanced and it is the responsibility of researchers to find the solution [8]. Therefore, this paper aims to provide a guideline for appropriate practices by recommending MOOCs characteristic for different academic discipline clusters in UTM. On the basis of the results, it is hoped that UTM and other universities can apply these guidelines in future to expand the use of the MOOCs.

This paper is organized as follows: Section 2 presents an overview of related works and motivation; Section 3 describes the method used for this study; Section 4 discusses the results; and Section 5 presents the conclusion.

2. RELATED WORKS AND MOTIVATION

2.1. MOOCs

The term MOOCs was first introduced in 2008 by Stephen Downes and George Siemens, with the term emphasizing connectivism, knowledge and the ability of anyone to participate in a course [9]. In 2011, Stanford University professors developed a few additional features such as educational videos and the use of open online platforms supported with free web resources [10]. MOOCs are an open registration application that can be accessed by anyone. This initiative is able to attract more audiences than traditional online education [11]. In addition, MOOCs have several advantages such as integrated social networking, accessible online resources, and assistance by leading practitioners in the field of study. The emergence of MOOCs has changed the concept of learning and diversified the learning styles in the education sector especially in regard to upper level education.

2.2 MOOCs in Malaysia

MOOCs in Malaysian HEIs are offered through OpenLearning, a MOOCs platform founded by Adam Brimo and Richard Buckland, and based in Sydney, Australia [12].

In March 2013, Taylor University was the first private university in Malaysia to implement

MOOCs which it launched via OpenLearning. In September 2014, four public universities began offering MOOCs via OpenLearning, with each university given the task to coordinate the course as a pilot project. The four universities were [13]:

- University Putra Malaysia (UPM) for Islamic and Asian Civilization
- University Kebangsaan Malaysia for Ethnic Relations
- University Technology Mara for Entrepreneurship
- University Malaysia Sarawak for ICT Competency

According to [14], the Ministry of Higher Education announced in late 2015 that over 60 MOOCs would be offered by 20 public universities in Malaysia via OpenLearning. The Ministry has also declared OpenLearning as the official MOOCs platform for public institutions of higher education in Malaysia [15].

In March 2014, UPM became the first public university in Malaysia to launch its own online platform known as “Putra Massive Open Courses” (PutraMOOC) [16]. This platform was developed for the academic staff to impart knowledge to those who are interested.

Other universities, such as Universiti Teknikal Malaysia Melaka, have followed the step taken by UPM. In addition, some universities utilize multiple MOOC platforms to complement the existing pedagogy. For example, UTM uses OpenLearning and has also created another MOOCs platform using OpenEdX sources owned by the edX platform.

2.3 MOOCs in the global view

Today, the use of MOOCs is widespread throughout the world. During 2015, the number of universities offering MOOCs doubled to more than 400 universities, resulting in a doubling of the number of cumulative courses to 2400 [17].

Other than imparting knowledge, some institutions have become known as successful universities in the development of MOOCs such as Massachusetts Institute of Technology (MIT), Harvard University, Stanford University, Princeton University, University of Sheffield, and University of California Berkeley (UC Berkeley). Most of these universities have made some contribution to the MOOCs learning style. For example, MIT and Harvard have published the results of large investigations into MOOCs. They launched their



first courses on edX, attracting over 53,000 registered students worldwide.

In 2012, two Stanford University professors introduced a new platform called Coursera which is open for any participants who want to join. According to Sa'don, et al. [18], the Coursera platform collaborates with 70 HEIs including Princeton University which is currently the top ranked university in the US. Even though the enrollment rates appear impressive in Coursera, Stanford University has also used more than one platform such as NovoEd and Academic Earth to disseminate their MOOCs broadly. In addition, during 2014, Stanford University created another new online platform called "Stanford Online".

The MOOCs offered by the University of Sheffield have attracted over 275,000 learners from 195 countries [19]. Learners participating in the courses reported high levels of satisfaction, with 92% highly rating their experience and 97% reporting they were likely to recommend the course to others [19].

As indicated in the above discussion, MOOCs have evolved and grown quickly across HEIs around the world. Within a short period, HEIs have attracted many participants to use MOOCs.

