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A Conceptual Persuasive Development Framework to Change Students' Behaviour in Massive Open Online Courses: A Review

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Abstract. Some experts attribute the relatively low completion rates of Massive Open Online Courses (MOOCs) partly to user dissatisfaction with the system. Live instructors are absent from MOOCs due to their delivery through virtual learning platforms. A distinctive feature distinguishing MOOCs from other e-learning systems is the significantly higher ratio between users and instructors. Consequently, the main challenges include limited interaction between students and study materials and the heightened need for instructor guidance. Consequently, enhancing the design of the existing MOOCs system is imperative to create a more engaging learning experience. Previous studies have attempted to incorporate persuasive design elements into e-learning systems. However, these studies must integrate persuasive design with motivational factors and effective learning strategies to encourage student behavior change and increase student engagement. The present

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study utilizes prior literature to establish a conceptual framework for persuasive e-learning development, known as PEDAL, which integrates motivational factors, learning strategies, and persuasive design principles. The initial section of the paper introduces issues related to student motivation, learning strategies, the MOOCs platform, and the potential impact of persuasive technology on enhancing the effectiveness of MOOCs. The subsequent section elucidates the methodology employed for the literature search. The third section explains the mechanisms of the PEDAL framework and discusses relevant previous literature that contributed to its development. Finally, the last section outlines the framework's limitations and potential future improvement. The paper also outlines how the proposed conceptual framework can be applied to design an effective e-learning system.

Keywords: E-Learning; Persuasive Design; Motivation; Learning Strategies; MOOCs

1. Introduction

University students tend to procrastinate on their academic tasks due to lecturers' lack of examinations and supervision (Nikolayeva et al., 2020). This behavior is considered a self-regulatory failure (Fritzsche et al., 2003; Greene et al., 2011), affecting student academic performance and emotional well-being (Rabin et al., 2011; Steel, 2007). Even though many students try to improve their academic performance by managing their study behavior to complete their academic assignments, they often need help maintaining their motivation and learning strategies, especially in the online learning setting (Filippou et al., 2016). It might be complex to measure the study behavior that could affect student academic performance (Filippou et al., 2016). Therefore, students' motivation must be studied as an essential prerequisite for learning.

E-learning, m-learning, and d-learning are closely related terminologies. E-learning is "the learning process assisted by digital electronic resources and media." Meanwhile, m-learning is a subset of e-learning defined as "e-learning using mobile devices and wireless communication," and d-learning is a combination of e-learning and m-learning. According to (Fischer, 2013), e-learning innovation is characterized as the technological e-learning forms viewed as new by potential users. E-learning is essential for educational development and provides opportunities for developing countries to improve their academic development, including countries with economic impediments (Modise, 2022) . Furthermore, it aids educators in upgrading their pedagogy of learning skills to the 21st-century tools and the current teaching force (Attewell et al., 2005). The teaching and learning process is a business process of educational organizations. The organization's process is obtained if the organization's members accept the chosen strategy. This acceptance includes the choice of technology, supporting teaching and learning to influence the changes in the learning behavior of its users (Zeng et al., 2015). The development of Internet-based communication technology can alter how learners communicate and interact. Examples of 2.0-based technologies are blogs, social media, YouTube, and others (Newman et al., 2016).

Thus, individual learning culture is related to maximizing the sustainability of technology use.

In Massive Open Online Courses (MOOCs), students must be able to manage their learning strategies due to the need for more guidance from instructors (Hood et al., 2015). Studies have shown that using MOOC-based e-learning systems result in higher dropout rates, particularly at the end of the course (Shukor & Abdullah, 2019). The pedagogy of MOOC-based e-learning systems differ from standard e-learning systems because of the high number of users since students are more independent in their learning due to a very high lecturer-to-student ratio (Nordin et al., 2016). Other than that, the inability to meet the deadline, the instructor's language, challenging assignments, and difficulties understanding the course topic are common causes of dropout (Sherimon et al., 2021). Considering that effective study behaviors in MOOCs contribute to students' performance, an increasing number of studies explore self-regulated learning strategies that influence the success of MOOCs (Lee et al., 2020). Research conducted by (Prince, 2004) found that lectures in which students are actively involved seem more effective than lectures in which students passively receive information. While a study by (Khan et al., 2017) clearly stated that student participation is an essential indicator of successful teaching and learning, regardless of the material or pedagogy. Therefore, student participation should be considered one of the learning strategies that could contribute to academic performance in online learning.

