Flexibility in e-Learning: Modelling its Relation to Behavioural Engagement and Academic Performance

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Abstract

The purpose of this study is to explore how perceived flexibility affect behavioral engagement and academic performances in an e-learning environment. The study was conducted following predictive correlational design. A total of 119 higher education students enrolled in a 15-week fully online course participated in the study. Data sources included Perceived Flexibility Scale data, behavioral engagement data derived from learning analytics indicators and academic performances of the students based on their mid-term grades, quiz results and final grades. The study data were analyzed using the Partial Least Squares Structural Equation Modelling approach to test the research model. The findings revealed that perceived flexibility of time and perceived flexibility regarding the content have significant positive effects on behavioral engagement and academic performances, whereas perceived flexibility of teacher contact, surprisingly, does not significantly affect. The study contributes to our understanding of the role of flexibility dimensions in online learning experiences and learning outcomes. The study concludes with discussing practical implications of the results and suggestions for researchers.

Keywords: Flexibility, e-learning, behavioral engagement, academic performance

Introduction

E-learning provides flexible learning opportunities to students in terms of time, place and pace of learning. Students can have opportunities to effectively engage in e-learning process through e-learning technologies (Kim, Hong & Song, 2019). However, students should take responsibility for pacing and regulating their online learning experiences and behave more autonomously to meet their learning goals in e-learning and distance learning (Shearer & Park, 2018). This raises questions about how to build effective e-learning design for students. The results of studies in the literature on the effectiveness of e-learning show that individual differences of students have a significant effect on learning outcomes and lead to shift pedagogical practices (Çakıroğlu et al., 2019; Dabbagh, 2007). Thus, it is necessary to take into consideration the individual differences of students and personalized design to build effective online learning experiences (Altun, 2016; Kinshuk, 2015). In this context, flexibility and flexible learning stands out as a broader phenomenon.

Theoretical Background

The literature on flexibility has highlighted that the flexible learning is a multifaceted concept and there is a challenging to define it due to due to its diverse characteristics (Garrick & Jakupec, 2000; Soffer, Kahan & Nachmias, 2019). From a technology-centered perspective, a variety of information and communication technologies should be provided to students for a flexible learning and learner should have access to alternative technologies (Chen, Kao & Sheu, 2003). From a pedagogically student-centered perspective, it is stated that students should be given flexibility in terms of time, space, learning at their own pace, changing learning strategies, and choosing learning resources and evaluation activities (Flannery & McGarr, 2014; Nikolov, Lai, Sendova & Jonker, 2018).

Table 1. Proposed dimensions of flexibility in e-learning

Source	Dimensions of Flexibility in e-Learning
Collis, Vingerhoets & Moonen (1997)	Content, delivery and logistics, entry requirements, instructional approach and resources, and time
Khan (2007)	Ethical, evaluation, institutional, interface design, management, pedagogical, resource support, and technological
Bergamin, Ziska, Werlen & Siegenthaler (2012)	Content, learning styles, methods, organization and infrastructure, requirements, space, and time
Li and Wong (2018)	Assessment, content, entry requirement, delivery, instructional approach, resource and support, orientation or goal, time
Soffer, Kahan & Nachmias (2019)	Learning time, learning place, access to learning resources

Collis, Vingerhoets and Moonen (1997) defined the concept of flexible learning as giving students the freedom to choose what, when and where to learn. According to Naidu (2017), flexible learning can be defined as "*a state of being in which learning and teaching is increasingly freed from the limitations of the time, place and pace of study*" (p. 269). He argued that flexible learning is a value principle not a mode of study. In addition, it should be noted that whereas technology is one of the vital elements for flexible learning, flexible learning refers to more than the use of technologies to minimize constraints in learning environment (Li & Wong, 2018).

In the literature, flexibility has been explained into multiple categories proposed based on diversity of their perspectives. Numerous studies have defined the flexibility considering many aspects of learning and teaching process. Table 1 presents flexibility dimensions identified by few studies in the flexible learning literature. Given the dimensions of flexibility as seen in Table 1, it is noteworthy that that there are many components relating to flexibility in e-learning such as academic, administrative, technical infrastructure and students. Thus, flexible learning brings together consideration of the learning and teaching process holistically for building effective learning experiences in a flexible manner.

Flexibility is a growing trend in e-learning in terms of both qualities in learning design and more learning possibilities for students (Veletsianos & Houlden, 2019). Flexible learning spaces facilitate behavioral engagement, student-centered pedagogies and interaction in learning environment (Kariippanon et al., 2019). Whereas there is increasing interest over flexible learning, what is not yet clear is the impact of perceived flexibility of students and its dimensions on behavioral engagement and learning outcomes in e-learning context. Thus, this study will focus on modelling relationship among perceived flexibility, behavioral engagement based on learning analytics indicators and academic performances of students.

