

Moderating Effect of Gender between MOOC-efficacy and Meaningful Learning

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Abstract: This study looks at three key concepts in 21st century e-education: MOOC-efficacy, meaningful learning, and gender among undergraduate students at Malaysian public universities. Its primary goal is to investigate the role of gender as a moderator in the relationship between MOOC-efficacy and meaningful learning. This study uses four criteria to define MOOC-efficacy (information searching, making queries, MOOC learning, and MOOC usability). Meanwhile, five dimensions are used to conceptualise meaningful learning (i.e., cooperative learning, active learning, authentic learning, constructive learning, and intentional learning). A cross-sectional survey design was used in this study. The data were collected using a 52-item questionnaire with reliability indices ranging from 0.822 to 0.890 for the dimensions. University students who volunteered to take part in the study and have prior experience using MOOCs make up the study's population. 603 students were chosen at random to represent the sample. Data analysis included the Structural Equation Modeling (SEM) test for moderation. The result indicates a change in the chi-square ($\Delta\chi^2$) value (0.779), which is lower than the chi-square (χ^2) critical value (3.841) at $p < 0.05$. This shows that gender did not emerge as a moderating factor of the relationship between MOOC-efficacy and meaningful learning among these students. An interesting finding includes the fact that males and females are provided an equal exposure and opportunity of education in Malaysia. There were no stereotyping and gaps in the educational treatment, opportunities and learning experience between gender.

Keywords: Gender, Massive Open Online Course (MOOC), meaningful learning, moderating effect, MOOC-efficacy.

1. Introduction

The educational landscape of the 21st century has undergone significant changes as a result of recent, extraordinary technological breakthroughs. Massive Open Online Courses (MOOCs) were initially inspired by the educational paradigms of e-learning, online learning, remote learning, and open learning (Dunn & Kennedy, 2019; Gómez-Galán et al., 2020). The conventional classroom faces a

significant uphill battle against MOOCs, which are a recent development in the field of web-based education. MOOCs provide students an alternate method of receiving interactive instruction and learning. MOOCs have been touted as a potential rejuvenation in instructional technology that responds to the technologically driven environment of 21st century education and industrial revolution 4.0 (Rose Alinda et al., 2017). In Malaysia, Massive Open Online Courses (MOOCs) are still in the beginning phases of their development, which are given through Open Learning. In this regard, MOOCs are now regarded as an essential medium for Malaysian universities to disseminate knowledge to a large number of students in a convenient manner (Ghazali et al., 2021).

Due to the novelty and exploratory nature of the Malaysian MOOCs effort, there are numerous concerns to discover and gaps to fill. Currently, there is a great deal of space for improvement in the current MOOC programmes due to their deficiencies (Adzhar et al., 2017; Ghazali et al., 2021). To establish a successful MOOCs platform, previous researchers have proposed that future study concentrate on and investigate students' MOOC-efficacy for a variety of target audiences and circumstances (e.g., Almahdi & Sulfeeza, 2017; Padilla Rodriguez & Armellini, 2017). Self-efficacy views of students are essential for the success of MOOCs as an online learning approach (Branson, 2017; Pilli & Admiraal, 2017; Wang & Baker, 2015). Students' self-efficacy is defined as their perception of their capacity to successfully complete specified activities (Bandura, 2000; Rodriguez & Armellini, 2017). Self-efficacy is a key concept that can provide us with a more in-depth understanding of the factors that contribute to successful completion of MOOCs. Besides that, scholarly research also indicated that the strength of self-efficacy has an impact on human behaviour or performance (e.g., Bandura, 2000; Padilla Rodriguez & Armellini, 2017; Manzano-Sanchez et al. 2018).

MOOCs are an innovative kind of online education that promotes a more personable classroom environment. The Ministry of Education Malaysia (2015) has proposed looking into the effectiveness of various online learning formats (like MOOCs) on students' ability to acquire meaningful learning. This is because it is crucial to foster a meaningful learning environment in online education that can also support learning in the 21st century. In keeping with the 4.0 industrial revolution (4IR) and 21st century learning, meaningful learning piques students' interest, keeps them actively involved in the learning process, and ultimately fosters the development of their individuality and social skills (Ghazali et al., 2020; Rose Alinda et al., 2017). Therefore, meaningful learning was decided as a factor for human behaviour or performance to be explored in the present research. Being the country to implement a national MOOCs program, Malaysia has set about finding the right platform to effectively deliver high quality courses, thus providing students with a dynamic and meaningful learning experience.

In addition to MOOC-efficacy and meaningful learning, the primary demographic element investigated in this study is gender. Even though a plethora of research looking into gender factors on the association between self-efficacy and performance, the findings are inconclusive. A few studies revealed that gender moderates the association between self-efficacy and performance (e.g., McKay, Dempster & Byrne, 2014; Spence et al., 2010) while some reported gender was not a moderator between the two constructs (e.g., Diaz, 2018; Young, 2015). Gender has been shown as a moderator of interest in educational research (Chou & Sun, 2017) and lead to differences in people's perceptions and utilization of the internet (Sun, Yu, Lin & Tseng, 2016; Wu, 2014). Future research should longitudinally examine the effects of gender differences on the relationship between academic self-efficacy and performance (Huang, 2013). Therefore, this study attempts to test whether students' gender moderates the relationship between MOOC-efficacy and meaningful learning. Establishing gender as a moderator will undoubtedly add to the existing body of knowledge. Thus, this has led to the formulation of the following research question: Does gender moderates the relationship between MOOC-efficacy and meaningful learning? The moderating effect of gender was tested in *Hypothesis-Gender moderates the association between MOOC-efficacy and meaningful learning*.