2.4 MOOCs issues and problems

In the context of the present study, there is a dearth of research conducted in Malaysia to discuss the problems faced by MOOCs. According to [20], through their MOOCs, Malaysian HEIs are focusing on several crucial strategies such as the roles, responsibilities, capacities and potential of different education stakeholders in order to contribute to the national initiatives.

[21] examined the issues and challenges faced by Open University Malaysia in developing MOOCs. There are some important skills that need to be considered in developing these MOOCs by faculty members, instructional designers and technical experts who provide coaching and mentoring. From there, the quality of learning is more guaranteed and it is more interesting to learn. The study also highlighted possible solutions to the challenges encountered by the parties involved in the MOOCs implementation.

In [22], the authors looked at the development of MOOCs at the International Islamic University Malaysia and proposed a conceptual solution to develop the MOOCs. They identified some features that should be included in the university's MOOCs

such as notes, quizzes, sustainable revenue and accreditation.

In summary, these studies cover some aspects of MOOCs improvements and issues in Malaysian HEIs. However, none of them analyze the MOOCs characteristics for the academic discipline clusters required in their institutions.

2.5 MOOCs characteristics

A characteristic is a special quality that makes MOOCs different from other approaches to learning. The quality refers to the character, disposition or nature of something. In other words, a characteristic can refer to a feature that helps distinguish a person or thing by a distinguishing mark or trait [23]. For example, MOOCs have their own unique characteristics such as video lectures and assessments.

According to [24], MOOCs are defined by key features including free courses and lectures formatted as short videos combined with formative quizzes that are easily accessible through technological devices and internet connectivity. However, [25] and [26] claimed that MOOCs are built on the characteristics of massiveness, openness and connectivist philosophy. This characteristic is explain by the following components: (1) Massiveness refers to the ability of the MOOCs to easily accommodate large numbers of students; (2) Openness involves several key concepts including software, registration, curriculum and assessment, and communication including interaction, collaboration, sharing and learning environment [27]; and (3) Connectivism refers to the ability of MOOCs to offer an emerging online teaching methodology inspired by a connectivist philosophy. According to [28], there are three key features include in MOOCs, namely, structured course organization, fragmented teaching content, and the short of teaching video.

Based on the previous researchers' views, it can be concluded that the characteristics of MOOCs can be described in many perspectives. Table 1 presents a summary of MOOCs characteristics from multiple perspectives which can be categorized and classified into five groups:

- 1) **Pedagogical** – the method used to design the course such as (i) *the behaviorist approach* that focuses on the external process of the mind and knowledge [29]; (ii) *the cognitive process* which refers to mental processing, processing information and creating knowledge [29]; (iii) *the constructivist approach* that is related to



socialization, cultural cues and the integration of new knowledge with existing knowledge [29]; and (iv) *the connectivist approach* that focuses on the interaction between one individual and another and the ways in which this interaction can make people process something in the proper way [29].

- 2) **Assessment** – the type of assessment that will be used in each course provided.
- 3) **Openness** – the freedoms of learning and general connection with all open movements such as open communication and open online participants.
- 4) **Technology** – the details or considerations of the software and hardware used for MOOCs implementation.
- 5) **Instructional design** – the systematic process by which instructional materials are designed, developed and delivered; this commonly depends on how the individual university wants to make learning more interesting and interactive.

Table 1: MOOCs Characteristics

Category	Characteristics	Author/s
Pedagogy	<ul style="list-style-type: none"> • Behaviorism • Cognitive • Constructivism • Connectivism 	[29], [30]
Assessment	<ul style="list-style-type: none"> • E-assessment • Peer-assessment • Self-assessment 	[31], [24]
Openness	<ul style="list-style-type: none"> • Cost • Certificate • Resource • Registration • Self-paced • Participant • Open source 	[32], [33], [27], [25], [26]
Technology	<ul style="list-style-type: none"> • Video lectures • Audio conferencing • Face-to-face • Blog, forums, social network • Lecture Note, PowerPoint and PDF • Gamification • Mobile 	[34], [35], [36]
Instructional Design	<ul style="list-style-type: none"> • Text digital, textbook • Illustration simulation • Video subtitles • Instructor taking to camera • Recorded traditional 	[37], [38]

lecture	
<ul style="list-style-type: none"> • PowerPoint • Animation • Visual 	

2.6 Academic discipline clusters

An academic discipline is a field of study that provides the framework for a student’s program of study [39]. Each academic belongs to a certain cluster in line with their field of expertise.

