Development and Validation of Student's MOOC-efficacy Scale: Exploratory Factor Analysis

Norliza Ghazali[1*], Mohamad Sahari Nordin[2], Tunku Badariah Tunku Ahmad[3]

[1]Faculty of Educational Studies, Universiti Putra Malaysia,
43400 Serdang Selangor, Malaysia
alezg@upm.edu.my
[2]Kulliyyah of Education, International Islamic University Malaysia,
P.O. Box 10, 50728 Kuala Lumpur, Malaysia
msahari@iium.edu.my
[3]Kulliyyah of Education, International Islamic University Malaysia,
P.O. Box 10, 50728 Kuala Lumpur, Malaysia
tbadariah@iium.edu.my
[*]Corresponding Author

https://doi.org/10.24191/ajue.v17i4.16182

Received: 21 April 2021
Accepted: 22 August 2021
Date Published Online: 31 October 2021
Published: 31 October 2021

Abstract: Massive Open Online Courses (MOOCs), the fast developing teaching and learning platforms of global interest, are the product of higher education's expanded usage of e-learning. MOOCs have been heralded as the potential educational breakthrough for the 21st century. A positive attitude toward self-efficacy is essential for successful MOOC implementation. However, only a few studies have been conducted to ascertain a student's MOOC efficacy level, and a very limited scale for assessing a student's MOOC efficacy has been identified in the context of Malaysia. This study aims to develop and validate a student's MOOC-efficacy scale for higher institutions. In this study, students' MOOC-efficacy was conceived in four ways (i.e. information searching, making queries, MOOC learning, and MOOC usability). A descriptive research design with a scale was employed to collect information from 289 students enrolled in higher institutions. The Educational and Psychological Testing Standards were adapted to develop a scale to gauge students' MOOC-efficacy. The scale's appropriate items, as well as its validity and reliability, were determined using Exploratory Factor Analysis (EFA). Significant levels of validity and reliability for the developed scale were found. The scale comprised four dimensions, i.e., information searching (three items), making queries (seven items), MOOC learning (six items) and MOOC usability (seven items), amounting to a total of 23 items. This scale was then used to determine the efficacy of higher institution students in using MOOCs. The eigenvalues of the four MOOC efficacy dimensions were within the range of 1.39 to 8.49. The factor structures explained 63.9% of the total variance. The scores of reliability varied in the range of 0.822 to 0.890. This work produced a psychometrically sound scale to measure students' MOOC efficacy. Students, educators, administrators, and other individuals may benefit from the application of the verified MOOC efficacy scale. The information generated from the scale can be utilized to determine the training needs of students, educators and MOOC developers.

Keywords: Exploratory Factor Analysis (EFA), Massive Open Online Course (MOOC), student's MOOC-efficacy, scale development, higher institutions.

1. Introduction

Massive Open Online Courses (MOOCs) are an emerging trend in online education that promote the use of online open education resources and internet-based courses. In light of the shift in Malaysia's Education Blueprint (2015–2025), the Ministry of Higher Education (MOHE) sees MOOCs as a critical component of higher education teaching and learning. They have gained widespread acceptance in higher education, owing to their adaptability to various learning environments, student learning flexibility and accessibility in pursuit of education and professional development (Albelbisi & Yusop, 2020; Ministry of Education Malaysia, 2015; Pili & Admiraa, 2017). The pandemic of COVID-19 has forced the closure of educational institutions all around the world in 2020. As a result of the shutdown, the on-line learning environments within those institutions have improved to the point where learning and teaching are no longer disrupted. MOOCs in higher education institutions have been found to aid in developing students' learning skills, increasing educational outcomes, and deploying effective communication with professors (Alhazzani, 2020; Safri, Mohi & Hanafiah 2020).