Persuasive technology is developed to change users' behavior (Fogg, 2009a). Because of the capability of helping students adapt and fasten the behavior change without coercion, this technology can be applied to MOOCs to improve students' poor study behavior (Filippou et al., 2015). Past studies have attempted to include elements of persuasive design within e-learning systems. However, few studies integrate persuasive design with motivational factors and efficient learning strategies to stimulate changes in student behavior and amplify student engagement. Since a higher dropout rate is a significant issue in MOOCs, it is important to understand the previous works on motivational factors, learning strategies, and persuasive technology to develop an effective MOOCs platform that could change students' behavior. This study uses previous literature to develop a conceptual framework for designing a persuasive e-learning system that combines motivational factors, learning strategies, and persuasive design principles to encourage students' behavior change and increase students' participation in MOOCs.

2. Methodology

There are five steps listed in the framework for finding literature which is 1) framing the questions for a review; 2) identifying relevant work; 3) assessing the quality of studies; 4) summarizing the evidence; 5) interpreting the findings.

2.1 Step 1: Framing the Questions for a Review

The Four main research questions (RQ) are formed to answer the importance of every research component and their relationship:

- RQ1: What factors contribute to improving students' behavior toward e-learning?
- RQ2: What persuasive design models or frameworks are suitable for e-learning?
- RQ3: How can persuasive designs improve students' behavior?

2.2 Step 2: Identifying Relevant Work

The search for articles should be done by considering multiple sources. The research selection criteria should be derived directly from the review questions and defined in advance. The forward and backward search method was used in this review to identify related research articles. This study uses the forward technique by considering Google Scholar, EBSCO host, ScienceDirect, and the ACM Digital Library as the main search engines. In contrast, the backward technique uses citations in the identified articles to find the continuity of the previous works.

2.3 Step 3: Assessing the Quality of Studies

Every stage of a review requires a quality assessment of the study. The minimally acceptable degree of literature should be able to answer the question formulation in Step 1 through credible search engines listed in Step 2. The selected research should be submitted to a more nuanced quality assessment using general critical evaluation guides and design-based quality checklists. These quality assessments help determine the literature's validity and make recommendations for future research. There are five conditions considered in the process of finding related articles. Articles that do not meet any one of the conditions were excluded. The conditions for search screening are as follows:

- Articles must be written in English.
- All articles are available in full-text format.
- All articles must contain search keywords.
- All articles must sufficiently explain the topic.

Table 1 explains every selected keyword used to search for literature.

Table 1: Explanation of the Search Keywords

Search Theme	**Explanation**
Learning Motivation	The result shows motivational factors that could affect students' achievement.
Learning Strategies	The result shows learning strategies to improve their learning progress or academic performance.
Persuasive Technology	The result shows the fundamentals of persuasive technology, including the definitions, type of technology, and other related information that could contribute to the study.
Persuasive Design	The result shows the works behind persuasive designs and how to implement persuasive designs in technology.
Persuasive E-Learning	The result shows existing research on persuasive e-learning technologies and the motivation behind them.
Behaviour Change	The result shows various behaviour change models that have the potential to be implemented

2.4 Step 4: Summarizing the Evidence

Figure 1 shows the review of the selection process of the articles. About 231 articles were found throughout the first stage of the review process based on predetermined keywords. Forward and backward methods were used at this stage. All the articles went through the Mendeley application's organising process, including checking for duplicated articles, which resulted in 187 articles left for the next review stage. The second stage requires the abstract screening process to identify relevant articles. This stage helped select relevant articles much faster, without necessarily going through the complete text, which is time-consuming and ineffective. 73 articles were found relevant after the second stage was completed. The 73 articles left were then subjected to the third stage to analyse the whole text based on the predetermined conditions. Any articles that did not fulfil the conditions have been excluded and categorized as irrelevant. Finally, only 44 relevant articles were chosen to establish the conceptual design framework in this study.

