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Understanding university students' behavioral intention to use Edmodo through the lens of an extended technology acceptance model

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Abstract

Educational social network sites have many uses in the field of education. The present paper aims to determine factors influencing students' behavioral intention to use a popular educational social network site, Edmodo. Using an extension of the technology acceptance model, we analyzed quantitative responses of 218 university students, registered in an Edmodo supported course. Data were analyzed through partial least squares structural equation modeling. Results highlighted that intention was significantly predicted by its antecedents. More specifically, the attitude was the most important factor, whilst perceived usefulness had a moderate impact on predicting intention. Perceived ease of use predicted perceived usefulness directly and also it influenced intention indirectly through attitude. External antecedents of perceived usefulness and perceived ease of use were all significant. Discussion and implications were drawn based on the results.

Key words: Edmodo, educational social network sites, learning management systems, structural equation modeling, technology acceptance model

Introduction

Web 2.0 technologies have altered the manner people use the Internet. One acknowledged web 2.0 tool used in education is social network sites (SNSs). In general, SNSs provide users to create a profile in the platform, communicate, and share information with other people easily (Basak & Calisir, 2015; Doğan & Gülbahar, 2018). With these potentials, SNSs enable new forms of learning through collaboration and social learning and thus are regarded to have positive contributions to the educational outcomes (Arteaga Sánchez, Cortijo, & Javed, 2019; Cao, Ajjan, & Hong, 2013). However, SNSs have been criticized for lacking some characteristics of learning management systems (LMSs) such as a library, assignment, scoring, schedule, and quiz (Durak, 2017). Furthermore, privacy invasions in SNSs are another concern for students (Cao *et al.*, 2013). For these reasons, "educational SNSs," having educational affordances of both SNSs and LMSs, have been started to be used in recent years. One of the most used SNSs in education is Edmodo, which is a free platform that is used by instructors, students, and also by parents. Supporting many

Practitioner Notes

What is already known about this topic

- Understanding why users accept or reject a particular information system is a common research area.
- Technology acceptance model (TAM) is used to explain individuals' acceptance and adoption of different technologies.
- Social Networking Sites (SNSs) have been used to enrich learning. However, the adoption of educational SNS studies is limited.

What this paper adds

- This study is one of the first attempts for employing extended TAM that scrutinizes factors influencing university students' intention to use Edmodo as an educational SNS and a learning management system (LMS) in teaching and learning environments.
- External antecedents included in the model (subjective norms, output quality, perceptions of external control, perceived enjoyment, technological complexity, and self-efficacy) significantly predicted university students' intention to use Edmodo as an educational SNS and LMS.
- Major factors driving the intention to use Edmodo were attitude and perceived usefulness.

Implications for practice and/or policy

- Considering that the attitude was found to have the strongest influence on the intention to use Edmodo, instructors may attach prominent importance to foster students' positive attitudes toward Edmodo use.
- Instructors may design virtual learning environments with collaborative activities on SNS to increase students' perceived usefulness.
- Designers and developers of an educational SNS should design interfaces that should be not only less complex but also more enjoyable.

languages, instructors can create and organize lessons, share course materials, make announcements, and initiate discussions through this platform. It provides a safe environment for discussion, feedback, collaboration, and customized learning thanks to SNS facilities (Durak, 2017; Yunkul & Cankaya, 2017). In addition, it offers to create assignments and quizzes, using course planning tools, creating and managing course related libraries by uploading videos, pictures, documents, and presentations (Doğan, Demir, & Ülkü, 2018; Durak, 2017). Therefore, it can be considered that Edmodo is a secure, social learning environment for managing learning activities, assignments, and group works (Gan, Menkhoff, & Smith, 2015).