Despite the widespread use of MOOCs across the world, it was frequently reported in many studies that MOOCs had poor completion and high dropout rates (e.g. Branson, 2017; Hakimi et al., 2017; Kruchinin, 2019). This was supported by the empirical analysis of the MOOC literature from 2014 to 2016 (Zhu, Sari & Lee, 2018) and analysis of the published research articles from 2008 to 2015 (Zawacki-Richter et al., 2018). The analyses reveal that high dropout and low completion rates in MOOCs were the predominant challenges of MOOCs at universities. Although free education encourages more enrolment, unfortunately, it often undermines the commitment of learners to complete a course (Hakimi et al., 2017; Shrader, Wu & Owen-Nicholson, 2016). Participants' lack of positive self-efficacy attitudes could be one reason for MOOCs' low completion and high dropout rates (Branson, 2017; Hodges, 2016; Wang & Baker, 2015). Bandura (1986) defines self-efficacy is a psychological construct, which discuss in general an individual's belief in his or her capability to accomplish a specific task successfully. The relationship between student motivation and efficacy with the completion of MOOCs was examined by Wang and Baker (2015). The findings revealed that students who completed the course tended to have higher self-efficacy beliefs. The same finding was revealed by Branson (2017) in his research on academic self-efficacy and MOOC completion rates among adult learners. Both studies found that self-efficacy beliefs are crucial in determining MOOC performance and achieving better completion rates. Nordin et al. (2015) revealed that more than fifty percent of the students in their MOOC acceptance research in Malaysia believed they would be unable to complete the exercises if there was no teacher to guide and coach them. More over half of the students (50.9%) were found to have low MOOC efficacy and could not complete the learning activities without explicit supervision.

Most MOOCs studies in Malaysia have focused on perceptions, acceptance, challenges, and factors influencing usage (Almahdi & Sulfeeza, 2017; Daneji, Ayub & Khambari (2019); Fadzil et al., 2016; Ghazali & Nordin, 2016; Goh, 2017; Habibah et al., 2016; Nordin et al., 2016). An in-depth investigation of self-efficacy and MOOCs is required (Almahdi & Sulfeeza, 2017; Ghazali, Mustakim & Nordin, 2021). There is a scarcity of empirical research on MOOC efficacy, particularly in the Malaysian setting. In their studies, Fadzil et al. (2016) and Nordin et al. (2015) found that self-efficacy was the most important factor that influenced MOOC readiness and acceptability in Malaysia. However, only five items examined self-efficacy in MOOC readiness context (Fadzil et al., 2016), and only three items were used in context of MOOC acceptance by Nordin et al. (2015). As a result, their research was insufficient to completely measure the idea of efficacy, particularly in the context of the Malaysian MOOC. To establish a successful MOOC platform, previous researchers have proposed that further study is required to investigate student MOOC-efficacy for a variety of target audiences and circumstances (e.g. Almahdi & Sulfeeza, 2017; Ghazali, Mustakim & Nordin, 2021; Padilla Rodriquez & Armellini, 2017). According to prior research, self-efficacy appears to be a critical aspect that must be highlighted in order to increase MOOC implementation in Malaysia.

Therefore, the purpose of this research is to develop a MOOC-efficacy scale that higher education students can use to assess their MOOC learning abilities. The findings of this study may be beneficial to students, educators, researchers, MOOC producers, administrators, and policymakers interested in enhancing the learning environment and implementing MOOCs.

1.1 Literature Review

Previous studies were reviewed to obtain an idea of the existing measures of student self-efficacy especially in e-learning, as this research is set in the context of MOOCs. The types of items formulated, and the scale used to measure student's self-efficacy were also reviewed. Most of the instruments used to measure student's self-efficacy were developed in foreign countries. A few instruments have reported their validity and reliability but most of the studies reported neither of these two qualities.

According to Bandura (1986), instruments measuring self-efficacy are domain-specific and situation-specific. This implies that the instrument used to measure self-efficacy has to be validated based on the domain and situation it is going to be administered in. The number of items measuring student's self-efficacy construct vary from one researcher to another. Most studies used the numerical rating scale to measure the strength of the self-efficacy construct. Likert scale is quite appropriate to investigate the strength of an individual's belief in his or her capability (Bandura, 1986). Many researchers have used the Likert scale ranging from one to five to measure self-efficacy (e.g. Chen, 2014; Eachus & Cassidy, 2006). However, Bandura (1977) used a 100-point scale, ranging in 10-unit scale to measure self-efficacy. The strength of self-efficacy was determined by summing up the expectancy scores. The most frequently adopted or used instruments for self-efficacy in an online learning environment as analyzed by Valencia-Vallejo, Lopez-Vargas and Sanabria-Rodriguez (2016) are Self-efficacy subscale of the Motivated Strategies for Learning Questionnaire (MSLQ) (Pinrich, Smith, Garcia & McKeachie, 1991) followed by Internet Self-efficacy Scale (ISES) and the Web-based Learning Self-efficacy Scale (WBLSES) (Tsai & Tsai, 2003). Other students' self-efficacy measures used by researchers are for instance; Web Users Self-efficacy Scale (Eachus & Cassidy, 2006), Computer Self-efficacy Scale (CSES) (Compeau & Higgins, 1995), Internet Self-efficacy Scale (Joo, Bong & Choi, 2000), and Educational Internet Use Self-efficacy Beliefs Scale (Sahin, 2009). On the other hand, recent measures which were developed to measure student's self-efficacy are like, Self-efficacy in Virtual World Learning Survey by deNoyelles, Hornik and Johnson (2016) and Self-efficacy in Internet based Learning Environment scale (SIBLE) by Chen (2014).