In the present study, the UTM academic discipline clusters were used to identify and categorize the characteristics in each cluster. The academic discipline clusters offered by UTM to students are shown in Table 2.

Table 2: List of Academic Discipline Clusters in UTM

Academic Discipline Cluster	Faculty in UTM
Engineering	<ul style="list-style-type: none"> • F. of Civil Engineering • F. Electrical Engineering • F. of Chemical Engineering • F. of Petroleum & Renewable Energy Engineering • F. Mechanical Engineering • F. of Geoinformation & Real Estate • F. of Bioscience & Medical Engineering
Computer Science & Information Technology	<ul style="list-style-type: none"> • F. Computing
Education	<ul style="list-style-type: none"> • F. Education
Science & Mathematics	<ul style="list-style-type: none"> • F. Science • F. of Geoinformation & Real Estate • F. Management • F. of Bioscience & Medical Engineering
Humanities/ Islamic Civilization	<ul style="list-style-type: none"> • F. Tamadun Islam
Entrepreneurship & Finance	<ul style="list-style-type: none"> • F. Management
Chemistry	<ul style="list-style-type: none"> • F. Science
Architecture	<ul style="list-style-type: none"> • F. of Built Environment
Material Science	<ul style="list-style-type: none"> • F. of Mechanical Engineering
Environmental Science	<ul style="list-style-type: none"> • F. of Built Environment
F= Faculty	

3. METHODS AND ANALYSIS

Content analysis was carried out by collecting and reviewing the curriculum and content of the online courses. This included exploring the

websites of several universities to analyze and gather the related information. At the same time, EndNote X7.0.1 was used as a database tool to avoid any duplication and unrelated literature. The six steps involved in the conduct of this study are shown in Table 3.

Table 3: Research Methodology

Steps	Description	Outcome
Step 1: Investigate the successful universities applying MOOCs.	<ul style="list-style-type: none"> Papers from journal and related proceeding have been reviewed as well as reports. 	List of six success universities in MOOCs.
Step 2: Identify MOOCs platforms and their characteristics.	<ul style="list-style-type: none"> Papers from journal and related proceeding have been reviewed. The website of each identified MOOCs platform has been explored. 	MOOCs platforms and their characteristics (Table 4)
Step 3: Identify MOOCs platforms used in each university listed in Step 1.	<ul style="list-style-type: none"> Papers from journal and related proceeding have been reviewed. The platform websites are viewed to identify the platform used by each university. 	Platforms used by success universities (Table 5)
Step 4: Identify academic discipline cluster used MOOCs in each university.	The platform websites have been viewed.	List of Academic Discipline cluster that used MOOCs (Table 6)
Step 5: Investigate MOOCs characteristics for each academic discipline cluster.	<ul style="list-style-type: none"> Papers from journal and related proceeding. The characteristic of academic discipline cluster has been investigated through the platform website. 	MOOCs Characteristic provide by each university (Table 7)
Step 6: Suggest the MOOCs characteristics for UTM.	Comparison between six identified universities and UTM has been done.	Initial recommendations of MOOCs characteristics based academic discipline cluster in UTM (Figure 1)

3.1 Step 1 – Investigate the successful universities applying MOOCs

In the first step, the universities that were successful in delivering MOOCs were identified from the literature including reports, the original websites of the universities and articles. More than ten universities appeared to be successful in delivering MOOCs. Of these, six universities were selected for this study since they had made significant contributions and are frequently the subject of discussion among MOOCs researchers. Each of these universities had their own success story as briefly discussed above in Section 2.3. They also have succeeded in attracting many students to use their MOOCs and they provide a wide range of interesting elements.

The six selected universities were: MIT, Harvard University, Stanford University, Princeton University, University of Sheffield and UC Berkeley.

3.2 Step 2 – Identify the MOOCs platform and their characteristics

The growth of MOOCs adoption in HEIs has increased the use of MOOCs and the number of platforms. This study investigated the six platforms used by the six selected successful universities. Among the six platforms, five were well known and were the most widely used platforms for MOOCs adoption, namely, Coursera, Udacity, Udemy, edX and FutureLearn [40]. Malaysian HEIs use OpenLearning as the MOOCs platform. Each of these platforms has their own characteristics as shown in Table 4.