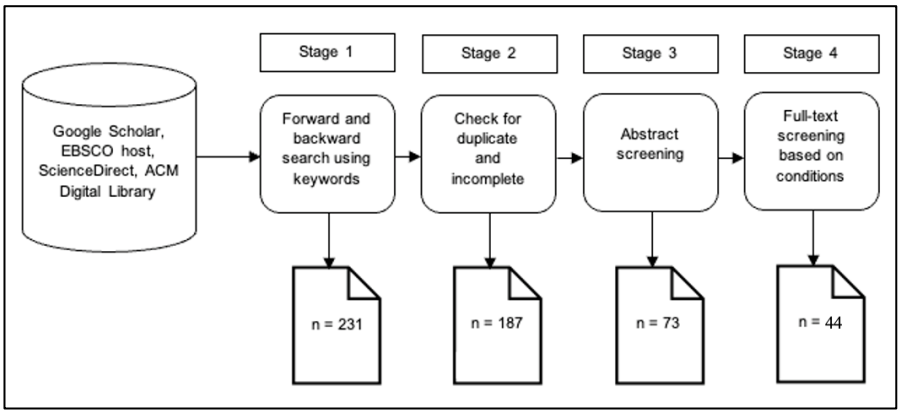

Figure 1: Literature Selection Process

3. The Conceptual Persuasive E-Learning Development Framework (PEDAL)

The conceptual framework is divided into three components which are 1) elements of students' motivational factors and learning strategies, 2) persuasive design principles that can be implemented in e-learning systems, and 3) expected students' behavior. Student-centered aspects, such as motivational factors and learning strategies, are shown in the first column. The second column is associated with persuasive design principles based on motivational factors and learning strategies. The third column is focused on expected behavior that may impact students. These three components of the conceptual design framework are interrelated. The guideline for implementing PEDAL is shown in Table 2.

Table 2: Guidelines for Implementation of PEDAL

No.	Phase	Component	Guidelines
1.	Identify motivational factors and	Motivational factors and learning strategies	Experiment with students using the MSLQ instrument (Filippou et al., 2016).

	learning strategies		**Outcome:** The most significant students' motivational factors, learning strategies, and potential study behavior.
2.	Implement persuasive design principles to the systems	Persuasive design principles	Consult with design and e-learning experts to map motivational factors and learning strategies to the most related persuasive design principles (Mhd Salim & Mohamad Ali, 2019). **Outcome:** Construct persuasive design features using the selected persuasive design principles by implementing the persuasive system development (PSD) method.
3.	Measure the impacts on students	Study behaviour	MSLQ instrument provides study behaviors linked to motivational factors and learning strategies to be tested (Mhd Salim et al., 2019a). **Outcome:** Evaluate the persuasive elements' effectiveness and repeat the second phase if the desired study behavior is not achieved.

According to PEDAL, designing persuasive e-learning systems consists of three phases. Identifying motivational factors and learning strategies is required in the initial phase. An experiment with students is needed to determine their motivational factors and learning strategies (Filippou et al., 2016). The most significant motivational factors and learning strategies that affect students' academic achievement will be discovered at the end of this phase. The second phase is developing an e-learning system based on Persuasive Design Principles, which includes constructing the system's features and interface using the persuasive system development process. This step necessitates the involvement of design and e-learning experts. These experts will be consulted to map motivational factors and learning strategies to the most relevant persuasive design principles (Mhd Salim & Mohamad Ali, 2019). The last step will assess whether the proposed persuasive design features help students achieve the target study behaviors. The second phase must be repeated if the targeted study behavior does not achieve. The conceptual persuasive e-learning development framework (PEDAL) is depicted in Figure 2.