In the context of MOOCs, a comprehensive examination of the review suggests the existence of limited measures to assess student's MOOC-efficacy. Padilla Rodriquez and Armellini (2017) used the General Self-Efficacy Scale in their research to measure student's self-efficacy in MOOCs. Six additional items were added to address self-efficacy related to specific study skills in MOOCs which covered the aspects of: 1) time management; 2) note taking; 3) information seeking; 4) comprehension of academic texts; 5) the use of the APA format, and 6) academic texts writing. Previously, Chang, Tseng and Kang (2015) developed and validated an online self-efficacy scale in MOOCs but focused specifically on the Engineering Graphics course. In the Malaysian context, two studies included student efficacy measurement in the context of MOOC acceptance (Nordin et al., 2015) and MOOC readiness (Fadzil et al., 2016). Nordin et al. (2015) measured three items on self-efficacy in MOOC acceptance, i.e. 1) completion of tasks independently; 2) completion of tasks with the assistance of others; and 3) completion of tasks using the built-in features available in the MOOCs. Fadzil et al. (2016) developed five items to measure student's self-efficacy in MOOC readiness, in particular their ability to download useful resources from the web, communicate through email, access the digital library, use the social media to connect with others and collaborate with others through online forums or discussions.

Students have reported feeling isolated, lonely, and unconnected as a result of recent developments in MOOCs and their characteristics (Almahdi et al., 2017; Kilgore & Lowenthal, 2015), implying the need for students to be responsible for their own learning and aware of their capabilities throughout the learning process in MOOCs (Fadzil et al., 2016; Nordin et al., 2015). According to a review of student self-efficacy measures in an online learning environment, there has been a lack of effort to build a valid instrument to measure student's self-efficacy specifically in MOOCs. The majority of the tools were designed to assess student's self-efficacy in an e-learning setting. The same issue applies in MOOCs' self-efficacy measurement model; this component appears to be overlooked (Willis, Spiers, & Gettings, 2013; Ghazali, Mustakim & Nordin, 2021). This study intends to construct student's MOOC-efficacy scale in light of the importance of self-efficacy beliefs in MOOCs (Branson, 2017; Wang & Baker, 2015) and the necessity for research on MOOC-efficacy in the Malaysian setting (Almahdi & Sulfeeza, 2017; Ghazali, Mustakim & Nordin, 2021). According to prior research, self-

efficacy is a student's belief in his or her own ability to successfully finish a task (Bandura, 1986; Cartwright & Atwood, 2014; Padilla Rodriquez & Armellini, 2017). MOOC-efficacy is a term that refers to a student's abilities and beliefs regarding their ability to complete various learning tasks within a MOOC.

The Internet-Based Learning Environment scale (SIBLE) (Chen, 2014) was utilised and adapted to construct the student's MOOC-efficacy measure in this study. The scale was developed with four main considerations in mind (see Table 1). Owing to its great psychometric qualities and ability to evaluate a wide variety of competences that are crucial in a virtual learning environment, the SIBLE scale is a good choice to capture the elusive concept of student's self-efficacy (Chen, 2014; Cheng & Tsai, 2011; Ching et al., 2014). SIBLE is made up of two survey scales: OAHS behaviour (online academic help seeking) and web-based learning self-efficacy (WLSE).

Table 1. Operational Definition of Student's MOOC-efficacy dimensions

Dimensions	Operational Definition
Information searching (IS)	Student's ability to sift through the enormous resources and volumes of input provided by the MOOC educator and other learners for relevant information and extract it utilising the available MOOC features. (adapted from Chen, 2014; Goh, 2017; Nordin et al., 2015; Rodriguez & Armellini, 2017).
Making Queries (QU)	Student's ability to make queries using MOOC features and support systems. To progress in MOOCs, students must know how to seek academic assistance and ask questions. (adapted from Almahdi et al., 2017; Chen, 2014; Fadzil et al., 2016; Nordin et al., 2015).
MOOC Learning (ML)	Student's ability to interact with a large number of students and learning materials. Students' ability to learn in an open online learning environment was also assessed in this area. (adapted from Almahdi et al., 2017; Chen, 2014; Fadzil et al., 2015, 2016; Nordin et al., 2015).
MOOC Usability (MU)	Student's ability to use the MOOC platform's learning features. This dimension assessed students' ability to engage with the content and learning activities on the MOOC platform. (adapted from Almahdi et al., 2017; Chen, 2014; Fadzil et al., 2015, 2016; Nordin et al., 2015).