Based on the MOOCs characteristics discussed above in Section 2.5, there are some different characteristics in each of the platforms. In order to identify the characteristics of each platform, the literature was reviewed. In order to validate the characteristics, the website platform was reviewed.

Table 4: MOOCs Platforms And Their Characteristics

Characteristics	Coursera	edX	Udacity	Udemy	FutureLearn	OpenLearning
Behavioral						
Conscientiousness				✓	✓	✓
Behaviorism	✓	✓	✓	✓	✓	✓
Cognitivism	✓	✓	✓	✓	✓	✓
Social Constructivism				✓	✓	
Assessment						
E-assessment	✓	✓	✓		✓	✓
Peer-assessment	✓	✓			✓	
Self-assessment		✓			✓	
Openness						
Cost	✓	Partly	✓	Partly	✓	
Certificate	✓	✓	✓	✓	✓	Partly
Resource	✓	✓	Partly	✓	✓	Partly
Registration	✓	✓	✓	✓	✓	✓
Self-paced			✓	✓	✓	
Participant	✓	✓	✓	✓	✓	✓
Open Source	✓	✓	✓	✓	✓	✓
Technology						
Video lectures	✓	✓	✓	✓	✓	✓
Audio Conferencing	✓					
Face-to-Face	✓	✓				✓
Blog, forums, social network	✓	✓	✓	✓	✓	✓
Lecture Note, PPT and PDF	✓	✓	✓	✓	✓	✓
Gamification	✓	✓				
Mobile		✓	✓	✓	✓	
Instructional Design						
Text, digital, textbook	✓	✓	✓	✓	✓	✓
Illustration simulation	✓	✓	✓	✓	✓	
Video Subtitles	✓	✓	✓		✓	
Instructor talking to camera	Partly	Partly	Partly	Partly	Partly	Partly
Recorded traditional lecture	Partly	Partly	Partly	Partly	Partly	✓
Power Point	Partly	Partly	Partly	Partly	Partly	Partly
Animation	Partly	Partly	Partly	Partly	Partly	Partly
Visual	✓	✓	✓	✓	✓	✓

3.3 Step 3 – Identify MOOCs platforms used in each university listed in Step 1

In order to identify the platform used by each successful university, several studies in the literature were reviewed. Next, the identified platforms were validated by reviewing the platform websites to ensure the valid platform was used.

Table 5 provides a summary of the platforms used by the six successful universities.

Table 5: Platforms Used By Successful Universities

No.	University/ Platform	Coursera	edX	Udemy	Udacity	FutureLearn
1.	MIT [41]		√			
2.	Harvard University [41]		√			
3.	Stanford University [42]	√				
4.	Princeton University [43]	√				
5.	University of Sheffield [43]					√
6.	UC Berkeley [42]		√			

3.4 Step 4 – Identify academic discipline cluster used MOOCs in each university

According to the discussion in Section 2.6 above, there are ten academic discipline clusters provided by UTM. However, only the following six academic discipline clusters had already started to use MOOCs at the time of this study: (1) Computer Science & Technology, (2) Engineering, (3) Education, (4) Language & Communication, (5) Islamic Civilization/ Humanities, and (6) Science & Mathematics. These six academic discipline clusters were subjected to the analysis as a sample representing the academic discipline clusters offered by the six successful universities.

Table 6 presents the list of academic discipline clusters offered by the successful universities. However, not all the academic discipline clusters offered were available in that learning session. Some of them had still not opened their session even though they had been offered.

Table 6: List Of Academic Discipline Clusters Offered By Each Successful University

No.	Top 10 Universities	Computer Science & technology	Engineering	Education	Language & communication	Islamic & civilization/ Humanities	Science & Mathematics
1.	MIT	√	√	√			√

2.	Harvard University	√		√		√	√
3.	Stanford University	√	√	√	√		√
4.	Princeton University	√				√	√
5.	University of Sheffield	√		√	√		√
6.	UC Berkeley	√	√		√	√	√

3.5 Step 5 – Investigate MOOCs characteristics for each academic discipline cluster

In this step, the MOOCs characteristics from the six successful universities were traced and recognized. The UTM MOOCs characteristics were also identified. Table 7 presents a summary analysis of the MOOCs characteristics provided by each university. Since there is a lack of research that discusses this problem, each of the characteristics was identified by reviewing the platform used by each university.