Flexibility and Learning Outcomes

Flexibility is regarded as a key concept in individualizing learning and teaching process, covering all activities of learners from entry to classes to the end of the learning process beyond the flexibility of place and time (Bergamin, Ziska, Werlen & Siegenthaler, 2012). This points out that flexibility is a multi-dimensional construct covering technological and pedagogical aspects of learning and teaching. As one-size-fits-all approach to flexible learning does not result in useful for all learners, more research is needed to better understand flexible learning considering nature and levels of flexibility in learning and teaching (Naidu, 2017). The most addressed dimensions of flexibility in e-learning are learner-related factors such as time, place, learning resources, interaction, and pace of learning (Li & Wong, 2018; Soffer, Kahan & Nachmias, 2019). In a comprehensive study, a model indicating enough dimensions of flexible learning developed based on their theoretical research on flexible learning (Bergamin, Ziska & Groner, 2010). The model consists of three dimensions of flexibility as follows: Flexibility of time management, flexibility of teacher contact, and flexibility of content. This study considers these dimensions of flexibility due to its appropriateness for e-learning environments and

personalized learning. Flexibility of time refers to possibility of students to determine learning time and pace of learning in online courses. Flexibility of teacher contact is related to the ease with which students can interact with the instructor through alternative ways of communication. Flexibility regarding the content refers to students' ability to learn the content when they want and decide (Bergamin, Ziska & Groner, 2010; Bergamin et al., 2012).

Flexible learning is important not only for face-to-face and campus-based learning but also e-learning, open and distance learning and blended learning. Flexibility is associated with the terms e-learning with the increasing technological applications in education (Li & Wong, 2018). Also, flexibility is fast becoming a key instruments in e-learning due to its influence on online learning experiences and learning outcomes. A systematic review study conducted by McGarry, Theobald, Lewis and Coyer (2015) revealed that flexible learning designs have a significant effect on learning outcomes in both e-learning and blended learning programs. In another study, perceived flexibility levels of university students were found to be a significant predictor of usefulness of e-learning (Al-Harbi, 2011). In a study conducted to evaluate an international distance learning program, it was found that Vietnamese academics liked online discussion boards' flexibility and their clear links to module materials and they found the module content to be of great use to their academic development and practices (Lewis et al., 2016). Bergamin et al. (2012) concluded that there was a significant relationship between perceived flexibility levels of distance students and self-regulated learning strategies. These studies provide strong evidence to support the effectiveness of flexibility in learning on learning and teaching process.

Although numerous studies have examined contributions of flexible learning to students and teachers, association between flexibility in e-learning context and academic performances have been investigated in few studies in the literature. A recent study conducted by Soffer, Kahan and Nachmias (2019) revealed that achievements of students were significantly related to patterns of flexibility based on learning time and access to learning resources in online learning environment. In their study, Austerschmidt and Bebermeier (2019) found that flexible support services in flexible online courses have a positive impact on academic success of students. Previous studies point out that students can improve their academic performances in e-learning environments which support high level flexibility in terms of technology, pedagogy, learning resources and activities (Bergamin, Ziska & Groner, 2010; McGarry et al., 2015). Thus, considering flexibility categories, three hypotheses are developed as follows:

H1. Perceived flexibility of time is significantly associated with academic performance.

H2. Perceived flexibility of teacher contact is significantly associated with academic performance.

H3. Perceived flexibility regarding the content is significantly associated with academic performance.

Flexibility and Behavioral Engagement

In the literature on learning and psychology, engagement is considered as one of the most misused and overgeneralized concepts (Azevedo, 2015). The definition of engagement varies in the relevant literature and there is terminological confusion. From general perspectives, engagement is described by Kuh (2009) as "*the engagement premise is straightforward and easily understood: the more students study a subject, the more they know about it, and the more students practice and get feedback from faculty and staff members on their writing and collaborative problem solving, the deeper they come to understand what they are learning*" (p. 5). This explanation commonly indicates a clear definition of engagement. Despite its common usage, engagement is used in different context and disciplines to mean different things. As an example for e-learning context, a systematic review study on engagement points out the term "online learning engagement" which refers to attitude, energy, students' devotion of time, value/interest, learning strategy or even creative thinking in e-learning environments We argue that students who (Yang, Lavonen & Niemi, 2018). Multiple representations of engagement such as school engagement, academic engagement, learner

engagement and student engagement are used in the relevant literature (Reschly & Christenson, 2012). These representations have been employed interchangeably both with same or different meaning.

Student engagement is a major area of interest in the field of educational sciences and its roots are driven by the desire to enhance students' learning (Reschly & Christenson, 2012). Researchers in the e-learning field have interpreted the concept of student engagement from various perspectives. According to an explanation of the term close to e-learning context, student engagement is defined as the active involvement of students in a learning activity and any interaction with instructors, other students, or the learning content through the use of digital technology (Christenson, Reschly & Wylie, 2012; Henrie, Halverson & Graham, 2015). Student engagement is considered as a multifaceted term including distinct components. There are various different models in the literature regarding student engagement. One of the most well-known and cited student engagement model is conceptualized by Fredricks, Blumenfeld and Paris (2004). They provide three engagement types such as behavioral engagement, cognitive engagement, and emotional engagement. Behavioral engagement refers to observable behaviors and participation necessary to learning performance (Kokoç, Ilgaz & Altun, 2020). Cognitive engagement refers to effort and investment, which is needed for understanding what is being taught. Emotional engagement includes the feelings and emotions of students towards components of learning process such as other students, instructors, and the school, which all affect their tendency to study (Fredricks, Blumenfeld & Paris, 2004).