1.1 Conceptual Framework

The conceptual framework in **Fig. 1** represents an expanded version of the SIBLE (Self-Efficacy in Internet-Based Learning Environment) scale, the meaningful learning framework (Howland et al., 2013), and gender as a mediator. MOOC-efficacy in this study refers to students' abilities and beliefs about performing specific learning tasks in MOOCs, whereas meaningful learning stimulates

students' intellectual curiosity and engages them in dynamic instructional activities. To assess MOOC efficacy, the SIBLE scale (Chen, 2014) was modified. It was conceptualised as having four important dimensions in the current study: i) information searching; (ii) making queries; (iii) MOOC learning; and (iv) MOOC usability. Because it has good psychometric properties and assesses a wide range of competencies that are important in a virtual learning environment, the SIBLE scale is appropriate for capturing the elusive concept of perceived self-efficacy (Chen, 2014; Cheng & Tsai, 2011; Ching et al., 2014). SIBLE was created by combining two survey instruments: one on online academic help seeking (OAHS) behaviour and one on web-based learning self-efficacy (WLSE).

OAHS is the notion that although students with high self-efficacy are learning on their own, they need to know when to seek academic help and when to ask questions to clear confusion. OAHS consists of 3 dimensions, namely information searching, formal query, and informal query. In this research, the researcher collapsed the three dimensions into just two that comprise information searching and making queries dimensions. Formal query in SIBLE measures students' capability to ask questions to instructors on the Internet-based learning platform, while informal query measures their ability to make enquiries generally in other Internet based platforms. From the findings of a preliminary study and supporting literature, the researcher decided to merge formal query and informal query into a single dimension termed as making queries. This decision was made in lieu of the study's scope, which covered a single MOOC and involved no other Internet-based learning platforms. As for the Web-based Learning Self-Efficacy scale, the items generally measure the integration of two concepts, namely web-based learning and web-based usability function. For this research, the researcher adopted these two dimensions into the MOOC context, i.e., MOOC learning and MOOC usability.

Given the empirical data showing how students' behaviour, performance, achievement, and learning are influenced by their sense of self-efficacy (Abdullah et al., 2015; Bandura, 2000; Rodriguez & Armellini, 2017). The goal of the current study is to investigate how students' MOOC efficacy affects meaningful learning. This study follows previous research recommendations to determine whether significant differences in students' MOOC capabilities influence their ability to self-regulate their learning, thus making it meaningful (Ghazali & Nordin, 2019; Hood et al., 2015; Koh, 2017; Pilli & Admiraal, 2017). Any pedagogical use of technology, such as MOOCs, should provide students with opportunities for meaningful learning (Howland et al., 2013). This study used Howland et al (2013)'s meaningful learning framework, which has five dimensions: (i) cooperative learning, (ii) active learning, (iii) authentic learning, (iv) constructive learning, and (v) intentional learning. Meaningful learning combines a variety of teaching and learning activities that allow students to develop knowledge, reflect on their experiences, and articulate the knowledge they have gained (Ghazali & Nordin, 2019; Sailin & Mahmor, 2018).

The association between self-efficacy and performance was also discussed with different demographic variables in previous research (e.g., Bandura, 1986; Achterkamp, Hermens & Vollenbroek-Hutten, 2015; McKay et al., 2014). In this research, the researcher aims to test MOOC-efficacy-meaningful learning association for the proposed variables, gender. Gender is examined as likely moderator of the association between MOOC-efficacy and meaningful learning.

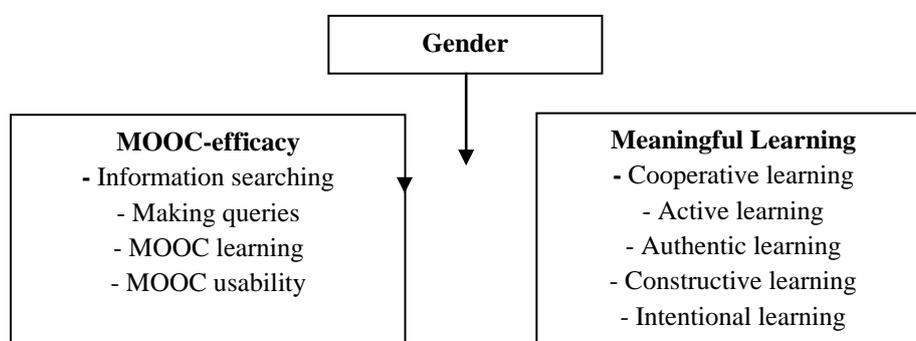


Fig. 1 Conceptual framework of the research

Note. A figure explaining the conceptual framework used in this research.

1.2 Literature Review

1.2.1 Self-efficacy and Meaningful Learning

Self-efficacy is a psychological construct, which discusses in general an individual's belief in his or her capability of handling particular tasks and challenges. This phenomenon basically involves human cognition; what an individual think about himself or herself. In order to have a systematic idea, to understand the sources of this phenomenon and its impact on human behaviour, several psychological theories have been reviewed. One of the psychological theories that is closely related to behaviour and cognition in the social context is the Social Cognitive Theory. It is widely considered to be derived from Bandura's (1986) Social Cognitive Theory (SCT), which is displayed in **Fig. 2**.