2. Materials and Methods

A descriptive research design with a scale was used to develop and validate the student's MOOC-efficacy scale.

2.1 The Scale's Development Process

Fig. 1 depicts all of the steps and procedures taken to develop the student's MOOC-efficacy scale. The stages and techniques listed below were adapted from The Standards for Educational and Psychological Testing. The Standards are the products of the cooperation of three bodies - the American Psychological Association (APA), American Educational Research Association (AERA), and National Council on Measurement in Education (NCME), a joint committee that outlines professional overview to promote sound and ethical use of tests and a basis for evaluating the quality of testing practices (AERA, APA & NCME, 2014). The Standards provide a professional overview of educational and psychological assessment design, implementation, scoring, and reporting. The Standards' principles and important components will aid professionals who develop or select tests, as well as those who analyse or assess test results (APA, AERA & NCME, 2014; Plake & Wise, 2014).

The Standards were chosen in the present research because the steps proposed in the Standards fit the context of the research. Moreover, the Standards have been reviewed and revised by a number of professionals in the field, and have been used all over the world. The latest 2014 version is the 5th revision of the original 1954 edition of the Standards, entitled 'Technical Recommendations for

Psychological Tests and Diagnostic Techniques'. The Standards were revised four times starting in 1954, then in 1974, 1985 and 1999, respectively. The most recent edition of the Standards, published in 2014, represents the best work of a large number of dedicated individuals with extensive commentaries provided by professionals in the field on whether and why the 1999 Standards needed to be revised. In the context of this research, reliable instruments or scales that measure student's self-efficacy already existed in the literature. However, these scales could not be used in this research as the context was entirely different, specifically because the items did not fit the purpose of the research. Hence, a new scale specific to the needs and context of this research which could fulfil the research objectives had to be developed.

Step 1 involved reviewing relevant material on student self-efficacy (e.g. Bandura, 1977, 2000; Padilla Rodriquez & Armellini, 2017; Cartwright & Atwood, 2014; Chen, 2014) to establish a proper conceptualization of student's MOOC-efficacy that could be applied in the research and measured accordingly. At this point, it was also ascertained that self-efficacy constructs were multidimensional in nature comprising different parts, which needed to be verified empirically in the subsequent processes. Among the literature reviewed, Chen (2014) stood out as the most relevant to the present research in terms of providing a framework that could guide the next step on developing a student's MOOC-efficacy scale. Chen (2014) proposed that student's self-efficacy in internet-based learning environments is a construct that comprises five dimensions. In the researcher's preliminary plan, three of the dimensions were adapted and simplified, while the other two dimensions were adopted to fit the context of student's MOOC-efficacy. In step 3, the researchers identified the dimensions and the respective operational definitions. To further refine Chen's (2014) five dimensions of student's self-efficacy in internet-based learning environments, an extensive number of empirical studies on student's self-efficacy and MOOCs (Fadzil et al., 2016; Ghazali & Nordin, 2016; Hodges, 2016; Nordin et al., 2015; Padilla Rodriquez & Armellini, 2017) were reviewed. Based on this extensive review, the following four dimensions were identified with the respective operational definitions: (i) information searching; (ii) making queries; (iii) MOOC learning; and iv) MOOC usability.

Step 4 produced a preliminary pool of items representing all the dimensions. With assistance from the preliminary study and supporting literature, the items were adapted from previous scales. To prevent redundancy, double-barrelled questions, and unnecessarily long and unclear items, the researcher continued to edit and develop the scale. A total of 36 items were included in the suggested scale. The researchers then performed content validation, which is the process of determining how well a concept's dimensions and elements can be defined successfully (Sekaran & Bougie, 2011). In this study, the content validity ratio (CVR) was employed to assess the scale's content validity. A thirty-member expert panel evaluated the items based on their representativeness in terms of content and dimension, clarity and formatting. The panel included two types of experts: professional experts and field experts (Rubio et al., 2003). Only two items out of a total of 36 required refinement because their CVR values fell below the critical values recommended by Colin and Andrew (2013) ($N = 30$, $Ove_{rcritical} = 0.333$, CVR_{all} = 2 items refined and revised). Other items suggested for revision by experts were also taken into account by the researchers. Almost ten percent (10%) of the items needed minor changes and refinements to make them clearer and more understandable to the respondents, as suggested by the panel of experts.