The current study focuses on behavioral engagement which concerns observable behaviors, participation in learning activities, and interest in learning tasks (Nguyen, Cannata & Miller, 2016; Schindler, Burkholder, Morad & Marsh, 2017), since online learning behaviors of students indicate and fit to behavioral engagement in the context of e-learning theoretically (Li, Yu, Hu & Zhong, 2016; Pardo, Han & Ellis, 2017). Behavioral engagement is easier to measure based on students' actions through Learning Management Systems (LMS) contrary to cognitive engagement and affective engagement (Wang, 2017). Furthermore, behavioral engagement of learners is fundamental to maintenance of successful online learning experiences. There is a growing body of literature that recognizes the importance of behavioral engagement in e-learning context (Meyer, 2014; Wang, 2019).

The key issue of how to keep students engaged in e-learning plays an essential role in the effective learning design process (Kokoç, Ilgaz & Altun, 2020). Moreover, finding ways for online students to stay engaged in online courses is so important for higher education institutions (Meyer, 2014). It should be noted that deeper understanding how to employ technologies to engage students in effective learning experiences is a vital aspect of current research trends in e-learning (Henrie, Halverson & Graham, 2015). In this regard, flexibility can be considered as one of key elements of making students more engaged into online learning process. E-learning technologies and online learning environment provide flexible learning opportunities for students to enhance quality of their learning experiences and outcomes in terms of time, place and pace of learning (Means, Toyama, Murphy & Bakia, 2013). Also, successful flexible learning results in effective learner-centered activities and facilitates building effective online learning experiences as indicators of behavioral engagement (Soffer, Kahan & Nachmias, 2019; Veletsianos & Houlden, 2019).

Moreover, a previous review study revealed that most of computer-based technologies had a positive influence on multiple indicators of student engagement (Schindler et al., 2017). To enhance behavioural engagement of students, there are various efforts to implement dimensions and features of flexible learning to online course and learning design through e-learning technologies (Li & Wong, 2018; Soffer, Kahan & Nachmias, 2019; Wang, 2017). When providing flexible learning opportunities to student, they are more engaged and willing to interact with peer and learning resources (Bergamin et al., 2012; Lewis et al., 2016; Naidu, 2017). This is likely to have an impact on behavioral engagement of students. Thus, the following hypothesis was examined:

H4. Perceived flexibility of time is significantly associated with behavioral engagement of students.

H5. Perceived flexibility of teacher contact is significantly associated with behavioral engagement of students.

H6. Perceived flexibility regarding the content is significantly associated with behavioral engagement of students.

Behavioral Engagement and Learning Outcomes

From a broader perspective, student engagement into learning is recognized as a powerful indicator of successful classroom instruction (Yang, Lavonen & Niemi, 2018) and as an important influence of learning performance (Kahu, 2013). Student engagement is related to students putting time, energy, thought and effort into learning process (Dixson, 2015). Hence, student engagement aims for improving learning performance, positive behaviors and willingness to participate in learning activities (Kokoç, Ilgaz & Altun, 2020). Yang, Lavonen and Niemi (2018) emphasize that students are willing to make more effort and to have the potential for sense of commitment, when engaged into online learning process. Kuh et al. (2008) found that student engagement had a positive effect on grades and persistence of students significantly. In another study, lack of engagement is a significant reason for lower completion rates in online courses (Kizilcec, Piech & Schneider, 2013). These studies find a clear link among effective online learning experiences, learning performance and student engagement as a broad phenomenon.

Considering specific to behavioral engagement, it seems the same relationship in the literature as explained above (Henrie, Halverson & Graham, 2015). As summarized by Schindler et al. (2017), the main indicators of behavioral engagement are participation in learning activities and interaction with others. As students make a reasonable time and effort to participate in online learning activities and tasks actively, they build effective online learning experiences that improve their learning performances (Goh et al., 2017; Morris, Finnegan & Wu, 2005). Students with lower behavioral engagement can exhibit negative behaviors in learning environment and have lower learning performance (Nguyen, Cannata & Miller, 2018). Furthermore, it is important to note that interaction with others and learning resources plays a critical role in terms of behavioral engagement. Interaction data extracted from LMS logs have been accepted as essential indicators of behavioral engagement in e-learning context (Henrie, Halverson & Graham, 2015; Pardo, Han & Ellis, 2017). Learning analytics studies have revealed a significant association between interaction patterns of learners with LMS and learning performances (Cerezo, Sánchez-Santillán, Paule-Ruiz & Núñez, 2016; You, 2016). The studies presented thus far provide evidence that indicators of behavioral engagement were identified as predictors of online learning performances. To sum up, previous studies have confirmed a positive association between behavioral engagement in e-learning environment and learning performances of students (Li et al., 2016; Pardo, Han & Ellis, 2017; Wang, 2017). Hence, it is expected that the students with higher behavioral engagement in e-learning environment will demonstrate improved academic performance. The following hypothesis was examined:

H7. Behavioral engagement is significantly associated with academic performances of students.