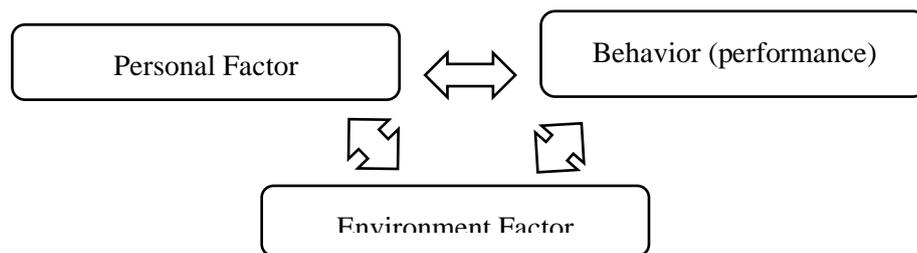


Fig. 2 Social Cognitive Theory (Bandura, 1986).

Note. Social Cognitive Theory derived by Bandura (1986) which is widely used in the social context to show the correlation of behaviour and cognition until today. From Bandura, Albert. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice Hall.

There is a dynamic and reciprocal interaction between personal, environment and behavioural factors as presented in the Social Cognitive Theory (Bandura, 1986). The strength of the interaction will differ based on the personal factor, a specific behaviour and a specific situation in which the behaviour may occur (Bandura, 1986). Personal factors such as cognition (how one thinks) induce different reactions to the environment and performance. Similarly, the environment in terms of social influence through modelling, instruction and social persuasion can influence personal factors and performance. Personal factors have important implications for human performance, depending on how they perceive the environment. In the context of a student's self-efficacy in higher institutions for instance, if he or she had a positive modelling or received positive persuasion from colleagues or instructors, his or her performance would be positive. However, if he or she experienced a negative modelling, his or her reaction would most probably be negative or could otherwise be depending on his or her personal qualities. If the student has strong personal qualities, he or she would be able to ignore the negative influences and continue to perform.

The most prominent feature of Social Cognitive Theory is the self-reflection ability of humans which is regarded as a personal factor. The self-judgement about one's capability to execute an action is self-efficacy beliefs. The self-judgement on one's capability to execute an action is called a self-efficacy belief. Bandura (1986) defines self-efficacy as an individual's belief in his or her capability to accomplish a specific task successfully. Positive self-efficacy beliefs could influence self-directed learning ability, thus leading to successful academic outcome or performance. Individuals with a high level of self-efficacy are confident in their abilities, self-motivated, able to regulate their learning, able to work with minimal guidance, persistent in facing difficulties or challenges and likely to have a high goal achievement (Bandura, 2000). According to this theory, individuals with high self-efficacy approach difficult tasks as challenges to be overcome rather than avoided. Highly confident people set challenges or goals for themselves, step up their efforts and maintain a strong commitment to achieve the goals. They quickly recover their sense of efficacy after failures or setbacks. They attribute failure to insufficient effort or deficient knowledge and skills which are acquirable. In contrast, people who doubt their capabilities avoid difficult tasks and believe in all kinds of adverse outcomes rather than

concentrate on how to perform successfully. In a nutshell, students' self-efficacy is best understood as students' beliefs in their capability to perform tasks successfully and it also determines their motivation to perform well.

In this research, self-efficacy beliefs were examined in the context of MOOCs due to the importance of self-efficacy beliefs in MOOCs (Branson, 2017; Wang & Baker, 2015) and the need for research on MOOC-efficacy in the Malaysian context (Almahdi & Sulfeeza, 2017; Ghazali & Nordin, 2019). MOOC-efficacy in the context of this research refers to students' beliefs in their capabilities to perform a specific learning task in the context of MOOCs. Students in this research are referring to those students who are in the Malaysian Higher Education Institutions. Due to the personalized learning environment in MOOCs, students have to recognize their capabilities to search for relevant information (Goh, 2017; Nordin et al., 2015; Padilla Rodriguez & Armellini, 2017), seek academic help and pose questions during their learning process in MOOCs (Fadzil et al., 2016; Nordin et al., 2015). Moreover, students' capabilities to learn in a MOOC environment and engage in MOOCs practically, are very important for the success of MOOCs (Almahdi & Sulfeeza, 2017; Fadzil et al., 2015, 2016; Nordin et al., 2015, 2016). Of the reviewed literature, the framework for students' self-efficacy in internet-based learning environments by Chen (2014) stood out as the most relevant guide to the present research on MOOC-efficacy. The framework was adapted and conceptualized in four important dimensions to measure MOOC-efficacy (independent variable) in the current research namely: (i) information-searching; (ii) making queries; (iii) MOOC learning, and iv) MOOC usability.

Self-efficacy is a major predictor of human behaviour or performance (Bandura, 1986). This was supported by the bibliometric analysis of research on self-efficacy in computer-based learning environment during the period between 2006 and 2015 (Valencia-Vallejo, Lopez-Vargas & Sanabria-Rodriguez, 2016) and analysis of self-efficacy in an internet-based learning environment from 1999 to 2009 (Tsai, Chuang, Liang & Tsai, 2011). The analyses revealed that self-efficacy was a predictor of students' successful performance in computational environments. Self-efficacy has positioned itself as an interesting aspect, which is the reason for e-learning designers and educators to emphasize it for students' successful performance. Besides a systematic review of psychological, educational and relevant online databases was conducted for studies investigating academic self-efficacy and performance among the population of university students. The research papers published between September 2003 and April 2015 were reviewed and they revealed that there was a significant relationship between these two constructs (Honicke & Broadbent, 2016). Another systematic review by Manzano-Sanchez et al. (2018), examining the relationship between self-efficacy and academic performance of Latina/o students in the United States also yielded the same findings as the previous review.