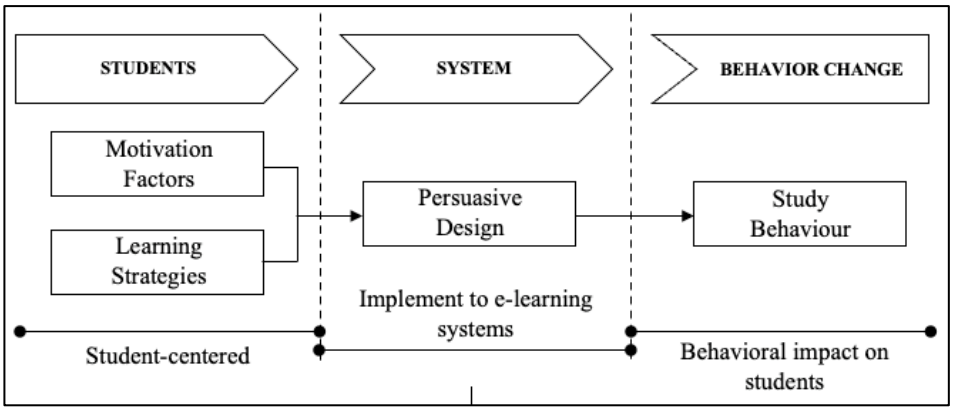

Figure 2: The Conceptual Persuasive E-Learning Development Framework (PEDAL)

4. Finding & Discussion

There are 3 main phases in the PEDAL framework, which are 1) Identifying motivation factors and learning strategies; 2) Persuasive e-learning design implementation, and 3) Evaluating study habits.

4.1 Phase 1: Identifying Motivation Factors and Learning Strategies

MOOCs are open and convenient access to web-based online learning courses that involve many students globally. It provides a new approach to learning and teaching (You, 2019). The difference between MOOCs and other e-learning courses is the ratio between students and instructors per course (Nordin et al., 2016). As the number of students in MOOCs is massively significant, this requires students to have vital self-regulated learning (SRL) skills to increase the effectiveness of the learning process (Greene et al., 2011; Wong et al., 2019). Students must effectively manage their motivation, cognition, and study behavior to perform academic tasks online successfully.

Procrastination is a common self-regulatory issue that leads to lower academic performance (Kim & Seo, 2015). Indeed, last-minute study before a deadline has resulted in less successful performance than studying at a consistent pace (Ariely & Wertenbroch, 2002). Students enrolled in MOOCs are prone to procrastination (Huang et al., 2018). It is commonly due to the exposure to online distractions they might prioritize over academics, such as social media, video streaming, and online games (Belo et al., 2014). Meanwhile, many studies have induced procrastination in the traditional learning setting (Marotta & Acquisti, 2017). However, the solution to the procrastination issues in online learning, specifically in MOOCs, still needs to be explored (Huang et al., 2018). This study proposes a conceptual persuasive design framework to fill the gap to increase students' engagement through e-learning systems.

Some researchers believe that issues like low completion percentage are partly because of user dissatisfaction with the design of MOOCs systems (Kizilcec et al., 2013; Korableva et al., 2019). In addition, most MOOCs systems are built without looking at the relevant aspect of human perception, causing the design to be peculiar to perception (Chen et al., 2017). Since MOOC offers a virtual learning system, there is no live instructor, and the central problem may be the interaction of students with the material given (Sethi, 2017). Therefore, students should be able to adapt to the design interface of the system (Haba & Dastane, 2019; Haron et al., 2019). There is a need to consider students' perspectives before developing a MOOCs system since most studies only collect data during direct interaction with the MOOCs system, in which students are only involved after the development process is completed.