Purpose of the Study

Flexibility calls for further inquiry from a variety of angles in the context of open and distance learning (Veletsianos & Houlden, 2019). Whereas a number of studies show importance of flexibility in e-learning (Bergamin et al., 2012; Austerschmidt & Bebermeier, 2019), what is not yet clear is the direct influence of perceived flexibility on behavioral engagement and academic performance of students. Moreover, previous studies stated that future studies were needed to explore causal relationship between dimensions of flexible learning and learning outcomes in the context of open and distance learning (Li & Wong, 2018; Soffer, Kahan & Nachmias, 2019). Thus, the purpose of the study is to explore how perceived flexibility affect behavioral engagement and academic performances in an e-

learning environment. To the best of my knowledge, no previous study investigated effects of perceived flexibility dimensions on behavioral engagement based on objective measures and academic performances of learners. It is hoped that the study will make a major contribution to research within the field of open and distance learning and enhance our understanding of the role of flexibility dimensions in students' learning in the context of e-learning. Moreover, the current study has measured behavioral engagement of students based on learning analytics indicators derived from LMS log data as an original way. The using online learning experiences of the students to measure behavioral engagement (Yang, Lavonen & Niemi, 2018) is one of the original aspects of the study.

Method

This correlational study followed a predictive correlational design (Creswell, 2012). The purpose of a predictive correlational design study is to predict the level of a dependent variable from the measured values of the independent variables (Grove, 2019). Rationale for using the predictive correlational design in the current study is to predict dependents variable based on other independent variables in a structural equation modelling framework.

Study Context and Procedure

The study took place in a mandatory course, namely "*Measurement and Evaluation in Education*" taught in English language teacher education program. The course was a fully online course. It was delivered through Moodle LMS by the same instructor. The goal of the course was to provide theoretical knowledge on basic concepts and psychometrics properties of instruments, and practical knowledge on developing new test and instrument. At the beginning of the study, a course page was created in Moodle v2.9 and the students were registered to the online course. The online course comprising 15 course units. Each learning units consisted of learning resources (video lectures, infographics, books and e-learning content packages) and learning activities such as online and asynchronous discussion forums, learning tasks, feedback and online quizzes. The learning resources and activities were provided students to increase interaction among students, instructor and e-learning environment. The video lectures on the course topics were created by the instructor and consists of accompanying lecture slides and instructor's image and voice. Forum board were offered the students to discuss content topics and share their thoughts collaboratively. The students could ask questions to the instructor through direct message in Moodle, e-mail and forum posts. Before each week starts, the instructor shared book chapters, infographics on summary of course unit of the week and short video lectures developed in the type of picture-in-picture. Learning tasks including problem-solving homework, a series of questions and weekly reflection report were given to the students weekly. The students engaged in the learning activities and access learning resources online in a flexible manner. The instructor as a facilitator participated in discussion activities, shared learning resources and gave students feedback to guide themselves in the online course. Online quizzes were administered by the instructor at the week 3, 6, 9, and 13 via quiz module in Moodle.

A total of 119 students completed the online course. An online survey form was designed to collect self-report data of the study. The form contained demographic questions and measurement items related to perceived flexibility scale. At the end of the study, the online survey form was embedded into course page in Moodle by using feedback module. All the participants filled the online survey form completely. The participants took about six minutes to complete the form.

The study has used learning analytics indicators to measure behavioral engagement of the students. Hoel and Chen (2018) emphasize the importance of privacy and data protection in learning analytics research. Thus, the sample of the current study consisted of students who were willing to share interaction data indicating their online learning experiences. The researcher gave confidence to the participants by making their own identity. The participants were elucidated on how to ensure data

privacy and protect their data by the institution. All the participants voluntarily participated in the study and were not rewarded by extra point or in kind.

Participants

A total of 119 higher education students enrolled in online distance courses at a major state university in Turkey were recruited for the study. All participants were pre-service English language teachers at the time of data collection in 2018. Convenience sampling method was followed to select the participants. Among the participants, 72 were female and 47 were male. The participants were aged between 20 and 25 years old and their average age was 22.58. They had all taken online courses delivered via Moodle LMS at the university for over one year. All participants provided informed consent to participate and took part in the study voluntarily.

Measures

The study used three data sources to answer the research questions. Data sources consisted of the following measures: Subjective data collected via Perceived Flexibility Scale, behavioral engagement data derived from learning analytics indicators and academic performances of the students based on their mid-term grades, quiz results and final grades.

Perceived flexibility scale in open and distance learning was used to measure perceived flexibility of the participants. Two different studies were carried out to develop original form of the perceived flexibility scale in open and distance learning (Bergamin, Ziska & Groner, 2009; Bergamin et al., 2012). Nine items from three constructs of the scale were extracted: *Flexibility of Time Management*, *Flexibility of Teacher Contact* and *Flexibility of Content*. In their study, a confirmatory factor analysis revealed that the core fit indices (χ^2/df = 1.14; CFI = 0.99; RMSEA = 0.028) were acceptable (Bergamin et al., 2012). Furthermore, the Turkish version of the scale indicated strong evidence for validity and reliability of the structure. Exploratory factor analysis yielded three factors and confirmatory factor analysis with maximum likelihood estimation validate the three-factor structure of the flexibility scale (χ^2/sd=1.26, RMSEA=0.04, NFI=0.96, CFI=0.99). The scale consists of three factors such as flexibility of time, flexibility of teacher contact, and flexibility of content. Flexibility of time is related to students' decision on when they want to learn and learning at their own pace. Flexibility in teacher contact is related to the ease with which students can communicate with the instructor and alternative ways of communication. Flexibility of content indicates the students' ability to learn the content they want and when they decide. The scale which consists of nine items with five-point Likert scale included in the Appendix.