In the context of this research, meaningful learning is a factor for human behaviour or performance as well as a dependent variable that has been explored. Ausubel (1963) who was a cognitive psychologist, explained that meaningful learning involves students in an active process of meaning-making where they interpret their learning experiences cognitively rather than regurgitate information. Meaningful learning is about how a person learns, the description of an instructional activity and how it should be organized. Meaningful learning occurs within "knowledge construction, not reproduction; conversation, not reception; articulation, not repetition; collaboration, not competition; and reflection, not prescription" (Bressington et al., 2018; Jonassen et al., 2003). Meaningful learning involves understanding how the information learnt fits together, while rote learning is the memorization of information based on repetition. Therefore, rote learning is forgotten rapidly whereas meaningful learning is not (Ausubel, 1963; Jonassen, 2002). Recently, several studies tried to integrate technological advancement into the educational landscape in order to support meaningful learning (e.g., Din, 2010; Hamdan et al., 2015; Howland et al., 2013; Koh, 2013, 2017; Yuniarta et al., 2012). The underlying dimensions of meaningful learning for the research were adopted from Howland et al.'s (2013) meaningful learning framework that has five dimensions, namely: (i) cooperative learning, (ii) active learning, (iii) authentic learning, (iv) constructive learning, and (v) intentional learning.

Previous scholars have recommended investigating the possibility of students' MOOC capability on influencing their experience of meaningful learning (Ghazali & Nordin, 2019; Pilli & Admiraal, 2017). Recent research by Koh (2017) also proposed a more rigorous examination of self-

efficacy in blended learning courses and its relationship with the various meaningful learning dimensions. A well-designed MOOCs encourage meaningful learning among students (Rodriguez & Armellini, 2017). Meaningful learning stimulates students' intellectual curiosity and engages them in dynamic instructional activities, thus encouraging the growth of holistic human characteristics which are in line with the 4.0 industrial revolution (4IR) (Selamat et al., 2017) and 21st century learning (Sailin & Mahmor, 2018). The findings of the research may afford insights into the pedagogical aspect of MOOCs and the deficiencies of the instructional model used in open learning environments, as highlighted by Fasihuddin et al. (2013).

1.2.2 Previous Research on Gender

Social Cognitive Theory has stated that biological characteristics of humans such as gender, age, race and physical attractiveness will induce different reactions in humans as they interact with the social environment (Bandura, 1986). Gender as a biological characteristic of humans, has evoked different reactions on human personality and behaviour (Bandura, 1986; Velu & Nordin, 2011a, 2011b). Some studies reported that there were significant differences in the individual self-efficacy between males and females (Huang, 2013; Fallen & Opstad, 2017; Jane, 2014; Ong & Lai, 2006), while others did not find any association between the two (Tarhini, Hone & Liu, 2014; Siti Salwa & Norwati, 2013). Ong and Lai (2006) explored gender differences in terms of their self-efficacy beliefs and the acceptance of internet-based learning (IBL). The research findings showed that the female rating of the internet-based learning self-efficacy (IBLSE) was lower than that of males. A meta-analysis by Huang (2013) containing 247 independent studies on gender differences in academic self-efficacy identified that there were significant differences between males and females. Females displayed higher language arts self-efficacy as compared to males, while males exhibited higher mathematics, computer, and social sciences self-efficacy than females. In the small-scale research by Jane (2014), she indicated that gender differences were significant among school children's self-efficacy. An interview with the teachers involved showed a lack of self-efficacy beliefs of their students and this potentially had an impact on the students' performance. However, another research by Siti Salwa and Norwati (2013) on students' general self-efficacy based on gender differences showed that there were no significant differences in general self-efficacy between males and females. With regard to the correlations between general self-efficacy and gender, the research revealed that there was very weak correlation, close to negligible.

Despite an abundance of studies examining the effect of numerous demographic characteristics on the relationship between self-efficacy and performance, the results remain unclear. Some research has shown that gender plays a role in determining the strength of the relationship between self-efficacy and performance (e.g., McKay et al., 2014; Spence et al., 2010), but other research has found that gender does not play a role in determining the strength of the relationship between the two constructs (e.g., Diaz, 2018; Young, 2015). When constructing ideas pertinent to the topic at hand, it was suggested that gender concerns should be taken into consideration (Ong & Lai, 2006). In subsequent studies, it will be important to study whether or not gender differences have any bearing on the relationship between academic self-efficacy and performance.

2. Materials and Methods

This research was purely quantitative in nature employing the cross-sectional survey design. The information was gathered with the use of a well-designed survey questionnaire.

2.1 Measures

The Standards for Educational and Psychological Testing served as a guide for the development of the measures used in this study (APA, AERA & NCME, 2014; referred to hereinafter as the Standards). Educators and psychologists can look to the Standards for a high-level overview of the full process of creating, administering, analysing, and reporting on assessment results. Professionals who specify, develop, or choose tests, as well as those who analyse or assess test findings, can use the

Standards as a guide to help them achieve their goals in designing a testing programme (APA, AERA & NCME, 2014; Plake & Wise, 2014). The content validity ratio, often known as CVR, is the metric that is used to measure the content validity.