Some studies report that the dropout rate in MOOCs is high, especially towards the end of the course (Onah et al., 2014; Shukor & Abdullah, 2019). Some studies found that the dropout rate is high as early as the first two weeks of students enrolling in the course, and the same trend is observed towards the end of the system, which starts in weeks 11 and 12 (Kloft et al., 2014). One of the reasons for the high dropout rate in this e-learning system is that they want to enroll and

participate in the course according to their respective pace. Besides, the lack of intrinsic factors that drive students to use the online e-learning system consistently causes high dropout rates (Khalil & Ebner, 2017). However, (Stracke, 2017) argues that it is more important for researchers to measure the success rate of students who follow the course than the dropout rate. A study by (Cilliers et al., 2023) shows that students' intrinsic and extrinsic motivation factors contribute to MOOCs completion. However, student learning patterns differ as some actively watch lecture videos but are passive in discussion sessions or vice versa (Sinha et al., 2014). Due to the issues stated in the previous research, this situation requires a more thorough analysis of MOOCs systems, especially regarding motivational factors and learning strategies, to improve the instructional design of the existing e-learning systems so that the systems' quality can meet students' needs and achieve their learning goals.

The Learning and Study Strategies Index (LASSI) by (Paul R. et al., 1991) and the Motivated Strategies for Learning Questionnaire (MSLQ) by (Weinstein et al., 2016) are two self-report instruments developed in earlier research to assess learning strategies. LASSI covers thoughts, behaviors, attitudes, and beliefs concerning successful learning experiences that interventions can cultivate (Griese, 2016). On the other hand, MSLQ was developed to determine the types of motivational factors and learning of college students (Kaldo & Õun, 2020). One of the strengths of the MSLQ over the LASSI is that there is no implicit internal model to interpret the data allowing researchers to create a model structure tailored to the requirements of their study (Filippou et al., 2016). The scales are also modular, consisting of two sections, a motivation section, and a learning strategies section. This study uses the MSLQ, considering learning strategies as essential aspects of the conceptual framework and learning process. The ability to customize the items makes the questionnaire a good fit for the research. It is also exploratory and provides more flexibility in interpreting the findings.

The MSLQ components are shown in Table 3. MSLQ is made up of 81 items that are divided into two categories: motivation and learning strategies. Those scales are broken down into two levels with specific study behaviors. Before creating a persuasive strategy, it is essential to understand students' study behaviors (Soemantri et al., 2018). MSLQ was designed with a social-cognitive approach to motivation and learning strategies in consideration, with students depicted as active information processors whose attitudes and cognitions influenced crucial instructional input and task aspects. (Gbollie & Keamu, 2017). Learning encompasses a wide range of skills and capabilities. Thus, numerous study behaviors have either a favorable or unfavorable impact on learning outcomes and require an in-depth study to get a deeper understanding before constructing suitable technology features that fulfill students' needs.

Table 3: Motivation Strategies and Learning Questionnaire (MSLQ) (Paul R. et al., 1991)

Motivation Scales	
Scale	**Subscale**
Value	Intrinsic Goal Orientation
	Extrinsic Goal Orientation
	Task Value
Expectancy	Control of Learning Beliefs
	Self-efficacy
Affective	Test Anxiety
Learning Strategies Scales	
Scale	**Subscale**
Cognitive and Metacognitive	Rehearsal
	Elaboration
	Organization
	Critical Thinking
	Metacognitive Self-regulation
Resource Management	Time and Study Environment
	Effort Regulation
	Peer Learning
	Help-Seeking

4.2 Phase 2: Persuasive E-Learning Design Implementation

Interactive technology influencing behaviour and attitude changes is considered persuasive technology (Fogg, 2009a). At the same time, a persuasive system is either a computer software or information system designed to alter attitudes, behaviour, or both without coercion (Oinas-kukkonen & Harjumaa, 2009). The mechanism of behaviour change is affected by students in a learning society that uses technology (Batsila et al., 2015). Students do not often embrace new technology-based learning methods. Students' participation is crucial in e-learning. This study took advantage of MOOC technology's ability to foster engagement and interaction, which aids in improving study behaviours. As a result, it can be used to support a newly developed e-learning system. A study by (Gram-hansen & Sandra, 2012) adopted the Functional Triad to develop the Persuasive Learning Design Framework for the Persuasive Learning Objects and Technologies (PLOT) project. Two tools for creating such persuasive learning objects were produced. PLOTMaker is based on the GLOMaker software tool,