In order to measure students' behavioral engagement in online learning experiences, interaction data of students in online distance learning environment was used. Behavioral engagement focuses on observable behaviors and effort necessary to academic achievement (Fredricks et al., 2004). Henrie, Halverson and Graham (2015) have suggested that behavioral engagement can be measured by a set of learning analytics indicators such as frequency of postings, responses, and views; number of learning resources accessed and time spent online. In the same vein, it is emphasized that learning analytics in online learning has been used as one of the favored methods for understanding engagement (Yang, Lavonen & Niemi, 2018). For an example, a study adopted the frequency-based and duration-based approaches to measure online behavioral engagement (Wang, 2017). Hence, the study used traces of students as behavioral engagement indicators following duration based and frequency based approach recommended by previous studies (Henrie, Halverson & Graham, 2015; Wang, 2017). The indicators of behavioral engagement considered in the study are as seen in Table 2.

The data source included interaction data of students related to behavioral activities during the period of the 15-week online course. The log data of students' interaction with learning activities were derived from a LMS (Moodle v.3.2) used in the online course. Seven measurable metrics were extracted after processing log data in the Moodle database and combining more data tables.

Table 2. The indicators of behavioral engagement in e-learning environment

Engagement Type	Variables	Description
Behavioral Engagement	Indicator 1	Frequency of logins to online learning environment
	Indicator 2	Total number of views on learning resources
	Indicator 3	Total time spent on learning resources
	Indicator 4	Total number of views on discussion board
	Indicator 5	Total time spent on discussion activities
	Indicator 6	Total number of completed learning tasks
	Indicator 7	Total time spent on reviewing feedback of quizzes

Previous studies in the literature show that these metrics represents core online learning experiences based on attendance, participation and social interaction from a behavioral perspective (Henrie, Halverson & Graham, 2015; Li et al., 2016; Wang, 2017), they were used as behavior engagement indicators in the study. The interaction data were transformed to Z scores before data analysis.

Academic performances of the students were indicated by mid-term grades (40%), quiz performance (20%) and final grades (40%) of the course. While the midterm exam with 20 multiple choice questions was administered at the week 8, the final exam with 25 comprehensive questions administered at the week 15. The quiz performances were average of scores of quizzes which were administered at the week 3, 6, 9, and 13, respectively.

Data Analysis

Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to test the research model and hypothesis. The most used types of structural equation modeling are PLS-SEM and covariance-based SEM. While PLS-SEM performs a variance-based estimation, covariance-based CB-SEM performs a covariance-based estimation. PLS-SEM can be primarily employed to develop frameworks by focusing on prediction and explaining the variance in the dependent variables (Hair, Hult, Ringle & Sarstedt, 2017). Considering characteristics of PLS-SEM and data of the study, it was decided that PLS-SEM fits the study better than covariance-based CB-SEM. The main reason to choose PLS-SEM path modeling method for analysis is that it can achieve high levels of statistical power with small sample sizes efficiently and handles constructs measured with single item and multiple items in a complex structural model without distributional assumptions (Hair et al., 2017). In addition, one of the relevant reasons is that the focus of the current study is based on predicting academic performance of the students.

Similar to covariance-based SEM, PLS-SEM consists of a structural (inner) model and a measurement (reflective outer) model and assess both of them in the analysis. Measurement model was evaluated following criteria such as reliability, convergent validity and discriminant validity. Structural model was assessed in terms of coefficients of determination, size and significance of path coefficients as the most important evaluation metrics recommended by Hair et al. (2017). The SmartPLS 3 tool (Ringle, Wende & Becker, 2015) was used to evaluate the research model.

Results

Measurement Model

Analysis results for the measurement model are shown in Table 3 which includes indicators' loadings, reliability of indicators, each latent variable's composite reliability (CR) and average variance extracted (AVE) values. As seen in Table 3, reliability values of each indicator of each latent variable were above the threshold of 0.50 as recommended by Hair et al. (2017). Thus, it confirms that all indicators were reliable. Besides, all the latent variables have CR values greater than 0.70 as minimum threshold for CR (Nunnally & Bernstein, 1994). This result indicated that internal consistency reliability for the

reflective outer model was high and reflective latent variables were reliable. All the indicators' loadings were above than 0.70 and all AVE values were greater than the threshold of 0.5 as suggested by Fornell and Larcker (1981). This result shows that convergent validity of the measurement model was well established. To ensure discriminant validity, the square root of the AVE value for each latent variable should be greater than the correlations among other latent variables (Fornell & Larcker, 1981). It is found that the square root values of AVE of the latent variables were above 0.873 and these values were greater that the correlations of each latent variable with others. This result indicates that Fornell-Larcker criterion for discriminant validity of the latent variables was met for the measurement model. In addition, the standardized root mean square residual (SRMR) of the path model was 0.047 for saturated model and for estimated model, indicating the path model fit was acceptable (SRMR < 0.08).