The Principal Component Analysis (PCA) was conducted on the inter-variables correlation matrix to identify the underlying dimensions measured by the variables. In PCA, all 23 MOOC-efficacy items and 31 meaningful learning items load successfully on their respective four and five dimensions. In a subsequent analysis, construct reliability was analysed using Cronbach's alpha. The reliability indexes are summarised in **Table 1**. Cohen and Swerdlik (2010) recommended the value of at least 0.70 as the ideal threshold for an instrument's reliability, which indicate adequate convergence or internal consistency. Hence, the recommended threshold of 0.70 was adhered to in this research. All reliability indexes were found to be above 0.70 (Ghazali et al., 2020), which are considered desirable for social science and educational research.

The instrument comprised three sections, namely Sections A, B and C. It was attached with a cover letter that introduced the research topic, research importance and guarantee of confidentiality. Instructions were given to guide the respondents through each part of the questionnaire and how they should respond. Section A requested the respondents' demographic information. Section B contained 23 items measuring MOOC-efficacy in four dimensions and Section C contained 31 items measuring meaningful learning in five dimensions. Every item in both Sections B and C was measured using the scale from 1 to 5, with 1 = *Not confident at all* and 5 = *Very confident* (for Section B), and 1 = *Strongly Disagree* and 5 = *Strongly Agree* (for Section C) adapted from Hoque and Awang (2016) and Hoque et al. (2017).

Table 1. Components of the Measures and the Reliability

Section	Component	Cronbach's Alpha
Section A	Demographic Information	-
Section B	MOOC-Efficacy	
	1. Information Searching (IS)	0.822
	2. Making Queries (QU)	0.890
	3. MOOC Learning (ML)	0.887
	4. MOOC Usability (MU)	0.889
Section C	Meaningful Learning	
	1. Cooperative Learning (CL)	0.885
	2. Active learning (AL)	0.838
	3. Authentic Learning (UL)	0.864
	4. Constructive Learning (OL)	0.876
	5. Intentional Learning (IL)	0.849

Note. This table demonstrates the reliability indexes used in this research which was derived using Cronbach's alpha.

2.2 Respondents

The population list totalling a number of 1,524 MOOC-experienced university students was obtained. Defining the population of the present study which refers to university students with a MOOC experience who willingly volunteered to participate in this research, enabled the research findings to be correctly generalized to at least this subset of students who have had some contact with MOOCs. The population was decided as such so that the study could have a clear sampling frame to make simple random sampling possible. Data collection was conducted in three public universities in Malaysia (i.e., Universiti Putra Malaysia (UPM), Universiti Sains Islam Malaysia (USIM) and Universiti Teknologi MARA (UiTM). The population defined for the research was representative of the population existing in the three universities, with male students making up 34.2% (n=521) and female students 65.8% (n=1003). The sample composition was fair as the average ratio of male to female students in these

three universities was 35:65, i.e. 35% male students to 65% female as reported in the 2017 higher education statistics (Ministry of Education Malaysia, 2017).

The targeted sample size was calculated based on the target population size of this research ($N=1,524$); therefore, the sample should be $95\% \pm 5 = 306$. This was determined based on Krejcie and Morgan's (1970) guidelines for deciding minimum sample size. In any research, a complex model estimation requires a large sample size (Hair et al., 2010) given the possibility of missing data (Hair et al., 2010). The decision to add more respondents to the sample is in line with the general rule given by Creswell (2012), that is, the larger the sample, the closer it will be in characteristics to the given population. In addition, oversampling of 40% to 50% to account for lost respondents or non-responses is also recommended by Salkind (2018). In order to ensure that an adequate sample size could be obtained for this research, an additional 50% was added to the minimum sample, hence $50\% + 306 = 459$.

The researcher decided to randomly select fifty percent (50%) of the students whose names appeared in the sampling frame ($N=1,524$) using the Statistical Package for the Social Science (SPSS) software. From the sampling frame, the required sample (i.e., $50\% \times 1,524 = 762$) was generated via a random selection of students' matric numbers. The questionnaire was then given to every student whose matric number was selected. A total of 762 questionnaires were distributed to the selected respondents. This figure was judged adequate for the research to overcome the problem of unusable questionnaires, generate sufficient data, and make defensible conclusions using the statistical measures proposed. Out of the 762 questionnaires distributed, 657 were returned, constituting a response rate of 86.22%. However, 34 questionnaires were not usable as they contained missing data. According to Sekaran and Bougie (2011), a 75% return rate is required for research to fulfil its purpose and objectives. Thus, the return rate of 81.76% ($n = 623$) obtained in the study was more than desirable. In the exploratory data analysis, 20 cases were removed from the data set leaving a final sample of 603 questionnaires to be analysed.