which enables the creation of self-contained digital learning objects (Behringer & Øhrstrøm, 2013). However, the study stated that future improvements must be made by improving the aesthetic aspect and giving extra support to students while using the system. This issue may happen because the design principles listed in the Functional Triad are very briefly articulated. It is unclear how the design principles can be applied to the specifications and features of the existing learning technologies.

Another persuasive design-related model is the Persuasive System Development (PSD) model (Oinas-kukkonen & Harjumaa, 2009). This model is more comprehensive and focuses on the design application. The PSD model is divided into four categories: primary task support, dialogue support, credibility support, and social support. There are 28 design principles, with each category having its principles. According to the PSD model, understanding critical issues behind persuasive systems, assessing the context, and developing system qualities are the three phases of persuasive system development. The PSD model aims to get users to change their behaviour or attitude.(Oinas-kukkonen & Harjumaa, 2009). The PEDAL framework uses the PSD model because it thoroughly explains the design principles' implementation process rather than the Functional Triad model, which tends to be restrictive and not directly applicable to persuasive system development and evaluation.

The development of a persuasive system according to the PSD model is divided into three stages. The first step is understanding the key issues underpinning the persuasive system. By recognizing the intent, event, and strategies for persuasive techniques, the system may be examined and developed after a comprehensive grasp of the challenges (Oinas-kukkonen & Harjumaa, 2009). The next step in creating a persuasive system is to analyse the persuasion context. Understanding the factors affecting the behaviour before constructing persuasive features (Harjumaa & Muuraiskangas, 2014). It comprises three elements: the intent, the event, and the strategy. There are three types of intentions which are endogenous, exogenous, and autogenous. People who create interactive technology are known as endogenous. Exogenous individuals are those that distribute or provide access to interactive technology to others, whereas autogenous individuals are those who adopt interactive technology. Since computers do not have their own goals, it is essential to identify these three sources of intention (Oinas-Kukkonen & Harjumaa, 2008). In e-learning technologies, systems' developers are endogenous, subjects' instructors are exogenous, and students are autogenous.

Because information technologies are continually evolving, it is critical to recognize the technical context in which technology systems' strengths, weaknesses, risks, and potential must be fully realized (Oinas-Kukkonen & Harjumaa, 2008). Figure 3 shows the process of analyzing the persuasive contact based on the PSD model. There are three contexts to consider in the event: use context, user context, and technological context. According to (Loh & Hamid, 2021), analyzing persuasive context involves users, persuasion strategies, and actual system features. Understanding the traits coming from the problem domain can help identify the use of context. At the same time, user context can be

determined by concentrating on the end-unique user's characteristics that indicate their level of technology literacy. The strategy is the last step to figure out during this phase. It is all about the message that gets through to the end users. Persuasion will increase if you have a clear message. As a result, a better understanding of the message and how it persuades end-users is critical (Oinas-kukkonen & Harjumaa, 2009).

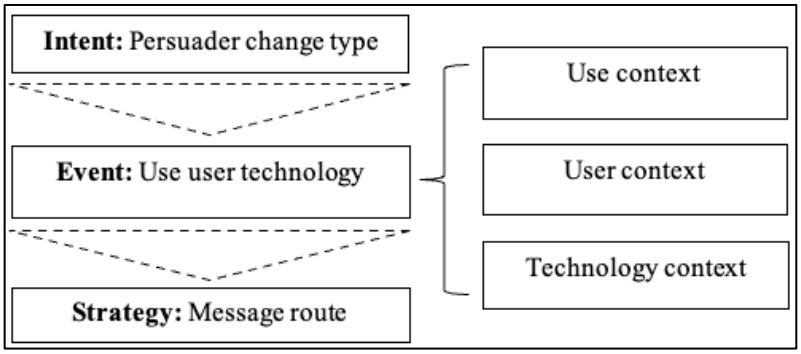

Figure 3: Analysing Persuasive Context Process (Oinas-kukkonen & Harjumaa, 2009)