Structure Model

PLS-SEM was employed to assess the structural model and test the hypotheses. Table 4 shows t-statistics of all the path coefficients of the inner model using two-tailed t test by the bootstrapping procedure of 1000 samples.

Table 3. Results for the reflective outer model

Latent Variables	Indicators	Loadings	Indicator Reliability	Composite Reliability	AVE
Flexibility of Time	item1	0.94	0.89	0.96	0.91
	item2	0.96	0.92		
	item3	0.94	0.88		
Flexibility of Teacher Contact	item4	0.97	0.94	0.97	0.94
	item5	0.96	0.92		
Flexibility regarding the Content	item6	0.79	0.62	0.92	0.77
	item7	0.90	0.81		
	item8	0.88	0.77		
	item9	0.90	0.81		
Behavioral Engagement	inter1	0.89	0.79	0.95	0.76
	inter2	0.91	0.83		
	inter3	0.89	0.79		
	inter4	0.90	0.81		
	inter5	0.86	0.74		
	inter6	0.71	0.51		
	inter7	0.90	0.81		
Academic Performance	Success	1.00	1.00	1.00	1.00

Table 4. T-statistics of path coefficients of the inner model

Path	t-statistics	p-value
Behavioral Engagement -> Academic Performance	2.208	0.027 *
Flexibility of Teacher Contact -> Academic Performance	0.863	0.388
Flexibility of Teacher Contact -> Behavioral Engagement	1.189	0.235
Flexibility of Time -> Academic Performance	2.394	0.017 *
Flexibility of Time -> Behavioral Engagement	2.125	0.034 *
Flexibility regarding the Content -> Academic Performance	8.957	0.000**
Behavioral Engagement -> Academic Performance	3.809	0.000**

* p<.05, ** p<.001

Table 5. T-statistics of indicator loadings of the outer model

Indicators	Flexibility of Time	Flexibility of Teacher Contact	Flexibility regarding the Content	Behavioral Engagement
item1	81.913 *			
item2	133.337 *			
item3	103.236 *			
item4		163.882 *		
item5		186.434 *		
item6			21.845 *	
item7			67.073 *	
item8			25.118 *	
item9			49.383 *	
inter1				31.445 *
inter2				42.595 *
inter3				34.202 *
inter4				35.016 *
inter5				23.380 *
inter6				11.708 *
inter7				40.045 *

* > 0.001

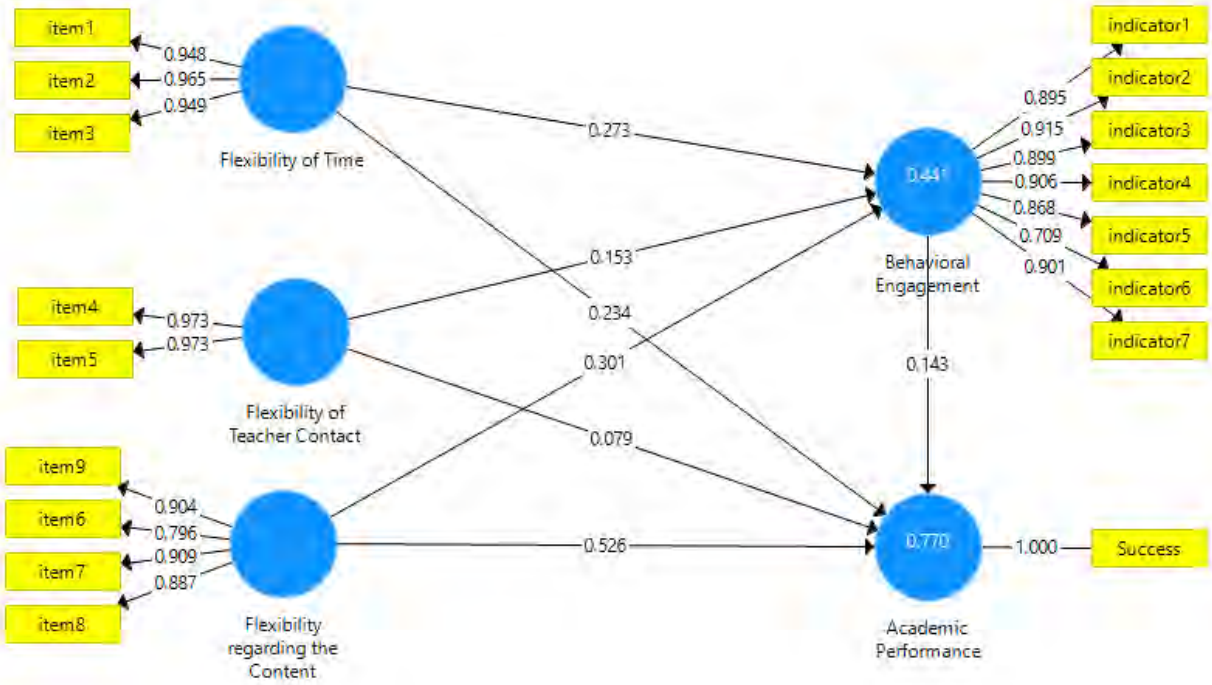

Figure 1. The PLS-SEM path modeling estimation results

As seen in Table 4, all the path coefficients of the inner model were significant statistically except two paths that includes flexibility of teacher contact to behavioral engagement and academic performance of learners. Table 4 clearly indicates that all the indicator loadings of the outer model were significant ($p < 0.001$). Table 5 presents t-values of indicator loadings of the outer model and PLS-SEM path modeling estimation results are shown in Figure 1.