2.3 Data Analysis Strategy

The full-fledged SEM approach was applied in this research to estimate the hypothesized conceptual model of MOOC-efficacy and meaningful learning. In SEM, there are two models: measurement model and structural model. The measurement model represents how items measure latent variables, while the structural model indicates how the measured constructs join with other constructs in a study (Wang & Wang, 2012). The two measurement models of this research (i.e., MOOC-efficacy and meaningful learning) were assessed through Confirmatory Factor Analysis (CFA) to examine the extent to which the corresponding items captured the concepts of MOOC-efficacy and meaningful learning in a reliable and valid way (Kline, 2015; Hair et al., 2010). CFA was also employed in this research to test for model fit, construct validity and construct reliability (Lomax & Schumacker, 2012; Awang, 2015). Running a CFA is the initial step in the SEM analysis to test a model and to see whether the constructs of MOOC-efficacy and meaningful learning are efficiently and sufficiently represented.

SEM can simultaneously estimate chains of direct and indirect causal influences among variables by including them into a structural model (Hair et al., 2010; Baleghi-Zadeh et al., 2014). It allows the researcher to evaluate a number of causal links between independent and dependent variables, as opposed to first-generation methods such as multiple regression analysis (Byrne, 2013). Using SEM, the researcher studied the association between MOOC-efficacy and meaningful learning in the context of this study. Cohen et al. (2013) concurred that the use of multiple regression is unrealistic or impractical due to its limited ability to identify linear correlations between variables or constructs. In such situations, multiple regression analysis may produce erroneous results. The most important aspect of SEM is its capacity to simultaneously examine the influence of several connected variables.

Furthermore, SEM is also seen as an analytical strategy for complex models that include multiple mediator variables (parallel or chain mediation), multiple antecedent variables, or multiple consequent variables (Mathieu & Taylor, 2006; Lance & Vanderberg, 2009). More so, most of the aforementioned methodological issues can be resolved by SEM alone. Precisely in this research, the researcher was able to verify the roles of gender as moderator in the association between MOOC-

efficacy and meaningful learning. Hence, the full-fledged SEM in this research encompassed a set of procedures used to assess the hypothesized conceptual model with latent variables and its complex network of relationships.

3. Results

3.1 Demographic Information

There were 762 questionnaires sent out, and 657 were filled out and sent back. This is an 86.22% response rate. But 34 of the questionnaires could not be used because there was missing information. Sekaran and Bougie (2016) said that a research project must have a 75% return rate in order to accomplish its goals. So, the study's return rate of 81.76 percent (n = 623) was more than good. According to Kline (2015), 200 is a common sample size for a SEM analysis in educational research, while Hair et al. (2010), suggested a minimum sample size of 100 to 150 to ensure a stable maximum likelihood estimation. The data set was left with a final sample of 603 to be analysed after the outliers were found. **Table 2** shows the demographics of the people who answered the survey.

Table 2. Demographics of the sample (N=603)

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	201	33.3
	Female	402	66.7
Age	Less than or equal 20 years	111	18.5
	21 to 23 years	426	70.6
	24 to 26 years	63	10.4
	More than 26 years	3	0.5
University	UPM*	278	46.1
	UiTM*	218	36.2
	USIM*	107	17.7
Race	Malay	569	94.4
	Chinese	15	2.5
	Indian	9	1.5
	Others	10	1.6
Religion	Islam	575	95.3
	Buddhism	10	1.7
	Hinduism	9	1.5
	Others	9	1.5

Note. This table shows an overview of the demographics of the respondents who had answered the questionnaires completely.

*UPM means Universiti Putra Malaysia; UiTM means Universiti Teknologi MARA; USIM means University Sains Islam Malaysia.

3.2 The Measurement Model

The Confirmatory Factor Analysis (CFA) was aimed at measuring the unidimensionality of the dimensions, the reliability of the latent variables and their validity in order to ensure that they all fit the data. Failure to ensure all this may cause the structural model to have low reliability. This research examined two main constructs, i.e., MOOC-efficacy and meaningful learning, where the former included four dimensions, namely information searching (IS), making queries (QU), MOOC learning (ML) and MOOC usability (MU), while the latter comprised five dimensions (i.e., cooperative learning (CL), active learning (AL), authentic learning (UL), constructive learning (OL) and intentional learning (IL)). CFA procedures were run on the two measurement models, one on MOOC-efficacy (the exogenous construct) and the other, on meaningful learning (the endogenous construct). The degree of

correspondence between the theoretical constructs and the observed data was assessed using goodness of fit (GOF) indices.

The fit statistics for MOOC-efficacy model in **Fig. 3** indicate adequate fit between the measurement model and the data: RMSEA = 0.061, CFI = 0.935 and a normed chi-square (χ^2/df) = 3.322. According to Hair et al. (2010), a hypothesized conceptual model that demonstrates a RMSEA value of < 0.08, a CFI value of ≥ 0.90 and a normed chi-square value of $2.0 \leq \chi^2/df \leq 5.0$ is accepted as having fulfilled the conditions of a valid measurement model. Thus, the indices of the MOOC-efficacy measurement model are within the acceptable parameters. All the statistics provide empirical evidence that the measurement model of MOOC-efficacy is psychometrically sound in terms of validity and reliability.