In preparation for step 7 i.e. pilot testing of the scale, each item was refined in step 6 after considering all of the expert feedback. The goal of the pilot study was to see if the items' meaning was clear to the participants and to test the scale's construct validity and reliability. The researcher also solicited feedback and suggestions from the respondents in order to further refine the scale. The construct validity was determined using an Exploratory Factor Analysis (Hoque & Awang, 2016). The internal consistency of the retained dimensions was estimated using the Cronbach alpha formula. After an exhaustive assessment of the items based on content validation (expert judgement) and pilot test findings, the scale was finalised in step 8. The completed scale was divided into two sections, A and B. In Section A, 11 closed and open-ended questions were used to collect demographic information from respondents. Section B examined student's MOOC-efficacy in four domains. Following the completion of the items, the scale was reviewed, proofread, and translated into Malay as a final step. The scale was linguistically validated by two experts who were fluent in both English and Malay to ensure that the items in both languages were conceptually equivalent.

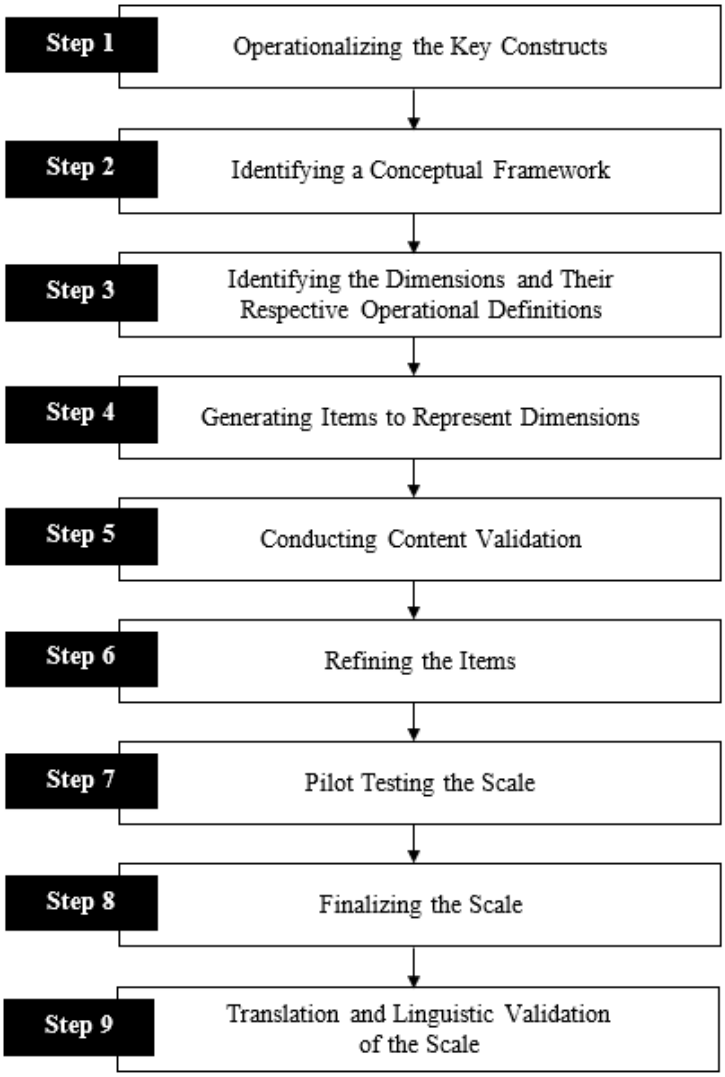

Fig. 1 The Scale's Development Process

2.2 Respondents

Data collection was carried out in order to pilot test the scale. A pilot study was done with 289 undergraduate students from public higher education institutions who consented to fill out the questionnaire. The respondents had used MOOCs either recently or in the past. A desirable sample size includes more than five times the total number of items (i.e., the original 36 items; Terwee et al., 2007); thus, this research met this requirement.