Table 5 indicated that all the outer model loadings are highly significant statistically. Figure 1 presents the standardized path coefficients for each hypothesis in the research model. The analysis results show that all the path coefficients of the model except for one latent variable was significant statistically. The flexibility constructs explained 44% variance of behavioral engagement. Perceived

flexibility of time (B = 0.273, p < 0.05, supporting H4) and perceived flexibility regarding the content (B = 0.301, p < 0.01, supporting H6) had significant effects on behavioral engagement, whereas perceived flexibility of teacher contact had no direct effect on behavioral engagement (B = 0.153, p > 0.05, not supporting H5). Besides, perceived flexibility of time (B = 0.234, p < 0.05, supporting H1), perceived flexibility regarding the content (B = 0.526, p < 0.05, supporting H3), and behavioral engagement (B = 0.143, p < 0.05, supporting H7) predicted academic performance significantly and explained 77% of its total variance. Also, perceived flexibility of teacher contact had no significant effect on academic performance (B = 0.079, p > 0.05, not supporting H2).

Discussion

The study set out to explore how perceived flexibility affect behavioral engagement and academic performances in the e-learning environment. To answer the research question, a research model based on literature review and theoretical basis was examined to reveal the relationship among the research variables. The results are discussed in the context of existing literature.

The most obvious result to emerge from the PLS-SEM analysis was that perceived flexibility of time and perceived flexibility regarding the content have a positive effect on academic performances of the students in the context of e-learning. In accordance with the present result, previous studies have revealed a strong association between flexibility in e-learning and learning outcomes (Austerschmidt & Bebermeier, 2019; McGarry et al., 2015; Soffer, Kahan & Nachmias, 2019). Similar to this result, their comprehensive systematic review study concludes that learning outcomes could be increased through flexible learning design (McGarry et al., 2015). In accord to the study of Soffer, Kahan and Nachmias (2019) also reported that there is a significant relation between academic performances of students and patterns of flexibility based on their online learning behaviors.

The results of hypothesis H1 and H3 may be explained considering nature of aforementioned dimensions of flexibility in e-learning. Whereas flexibility of time indicates time and date to start or finish the course pace of learning and in a course, flexibility regarding the content relates to level of difficulty of course content, sequence in which topics are covered, and topic to learn (Li & Wong, 2018). In this sense, it may be thought that students have higher academic performances as they have opportunities to flexibility of access to learning resources and to study at their own speed in e-learning environment. It should be noted that flexibility in learning has been seen as an approach which targets satisfying diverse learners' needs and enhancing learning and teaching quality (Li & Wong, 2018). Moreover, flexible learning is an important consideration that needs to be considered in order to adapt to changing conditions and contexts in learning environment (Naidu, 2017). Also, it addresses the needs of working and adult students in a special way, as it takes into account the diversity of previous knowledge and life experiences of students and supports self-directed learning (Ammenwerth, Hackl & Felderer, 2019). Therefore, flexibility in e-learning is vital for online students to improve their learning process. On the other hand, Bergamin, Ziska and Groner (2010) and McGarry et al. (2015) addressed that students can enhance their academic performances in e-learning environments which provides high level flexibility in terms of technological, pedagogical and learning issues. The results of the hypothesis H1 and H3 in the current study confirm these arguments explained above.

Another important result was that perceived flexibility of time and perceived flexibility regarding the content have a positive effect on behavioral engagement in the context of e-learning. The result is consistent with those of previous studies (Lewis et al., 2016; Soffer, Kahan & Nachmias, 2019; Wang, 2017). The result implies that if students have the choice to learn at their own pace and to determine when they want to learn in online learning environment, they engage with online learning activities and learning resources more. A possible explanation for this might be that implementing flexible learning opportunities get students more engaged in online learning process (Bergamin et al., 2012;

Naidu, 2017). This is in line with the argument that flexibility in e-learning brings student-centered activities together and supports students to gain online learning experiences as indicators of behavioral engagement in e-learning (Soffer, Kahan & Nachmias, 2019; Veletsianos & Houlden, 2019). Another possible explanation for the result can be related to source of engagement which has been clarified with a four-component model grounded in self-determination theory (Skinner & Pitzer, 2012). According to the model, people engage more and participate constructively with them as needs of people are met by social contexts or activities. Otherwise, they become disaffected and drop out. A similar situation is true for online students. Students gain more online learning experiences and actively engage in learning process with flexible learning environment in where they can adapt aspects like the time, place and content of course to meet their own needs (Buß, 2019; Li & Wong, 2019). Thus, it is an expected result that high level of perceived flexibility of time and perceived flexibility lead to high level of behavior engagement in e-learning.