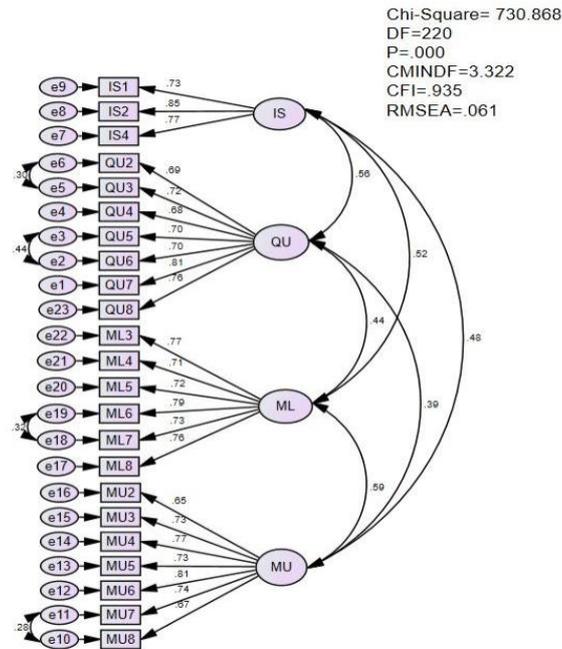


Fig. 3 CFA of MOOC-efficacy

A factor loading of 0.6 or higher for each item, according to Awang (2015), indicates high convergent validity. The factor loading of all items in this study is greater than 0.6, with a minimum value of 0.647. The AVEs for all four model dimensions (information searching, making queries, MOOC learning, and MOOC usability) were greater than 0.5. The composite reliability (CR) value was also greater than 0.7, providing additional evidence to support the measurement model's convergent validity and reliability. The discriminant validity of the model was demonstrated by the AVE factors, which were greater than the squared shared variance (SV) for all constructs (Fornell & Larcker, 1981). All of the inter-factor correlation values in the model were less than 0.85, indicating strong evidence for discriminant validity (Awang, 2015).

On the other hand, all the statistics provide empirical evidence that the meaningful learning measurement model was construct valid and reliable. For this model in **Fig. 4**, a RMSEA of 0.340, a CFI of 0.970 and a normed chi-square (χ^2/df) value of 1.740 were obtained. Thus, the model's fit indices fell within the acceptable values--except for the normed chi-square value which was less than 2 (Hair et al., 2010). However, Bentler (1990) stated that a normed chi-square value of less than five is acceptable if the sample is more than 200. Since the study's sample was 603, the fit indices of the meaningful learning measurement model were, therefore, acceptable.

All meaningful learning items had factor loadings greater than 0.6, with the minimum loading being 0.623 and the maximum loading being 0.806. Except for intentional learning, the AVEs of all four model dimensions (cooperative learning, active learning, authentic learning, and constructive learning) were greater than 0.5, indicating convergent validity (Hair et al., 2010). According to Fornell

and Larcker (1981), an AVE of 0.4 is acceptable when the CR of the construct is greater than 0.7. As the CR values for all dimensions of meaningful learning were greater than 0.7, the AVE for intentional learning (0.448) was thus acceptable in this case, supporting the claims of convergent validity and reliability. The dimensions' inter-factor correlation values were less than 0.85, with a minimum of 0.545 and a maximum of 0.782, indicating that the model has discriminant validity.

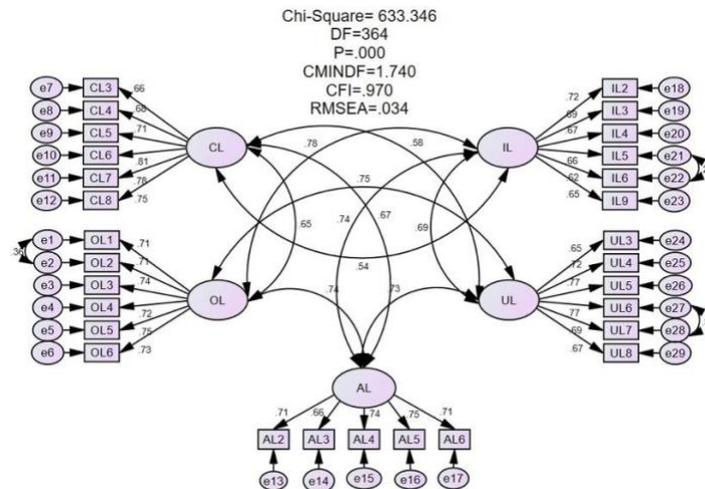


Fig. 4 CFA of Meaningful Learning

3.3 The Structural Model

After the measurement model was validated, it was transformed into a hypothesized structural model to test the causal effect of MOOC-efficacy on meaningful learning with hypothesized causal paths. The resultant structural model of MOOC-efficacy and meaningful learning, together with the standardized estimates and fit indices obtained. The fit indices indicate an adequate fit: RMSEA = 0.041, CFI = 0.923 and $\chi^2/df = 2.067$. The results showed that the path coefficient between these two constructs was practically important and statistically significant. For that reason, the structural analysis of the model postulated that MOOC-efficacy would have a significant positive impact on meaningful learning experience.

3.4 Moderation Effect of Gender

After examining the path relationships in the main model, the next step was to examine the moderation effect of gender. There are several methods used to test for moderation effects within a structural model, namely testing for interaction effects and using multiple-group analysis (MGA) (Hair et al., 2006). The study used multi-group analysis via AMOS to examine the moderation effect of gender.

To test for gender invariance, a simultaneous analysis of two subsamples (male and female students) was carried out. In the analysis, the path coefficient between MOOC efficacy and meaningful learning (MOOC-efficacy-->meaningful learning) was constrained to be equal across the male ($n_1 = 201$) and female groups ($n_2 = 402$). **Table 3** shows a change in the chi-square ($\Delta\chi^2$) value (0.779), which is lower than the chi-square (χ^2) critical value (3.841) at $p < 0.05$ (Hair et al., 2006). Therefore, the findings show that gender did not moderate the relationship between MOOC-efficacy and meaningful learning. Thus, *Hypothesis: Gender moderates the association between MOOC-efficacy and meaningful learning* is rejected. The full results are shown in **Table 3**.