2.3 Data Analysis

The pilot study data was entered into and analysed using the Statistical Package for the Social Sciences (SPSS) statistics software version 22. Construct validity of the student's MOOC-efficacy scale was determined using an exploratory factor analysis (Hoque & Awang, 2016). The inter-variables correlation matrix was used to identify the variables' underlying dimensions. Second, the factor loadings were calculated, and the initial factors were rotated using direct oblimin rotation to increase the dimensions' interpretability. The strategy is consistent with the desire to discover the simplest factor structure and the premise that the underlying constructs are conceptually connected. Third, Kaiser's criterion for important factors, the scree test, the significance test on factor loading, and the interpretability of the extracted factors were used to decide the number of dimensions to be preserved

(Kaiser, 1958). Finally, the internal consistency of the retained dimensions was calculated using Cronbach's Alpha.

2.4 Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) plays an important role in assessing the inter-relationships between the items in a student's MOOC-efficacy dimensions. It compresses a set of items into a single dimension with minimum information loss, allowing for more precise and meaningful inference (Field, 2013). According to Awang (2012), the EFA technique must be performed if the researcher has already adjusted the instruments and modified statements to fit the current study. This is because the present topic of study may differ from earlier studies, or the current study in terms of socioeconomic, ethnic, and cultural status of the population. As a result, there may be some items that had been previously developed but are no longer appropriate for the current study. Therefore, researchers must recalculate the value of construct validity and internal reliability, as well as the new Cronbach's Alpha, for the present scale (Awang, 2012).

To begin, the Kiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity were calculated to determine the appropriateness of the analysis. For the factor analysis to be appropriate, the KMO common agreement or acceptability index must be larger than 0.6, and the Bartlett's test of sphericity must be significant at ($P<0.05$) (Awang, 2012; Hoque & Awang, 2016). The total variance explained was then examined as part of an extraction procedure in order to limit the number of elements to a manageable level. The components that are kept should be able to explain at least half of the overall variance (Streiner, 1994). Items with eigenvalues greater than 1.0 are split into multiple dimensions (Awang, 2012; Pallant, 2010). In addition, only elements with a factor loading greater than 0.4 were preserved from the rotated component matrix (Field, 2013; Hair, Black, Babin & Anderson, 2010).

3. Results

3.1 Demographic Information

Two hundred and eighty-nine of the three hundred questionnaires distributed were returned, resulting in a 96.3% response rate. According to Sekaran and Bougie (2016), a research must have a 75% return rate in order to achieve its goals and objectives. As a result, the study's return rate of 96.3% (N = 289) was more than satisfactory. The respondents consisted of 204 students with females comprising 70.6% of the total, as shown in Table 2. Malay students accounted for the greatest percentage of the sample (84.8%), while the remaining percentage was somewhat equally divided among the representatives of other races: Chinese (5.5%), Indian (4.5%), and others (5.2%). In a similar pattern, Muslims formed the biggest religious group in the sample (86.1%), while the remaining percentage was almost equally divided among Buddhism, Hinduism and other religious adherents (5.9%, 4.5% & 3.5% respectively).

Table 2. Demographics information (N=289)

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	85	29.4
	Female	204	70.6
Race	Malay	245	84.8
	Chinese	16	5.5
	Indian	13	4.5
	Others	15	5.2
Religion	Islam	249	86.1
	Buddhism	17	5.9
	Hinduism	13	4.5
	Others	10	3.5

3.2 Exploratory Factor Analysis of the Student's MOOC-efficacy scale

Following the content validation process, four dimensions (i.e., information searching (eight items), making queries (eight items), MOOC learning (ten items) and MOOC usability (ten items) with a total of 36 developed items were proposed for student's MOOC-efficacy scale. Initially, KMO and Bartlett's Test were applied to all the developed items. Table 3 contains a summary of the findings.

Table 3. KMO and Bartlett's Test for Student's MOOC-efficacy Scale

Student's MOOC-efficacy	Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.911
	Bartlett's Test of Sphericity	Approx. Chi-Square	7966.218
		df	253
		Sig.	.000

KMO's estimate of sample adequacy is outstanding, exceeding the required value of 0.6, and Bartletts' Test of Sphericity is substantial, as shown in Table 3 (Awang, 2012; Hoque & Awang, 2016). As a result, a KMO score close to 1.0 and a Bartlett's test's significance value of 0.0 suggest that the data is acceptable and suitable for the following step. The eigenvalues of the four dimensions of the student's MOOC-efficacy scale then fell between 1.39 and 8.49. This indicates that the items have been classified into four dimensions and will be considered for further study. 63.9% of the variation is explained. All 23 items with a factor loading greater than 0.4 were considered under the four dimensions of the student's MOOC-efficacy scale, as shown in Table 4. The other 13 items from the 36 items were removed.