The final step in developing a persuasive system is constructing system features. The Persuasive System Design (PSD) model in Table 4 outlines the persuasive design principles. Primary task support consists of principles that help people simplify their primary tasks. Support for generating computer-human dialogue helps keep end-users on track with their desired behaviour. Finally, computer-mediated interaction between users has important implications for persuasion (Fogg, 2012). To keep end-users motivated, social support will provide social interaction elements amongst users. Evidence shows that modifying social norms affects behavior change (Oinas-Kukkonen & Harjumaa, 2008). System credibility support describes how to create a trustworthy persuasive system. According to (Kelders et al., 2012), persuasive features may increase users' engagement. However, not ever only some persuasive features are used in BCSS because, in some circumstances, adding more persuasive features could make a system less persuasive overall (Oinas-Kukkonen, 2013). The PEDAL framework requires design and e-learning experts' involvement in this phase to suggest suitable features based on their experience and studies conducted in Phase 1.

Table 4: Persuasive Design Principles (Oinas-Kukkonen & Harjumaa, 2008)

Category	**Design Principles**
Primary Task Support	Reduction
	Tunnelling
	Tailoring
	Personalization
	Self-monitoring
	Simulation
	Rehearsal

Dialogue Support	Praise
	Rewards
	Reminders
	Suggestion
	Similarity
	Liking
	Social Role
System Credibility Support	Trustworthiness
	Expertise
	Surface Credibility
	Real-World Feel
	Authority
	Third-party endorsements
	Verifiability
Social Support	Social Learning
	Social Comparison
	Normative Influence
	Social Facilitation
	Cooperation
	Competition
	Recognition

4.3 Phase 3: Evaluating Study Habits

Since persuasive systems are designed to change attitudes, it is crucial to consider the significant behavior change theories. The Transtheoretical Model for Behavioural Change, also known as the Stages of Change model, is one such model (Moore, 2005). According to this model, pre-contemplation, contemplation, preparation, action, maintenance, and termination are the six phases of behaviour change. The first and second stages contemplate a transition, while the third and fourth stages are about deciding to perform a new behavior and prepare for it. Step five occurs when the new behavior is consistently performed, despite the tendency to revert to the old behavior. Stage six occurs when the person has entirely performed and accepted the new behavior. According to this model, transitioning through the stages has been observed, each lasting six months (Moore, 2005). However, the theory of breaking down behavior change into phases dependent on time has been challenged. It is difficult to believe that human

behavior is a definite linear mechanism with a permanent result, given that human behavior is often irrational and unpredictable. Permanently terminating an undesirable behavior is also debatable since many people stop doing something they do not want to do to relapse after a long period.

The Fogg Behaviour Model (FBM) is another behavior change model that may well be associated with persuasive technology (Fogg, 2009a). Motivation, ability, and triggers are the three factors that influence behavior change. To ensure that the target behavior occurs, an individual must have sufficient motivation, ability, and an effective trigger, in which all three factors must be present simultaneously (Dohnke et al., 2011). An external trigger would not be successful if performing the behavior is complex and users have little motivation. If users' ability is poor but their motivation is high, a trigger will only work if the system helps them reduce the challenges. Simultaneously, if motivation is low, but the ability is high, the system must encourage increased motivation before using a trigger (Filippou et al., 2015). The FBM model can improve persuasive techniques and recognize problems in persuasive systems that fail to achieve the desired results. Furthermore, the FBM model also assists people in thinking systematically about motivational factors, elements of simplicity, and triggering techniques (Fogg, 2009a). To ensure that the system achieves its goal, it is essential to understand the behavior change model. The Fogg Behaviour Model (FBM) presents a method of thinking about factors influencing user behavior. Misunderstandings of these three aspects, motivation, ability, and triggers, could cause a persuasive design to fail. The Fogg Behaviour Model is depicted in Figure 4. The figure shows how easily users can accomplish the goal behavior with strong motivation, high ability, and the correct type of triggers.