Table 7: MOOCs Characteristic Provided By Each University

Characteristics	Computer Science & technology	Engineering	Education	Language & communication	Islamic civilization/ Humanities	Science & Mathematics
Assessment	E-assessment	▲♦●	▲●	▲♦●	■	* ▲♦●●
	Peer-assessment	*●	▲●	▲		*
	Self-assessment	♦	▲	♦■		▲
Openness	Cost	×	▲×	×	×	▲×
	Certificate	▲♦●●	▲●	▲♦●	▲■	▲*
	Resource	▲♦●●	▲●	▲♦●	▲■	▲*
	Registration	▲♦●	▲●	▲■	▲■	▲*
	Self-paced	●	●	●	●	●
	Participant	▲♦●●	▲●	▲♦●	▲■	▲*
Technology	Video lectures	▲♦●●	▲●	▲♦●	▲■	▲*
	Audio Conferencing	♦				
	Face-to-Face	♦♦	○	♦		♦
	Blog, forums, social network	▲♦●●	▲●	▲♦●	▲■	▲*
	Lecture Note, PPT and PDF	▲♦●●	▲●	♦▲	▲	▲*
	Gamification	○		▲		*
	Mobile			▲		
Instructional Design	Text, digital textbook	▲♦●	▲●	▲♦	▲■	▲*
	Illustration simulation	▲♦	▲	▲♦●	▲■	▲*
	Video Subtitles	♦♦	○	▲	■	*
	Instructor taking to camera	♦♦●	♦●	▲■	■	*
	Recorded traditional lecture	♦				*
	Power Point	▲♦●	●●	●	■	●●
	Animation	●	▲●	■●	■	▲*
Virtual	▲♦●	▲●	▲♦●	▲	▲*	

▲ → MIT
♦ → Harvard University
● → UC Berkeley
* → Princeton University
■ → University of Sheffield
● → UTM
x → Stanford University

After the analysis was completed, four groups of MOOCs characteristics were further analyzed for each university in terms of the assessment, openness, technology and instructional design.

3.6 Step 6 – Suggest the MOOCs characteristics for UTM

In the final step, the appropriate practice of MOOCs characteristics was examined in order to formulate specific recommendations for UTM. Based on the characteristics identified previously, a comparison between UTM and the successful universities was made. The purpose of this comparison was to identify the characteristics provided by the successful universities which were not being provided in UTM MOOCs. The

characteristics that did not belong to a UTM academic discipline cluster were identified. Then, the results formed the basis of the initial recommendations for UTM MOOCs to improve the learning style. This part of the analysis was done by reviewing the platform used by each university.

The analysis showed there many academic discipline clusters had not yet opened their learning session. Figure 1 presents the initial recommendations on MOOCs characteristics for each academic discipline cluster in UTM.