3.3 Reliability of the Students' MOOC efficacy scale

In a subsequent analysis, construct reliability was analysed using Cronbach's Alpha. Cohen and Swerdlik (2010) and Nunnally (1978) recommended the value of at least 0.70 as the ideal threshold for a scale's reliability, which indicates adequate convergence or internal consistency. Hence, the recommended threshold of 0.70 was adhered to in this research. All reliability indexes for each dimension of the student's MOOC-efficacy scale were determined to be over 0.70, which is deal for social science and educational research (see Table 4) (Awang, 2012; Hoque & Awang, 2016; Hoque et al., (2017). The final student's MOOC efficacy scale comprised a total of 23 items with three items in information searching, six items in MOOC learning, seven items each in making queries and MOOC usability.

4. Discussion

The findings show that the student's MOOC-efficacy scale has sufficient validity and reliability for assessing student's MOOC learning abilities. Preliminary studies and earlier literature reviews aided in the construction of student's MOOC-efficacy constructs by identifying the elements and dimensions of student's MOOC-efficacy constructs in the current study. The content validity ratio (CVR) measures how effectively the dimensions and elements of a concept may be described and maintains the scale's content validity. The researcher was able to fine-tune the scale and decide which items to keep and which to discard by using item CVRs. The decisions to keep, change, or remove items were not made only on the basis of scientific evidence. The EFA was then used to assess the construct validity and reliability of the student's MOOC-efficacy scale. The findings further support the notion that self-efficacy is a multidimensional concept, as evidenced by the findings of a number of other researchers (e.g., Bandura, 1977, 2000; Padilla Rodriquez & Armellini, 2017). The student's MOOC-efficacy scale is a multidimensional construct consisting of four valid and reliable dimensions: (i) information seeking, (ii) making queries, (iii) MOOC learning, and (iv) MOOC usability, which is related to student's MOOC abilities. This is a significant implication to the current self-efficacy literature since there is a paucity of research and scales that measure student's self-efficacy, particularly in MOOCs, as pointed out by the other researchers. (e.g., Almahdi & Sulfeeza, 2017; Ghazali et. al., 2021).

Table 4. Factor Loadings and Cronbach's Alphas for the dimensions of Student's MOOC-Efficacy Scale

Code Item	Items	Dimension			
		Information Searching	Making Queries	MOOC Learning	MOOC Usability
	When I need to search for information while using a MOOC, I am able to…				
IS2	use links attached to other relevant information websites.	.868			
IS1	use online interaction features to get information.	.863			
IS4	seek relevant information from the massive MOOC material.	.791			
	When I face difficulties in a MOOC, I can…				
QU7	seek assistance from a MOOC administrator.		.906		
QU6	seek advice from a MOOC instructor.		.804		
QU5	seek other learners/ peers to share learning problems.		.797		
QU8	ask support from the specific person/group in a MOOC.		.791		
QU2	conduct an online discussion with other MOOC learners.		.701		
QU3	engage in a discussion with a MOOC instructor.		.695		
QU4	request help using 'HELP DESK' features.		.624		
	I experience no difficulties…				
ML3	learning from the massive materials/ resources in a MOOC.			.861	
ML8	learning in an online learning environment in MOOC.			.857	
ML7	learning with many new learners/peers in online learning environment.			.837	
ML6	exploring learning materials in a MOOC (without any limitation).			.834	
ML5	accessing learning materials in a MOOC at all time.			.726	
ML4	managing the diverse materials/ resources from other MOOC learners.			.633	
	It is easy for me to…				
MU3	engage in forum/ comment/ discussion in a MOOC.				.863
MU7	understand MOOC content in a variety of forms (e.g. live action video, animated video, cartoon version of instructor).				.859
MU6	master the learning content in a MOOC.				.818
MU5	capture the basic concepts taught in a MOOC.				.789
MU8	understand the learning tasks in a MOOC.				.741
MU4	make self-evaluations through the learning process in a MOOC.				.734
MU2	upload learning material/ assignments in a MOOC.				.532
	Cronbach's Alpha	.822	.890	.887	.889