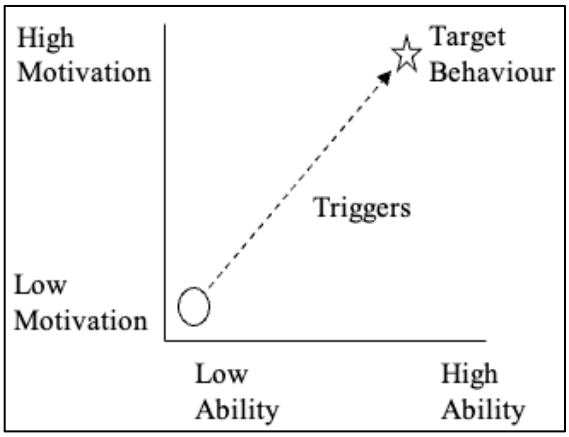

Figure 4: The Fogg Behaviour Model (Fogg, 2009a)

There are two main differences between The Stages of Change model and the Fogg Behaviour Model: The Stages of Change model explains how behavior works as a process, whereas Fogg Behaviour Model discusses how behavior change can happen. Despite their differences, these two types of theories are complementary rather than contrasting each other. Models like Stage of Change can help in understanding behaviors in-depth. It is implied, for example, that once an individual has been persuaded, their behavior will be permanent. Persuasive

system design may not result in long-term behavior change; instead, continuous triggers (as defined by the SNAP concept of states of behavior) will be required.

The first step in creating a persuasive technology that works is to choose an appropriate behavior to change. The design team should choose the most important, specific, and basic behavior. This step frequently necessitates the reduction of a significant aim to a small, seemingly minor goal (Fogg, 2009b). Students' learning strategies and study behaviors influence their academic success. They can participate purposefully in learning after understanding their learning styles and attitudes (Magulod, 2019). Since each component in the MSLQ has unique study behaviors, researchers can use it to indicate a successful MOOCs system (Mhd Salim et al., 2019b). After selecting the appropriate study behavior, it is time to consider what keeps the students from doing the target behavior, whether due to a lack of motivation, skill, or a well-timed trigger. This is the point where persuasive design elements come into action. These elements may have varying effects on students' learning behavior. After determining the obstructive factors to adopting the desired behavior, the next would be evaluating the effect of persuasive design elements and testing them on students. It is essential to emphasize the need for revisiting the development of persuasive features if significant behavior changes are not achieved.

4. Conclusion and Future Work

Previous attempts at incorporating persuasive design in e-learning systems often lacked integration with motivation and effective learning strategies, limiting their ability to drive student behavior change and enhance engagement. This study uses previous literature to establish the conceptual persuasive e-learning development (PEDAL) framework to increase students' participation in MOOCs. The framework's objective is to positively change students' behavior by tailoring the design of MOOCs to align with their specific motivation and learning strategies. Different study behaviors among students make the PEDAL framework very much relevant. The PEDAL framework can be considered a student-based design framework where students' factors are actively included throughout the development process. Three essential components in the PEDAL framework are motivational factors, learning strategies, and persuasive design principles. These three components are interrelated and cannot be separated in the developing process to ensure the e-learning features consider students' perspectives as the end-users. Apart from reviewing past research, this paper also explains the process of implementing the PEDAL framework to develop an effective e-learning system.

Future work calls for more experts, especially in psychology and pedagogy, to validate and improve the current framework, especially regarding behavior change. Apart from that, there is a need to implement the PEDAL framework in the development process of an existing e-learning system and evaluate the system’s acceptance level to find out the weak points of the framework. This process is necessary to assess whether the proposed conceptual framework is relevant in changing students' behavior.

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