The most interesting result was that there was no significant direct effect of perceived flexibility of teacher contact on behavioral engagement and academic performances. Flexibility in teacher contact means the ease with which students can communicate with the instructor and alternative ways of communication. Hill (2006) argues that teacher plays a key role in flexibility in learning. Moreover, a previous study found significant effects in the flexibility of the teacher contact for cognitive, metacognitive and resource-based strategies of students (Bergamin et al., 2012). In the study, alternative ways of communication were provided to students such as e-mails, message tool in LMS, social networking. In this sense, the result on perceived flexibility of teacher contact in the present study seems to be an unexpected outcome. One may speculate about the reason is that this contradiction may be derived from student-centered activities and flexible navigation of students in the e-learning environment. Thus, it is important to bear in mind that role of flexibility in e-learning indicates a shift towards online learning experiences of students and learner engagement from teachers and teaching process (Naidu, 2017; Soffer, Kahan & Nachmias, 2019).

In the study, it was revealed that behavioral engagement of students had a positive effect on their academic performances. The result confirms the association between behavioral engagement and academic performances, which has been pointed out by previous studies (Kuh et al., 2008; Li et al., 2016; Pardo, Han & Ellis, 2017; Wang, 2017). Similarly, Kim, Hong & Song (2019) found that academic engagement, which were affected by student experiences with e-learning systems, had significant effect on academic performances of students. In addition, the result implies that students with higher behavioral engagement, who they make a reasonable time and effort to interact with online learning resources, have higher academic performances. Furthermore, the relevant result is important because the measurement of behavioral engagement of students is based on indicators reflecting online learning experiences derived from interaction data of students, not to subjective measures via scale and instrument. It is remarkable that most of the studies in the literature measured behavioral engagement via self-report engagement scales (Yang, Lavonen & Niemi, 2018). Meyer (2014) emphasizes that the focus on student engagement in online learning tends to center on what is happening with the student in online courses. Thus, measuring online behaviors of students tracked by LMS plays a vital role in deeper understanding their online learning experiences and behavioral engagement (Henrie, Halverson & Graham, 2015; Wang, 2019). Following a novel way, the current study has used online learning experiences derived from LMS to measure behavioral engagement of students. Previous studies have found that behavioral engagement based on online learning experiences and interaction patterns of learners with LMS had a positive influence on academic performances of students (Cerezo et al., 2016; You, 2016; Wang, 2017). These results are in agreement with the result obtained in the current study.

Conclusions

The present study contributes to the literature by showing that higher level of perceived flexibility on time and content could lead to more behavioral engagement and academic performance in the context of e-learning. In addition, the results of the study have implications and educational practices around perceived flexibility in the context of e-learning. They also support the idea that students who have high flexibility in e-learning are more engaged in learning behaviorally and have higher academic performances. Thus, it can be suggested that learning experience designers and instructors should provide flexible e-learning environment allowing students to decide when and where they can learn.

The online courses should support flexibility of time and access to course content and minimize the limitations of time and pace of study. In this sense, greater efforts are needed to develop innovative approaches for embedding flexibility in e-learning. Flexibility in e-learning is expected to encourage students to engage more with learning content in their own pace, leading to high learning performance. In conclusion, the evidence from the current study suggests that learning designers and instructors can improve learning performance and behavioral engagement of students by implementing of flexibility in terms of course content and learning time in the context of e-learning. An important practical implication is that e-learning environments should allow students to view learning resources in a flexible sequence anytime and to complete learning tasks depending on flexible deadlines. To enable flexible learning experiences, instructors can provide rich learning resources with different modality, student-centered learning activities, flexible navigation and self-pacing of learning to students in e-learning environments.

Limitations and Future Studies

The reader should bear in mind that the study is based on an online distance course which provided many more flexible learning opportunities in terms of content, learning time, assessment and learning activities. Additional modelling studies are needed to compare different e-learning environments with different levels of flexibility. Considering associated variables with flexibility in e-learning and self-regulated learning, the research model needs to be extended to the antecedents to improve the findings of the influence of perceived flexibility dimensions on learning outcomes and other engagement types such as emotional engagement and cognitive engagement. A limitation of the study is that the results are based on self-reported data and interaction data of learners. Further studies modelling perceived flexibility and behavioral engagement based on multimodal learning analytics indicators may be worthwhile. Another limitation may be that the modelling study requires replication in other samples of open and distance learners with different demographic traits. Future studies with larger samples should test the research model for open and distance learners of different demographic groups in especially longitudinal studies. Researchers should make considerable efforts to gain understanding how perceived flexibility effects on other dimensions of engagement such as cognitive engagement and emotional engagement. In addition, cross-cultural studies are required to determine whether or not a similar result of testing the research model is found for other samples from different cultures.

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Appendix A. The Perceived Flexibility Scale

Factors of the Scale	Items
Flexibility of Time	I can decide, when I want to learn
	I can define my learning pace myself
	I can repeat the subject matter at will
Flexibility of Teacher Contact	I can contact the teacher at any time
	There are different possibilities of contacting the teacher
Flexibility regarding the Content	I have a say regarding the focus of the topics of class
	I can prioritise topics in my learning
	I can choose between the different learning forms: on campus study, online-study, self-study
	I can learn topics of special interest

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