In terms of practical applications, this study has resulted in the development of a psychometrically sound scale to assess student's MOOC efficacy. Due to the recency of MOOCs, research on this e-learning platform and related variables such as MOOC-efficacy is still in its early stages in Malaysia. The research has developed an efficacy scale that may be used as an effective diagnostic tool to assess MOOC-efficacy of the students. The researchers anticipate that this reliable and valid scale will spur future self-efficacy research, particularly in MOOCs. Students, educators, administrators, and many others may benefit from the usage of the validated MOOC-efficacy measure. Students can assess their MOOC efficacy and make the required adjustments to improve their learning outcomes. Lecturers and instructors may use the results to determine their student's MOOC efficacy levels on a broad and specific scale. The information can then be used by lecturers or instructors to provide clear, positive, and consistent feedback to their students in order to improve their MOOC efficacy. It can offer precise information to the instructors to help them create constructivist instructional methodologies and master learning objectives, which could lead to more engaging MOOC teaching and learning. In the context of MOOCs, learning style evaluation could be effective for tailoring relevant learning content and assignments for specific students (Nordin et al., 2015, 2016).

The information can also be used in higher education organisations to identify students' MOOC skills. The data gathered from the scale can be used to determine the training requirements of the students as well as the lecturers and instructors. The findings will help in structuring professional development programmes or courses in areas where students and instructors are less effective, as well as informing instructors and faculty members about the training and development activities that are required to improve MOOC instructional strategies and their implementation. The successful deployment of a self-efficacy intervention will aid MOOC students and instructors in improving their performance. Furthermore, MOOC providers or instructors must offer high-quality courses, as well as innovative user-friendly features and interactive material in order to pique and maintain students' interest in MOOCs to enhance their motivation and efficacy in using them. Conducting a need analysis to discover students' requirements, interests, and expectations could be beneficial as a foundation for building effective MOOCs. In order to attract MOOC participation, they must also be made aware of potential barriers to MOOC participation, such as internet accessibility and infrastructure.

4.1 Limitations and Recommendations

The self-efficacy component, according to scholars, is domain-specific, culture-specific, multifaceted and multidimensional (e.g. Wang & Baker, 2015). The best way to assess self-efficacy is to look at the specific abilities. As a result, findings from other studies on self-efficacy beliefs cannot be applied to local circumstances (Tschannen-Moran & Hoy, 2001). It should be emphasised that the current study utilised SIBLE (Chen, 2014) to synthesis four characteristics of student's MOOC-efficacy (information searching, making queries, MOOC learning and MOOC usability) in order to offer a model to explain student’s efficacy in the virtual platform. Other appropriate instruments for assessing self-efficacy in online learning, such as the self-efficacy in virtual world learning survey (deNoyelles, Hornik, & Johnson, 2016) or the web-based learning self-efficacy scale (WBLSES) can be used in future research to measure the construct of student's MOOC-efficacy (Tsai & Tsai, 2003). Other dimensions that are relevant for analysing a student's MOOC-efficacy and can contribute to the development of a model that measures the construct systematically could be considered.

It is a known fact that self-efficacy beliefs are alterable by intervention; hence the construct should be measured before and after any given intervention to raise students’ self-efficacy beliefs. The researchers hereby recommend some intervention to be administered to enhance student’s MOOC-efficacy in specific tasks and test the effectiveness of the intervention. The methodological approach of the research can also be altered in order to strengthen the existing results or validate them. The researchers recommend adopting an experimental or longitudinal design to be applied in future research. A constructivist philosophical approach to research can be adopted in which other methods for collecting and analyzing data could be used. Moreover, the researcher suggests that document analysis, interviews or observations could be added as data collection methods to gather richer data.

5. Conclusion

In 21st-century education, MOOCs have emerged as a new online media for course delivery and learning. It is capable of effortlessly reaching a huge number of learners with high-quality information and interactive learning tools. This study adds to the existing literature on student self-efficacy in MOOCs by providing a fresh viewpoint and contribution to the field. A built scale of student's MOOC-efficacy was established and tested with data acquired from university students, based on the Social Cognitive Theory, the Self-efficacy in Internet-Based Learning Environments scale (SIBLE), and researches on student self-efficacy. The psychometrically sound MOOC-efficacy scale for students established as a result of this research may assist the students, educators, researchers, MOOC producers, administrators and legislators in gaining substantial information on MOOC implementation. Student efficacy in MOOCs is a significant topic that requires additional research in order to incorporate appropriate teaching and learning experiences, because online learning is critical in the context of the Covid-19 pandemic and 21st-century education.

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