Table 3. Results of Multiple Group Modeling by Gender

H*	Model	Chi-squared (χ^2)	df	Critical value	Chi-squared difference ($\Delta \chi^2$)	Sig
H1	Unconstrained	4240.458	2518	3.841	0.779	N.S*
	Constrained	4241.237	2519			

Note: This table shows the results of the calculation for the relationship between genders versus MOOC- efficacy and meaningful learning of the respondents who had answered the questionnaires completely. The results showed that there is no relationship between the gender and MOOC-efficacy and meaningful learning, which indicates that the hypothesis is rejected.

*N.S means not significant; H means hypothesis.

4. Discussion

The research question sought to verify the role of gender as moderator between MOOC- efficacy and meaningful learning. The moderating effect of gender was tested in *Hypothesis-Gender moderates the association between MOOC- efficacy and meaningful learning*. The findings of this research show that gender did not moderate the relationship between MOOC- efficacy and meaningful learning. Thus, the results did not support the hypothesis. It is justifiable then to conclude that gender did not interact with the MOOC efficacy to influence meaningful learning: hence in this study, gender was not a moderating variable. The observations are in line with previous findings (for example, Diaz, 2018; Young, 2015) which reported that gender did not moderate the association between self- efficacy and performance. Therefore, this research has added to the existing body of evidence that emphasizes that students' self- efficacy- meaningful learning association was not dependent on gender. In Malaysia, both males and females have equal access to school and the same opportunities to learn. There was no gender bias in any aspect of the educational system, including how students were treated, the chances they were given, or the lessons they were required to learn.

Despite the inclusion of gender in the equation, the fact remains that students' MOOC- efficacy determines their meaningful learning experience. That gender did not moderate the model was likely due to the absence of gaps and stereotyping in the educational opportunities and learning experiences among gender, especially in the context of Malaysian education. As mentioned in the Malaysia Federal Constitution (1957) of the rights in respect of education, there shall be no discrimination against citizens based on their religion, race, descent, place of birth or gender. Males and females are provided an equal exposure and opportunity of education in Malaysia. Islam & Asadullah (2018) in their research have claim that Malaysia showed the lowest degree of gender stereotypes in their school textbooks. In other words, textbooks in Malaysia have the highest gender balance compared to Indonesia, Pakistan and Bangladesh (other countries involved in the study) textbooks.

4.1 Limitations and Recommendations

Scholars say that the self- efficacy dimension is complicated, multidimensional, specific to a domain, and unique to a culture (e.g., Wang & Baker, 2015). The best way to measure self- efficacy is by looking at specific skills. This study took the dimensions of SIBLE (Chen, 2014) and used them to make a reliable measure of MOOC- efficacy. The sizes were limited to those that SIBLE had suggested (Chen, 2014). Based on what was found, the four factors of MOOC- efficacy had a big, positive effect on how much students learned and how well they learned it. This opens the door for future research to look at other MOOC- efficacy factors, such as MOOC interaction, MOOC challenges, and time management in MOOCs, that might affect meaningful learning. These other factors may give more information to help explain what makes learning more meaningful for students. In the current study, the researcher has examined gender access as moderator variable, future researchers are subsequently

encouraged to examine the factorial validity of the MOOC-efficacy scale used on other variables such as race, religion, computer self-efficacy and academic qualification.

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 researcher hereby recommends some intervention to be administered to enhance students' 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 researcher recommends 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. Given the shift and increasing inclination towards meaningful learning in higher education, the development of alternative assessment methods takes priority (Al-Mahrooqi & Denman, 2018; Centre for Academic Development of Universiti Putra Malaysia, 2018). Alternative assessment focuses on the application of knowledge and skills as well as higher levels of real-world applications (Reardon, 2017). The assessment could be designed by taking into account the factors that affect meaningful learning in order to measure what students have actually learned from the curriculum (Pili & Admiraal, 2017).

5. Conclusion

MOOCs are a brand-new form of online instruction and learning for the classroom of 21st century education. It is capable of reaching a large number of learners in an effortless manner with high quality content and interactive tools for learning. This research has brought a new perspective to current literature on students' self-efficacy in the context of MOOCs and meaningful learning. The Social Cognitive Theory, the Self-efficacy in Internet-Based Learning Environments scale (SIBLE), the meaningful learning framework, and previous research on students' self-efficacy and meaningful learning were used to come up with a research model, which was then tested with data from students in higher education. This research examined the relationship between MOOC-efficacy and meaningful learning, producing results that demonstrated a strong, positive relationship between the two constructs. Gender was not found to be a significant moderator of the link between MOOC-efficacy and meaningful learning. An interesting finding includes the fact that males and females are provided an equal exposure and opportunity of education in Malaysia. There was no gender bias in any aspect of the educational system, including how students were treated, the chances they were given, or the lessons they were required to learn. The findings of the research as a whole have a great deal of significance, particularly for students attending educational institutions of higher learning in Malaysia, as well as for teachers and administrators working in educational institutions. Given the prominence of online education and cutting-edge technologies in the classroom of the 21st century, the self-efficacy and depth of learning experienced by students enrolled in MOOCs are crucial topics to explore further.

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