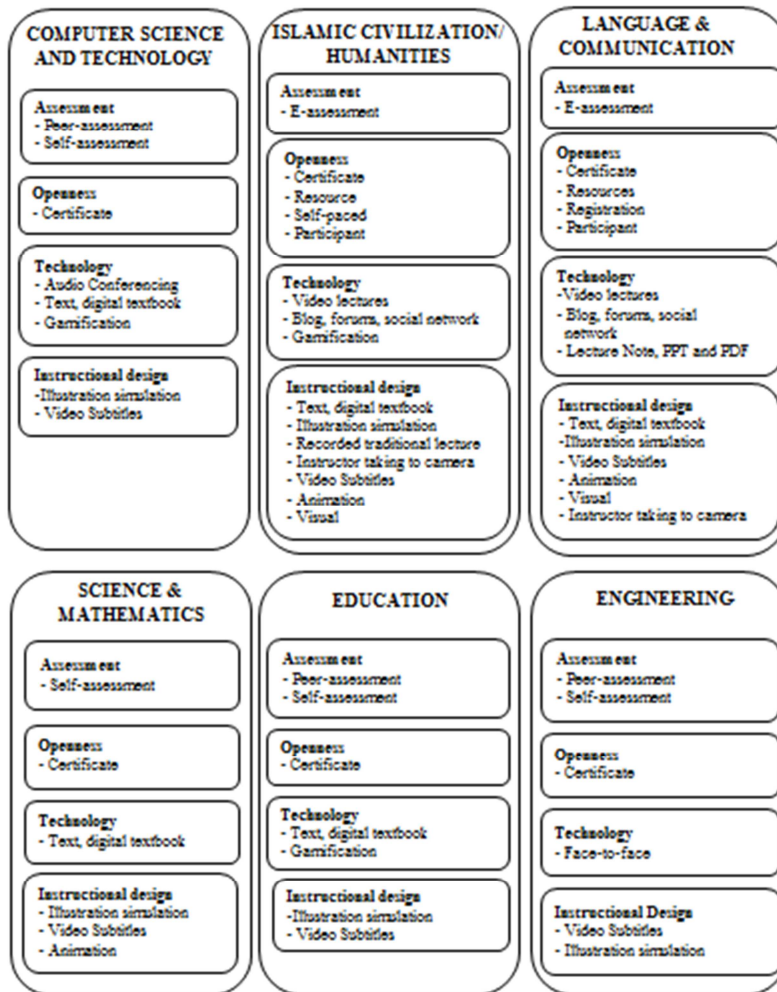


Figure 1: Initial Recommendations of MOOCs Characteristics For Each Academic Discipline Cluster In UTM

4. DISCUSSION

Overall, there are several appropriate practices of MOOCs characteristics where can be suggested to UTM MOOCs as presented above in Figure 1. However, the findings have not yet been validated and verified by any stakeholders. This may be

addressed in future work, as well as the addition or removal of some features.

Based on the identified result, most of the cluster featured in the MOOCs categories shared similar characteristics with one that has been recognized. Though, not all clusters use the features that are present in each of these categories for example animation, resources, self-assessment and etc.

These all characteristics that have been identified in MOOCs platform through content analysis have truly aligned with previous research. In other words, each category of characteristics that has been identified is strongly supported by literature review that has been thoroughly done.

Some limitations and issues were faced during the conduct of this study. For example, there are five characteristics category that has been identify and used for analysis purposed. However, only four out of five characteristics category has been analyzed namely, assessment, openness, technology, and instructional design. The fifth category of pedagogy was used to measure the characteristics in the platform only. This was due to the difficulties in determining the pedagogy used in each academic discipline cluster since there is a lack of research that focuses on this context. Essentially, pedagogy should be considered to be proposed in this study but, there is no appropriate way to identify the pedagogy used in each academic discipline cluster. Usually, the characteristic provided by each platform and university is different, in accordance with the institution's particular needs.

Another limitation existed in the process of identifying the characteristics in the academic discipline clusters used by the successful universities and UTM. Some of the academic discipline clusters had not yet started their learning session. For that reason, it was hard to identify the characteristics used and the comparison was done on the available academic clusters only.

In addition, Stanford University provided a payment feature for participants who want to join the six academic discipline clusters through the Coursera platform. Hence, it was problematic to identify the other characteristics used.

5. CONCLUSION AND FUTURE WORKS

Designing MOOCs is a complex task; nevertheless, MOOCs have captured the attention of many HEIs. UTM has made a foray into the MOOCs learning environment and it is one of the public universities in Malaysia offering MOOCs via multiple platforms, namely, OpenLearning and OpenEdX. These MOOCs make education easily accessible to anyone, anywhere, anytime around the world.

Therefore, the quality of learning and teaching can be improved. However, since the implementation of MOOCs is still at the emerging stage in UTM, there are some flaws that need to be

resolved in terms of the characteristics. Thus, the present study makes initial recommendations for MOOCs characteristics that can be applied for each academic discipline cluster in UTM in particular. As a result, MOOCs can be seen as a potential way to transform conventional learning through the creation of an innovative high-tech learning space.

To result in better research and have in-depth discussion, a number of future works have been proposed to be studied in the future. Usually, each of academic discipline clusters has their own uniqueness. This uniqueness have makes them different with other cluster. Therefore, it is suggested to ascertain MOOCs characteristics that suit with the uniqueness. If the appropriate characteristics are known, it can be strongly applied into the cluster to visualize an interesting learning. Another future works that may be done is identifying appropriate method to analyze the pedagogy that delivered academic discipline cluster using MOOCs.

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