An important area in the field of information technology is investigating users' adoption, acceptance, or rejection of a particular system (Venkatesh, Morris, Davis, & Davis, 2003). Although Edmodo has been recognized as a promising learning tool, the success of the system depends on how it is embraced by the users. Research was conducted on the acceptance/adoption of different systems including students' SNS adoption (Akman & Turhan, 2017; Choi & Chung, 2013), Facebook acceptance (Arteaga Sánchez *et al*., 2019; Basak & Calisir, 2015; Chang, Hung, Cheng, & Wu, 2015) or other LMS adoption (Joo, Kim, & Kim, 2016; Saroia & Gao, 2019). However, only a few studies have focused on factors affecting students' adoption of Edmodo (Yildiz-Durak, 2019; Zain, Hanafi, Don, Yaakob, & Sailin, 2019). With the increasing educational potentials of Edmodo for teaching and learning, exploring students' intention to use Edmodo is of significant importance. Given this rationale, the aim of this study is then to predict factors that influence

students' behavioral intentions to adopt Edmodo. To that aim, the extended technology acceptance model (TAM) was used as a theoretical framework.

Problem statement

In recent years, Edmodo has prompted researchers' attention and an increasing trend of research on this topic has emerged. For example, in a study, Edmodo was used to facilitate m-learning activities and it was found that Edmodo supported collaboration and allowed learning anywhere and anytime (Oyelere, Paliktzoglou, & Suhonen, 2016). Another study observed that Edmodo and SNS use were advantageous in terms of communicating and sharing course materials and providing useful tools to students (Durak, 2017). Ma'azi and Janfeshan (2018) found that using Edmodo developed intermediate EFL learners' writing skills and attitudes.

Despite this interest, research mostly concentrated on utilizing Edmodo to support learning and exploring its effect on different educational outputs (eg, Alqahtani, 2019; Wendt & Rockinson-Szapkiw, 2014) and perceptions of the participants (eg, Al-Said, 2015; Beyatli, Altinay, & Altinay, 2018). Considering the fact that the eventual success of a system depends on its continued use (Bhattacherjee, 2001b), it could be postulated that research is needed on how the users perceive Edmodo and whether they intend to adopt it. However, only a few studies have addressed this issue (eg, Yildiz-Durak, 2019; Zain *et al.*, 2019). To ensure this educational SNS is an effective instructional technology, first, it needs to be accepted by the students. An investigation is, therefore, required to both determine and better understand the factors that contribute to student acceptance or rejection of Edmodo. Determining these factors is taught to help instructors to benefit from such tools and their LMS selection. Furthermore, the developers of Edmodo can review and improve the system based on the outputs of this study. As a final contribution, to the best of our knowledge, there is no research examining factors affecting Edmodo usage intention as an SNS and LMS from the lens of extended TAM. On the other side, although TAM is the robust model in the acceptance studies (King & He, 2006), it was criticized as being too parsimonious (Teo, Huang, & Hoi, 2018). Moreover, employing TAM without external factors cannot provide specific views about the system (Mathieson, 1991). In order to overcome this issue, several studies used extended TAM to get good explanatory power and explained total variance as cited by Abdullah and Ward (2016). Thus, this study can provide a viewpoint for students' intention to use Edmodo through the lens of extended TAM.

Theoretical framework and the model

TAM and the importance of the model

Researchers have studied the acceptance behavior of users through different intention models (Davis, Bagozzi, & Warshaw, 1989), one of which is TAM. TAM is first introduced by Davis (1989) and adapted from the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975). TAM is used to explain and predict any computer related behavior intention, while TRA is used to explain any human behavior (Davis *et al.*, 1989). TAM was used and empirically validated in different contexts such as acceptance of e-learning (Gamble, 2018; Lee, Hsieh, & Chen, 2013), m-learning (Hao, Dennen, & Mei, 2017; Mac Callum, Jeffrey, & Kinshuk, 2014), web 2.0 technologies and ICT collaborative tools (Cheung & Vogel, 2013; Kwok & Yang, 2017).

TAM consists of four variables: Perceived usefulness (PU), perceived ease of use (PEOU), attitude (ATT), and behavioral intention (BI) (Davis, 1989). However, in some cases, external factors can be incorporated into the model to increase the predictive validity of the model. Many factors affecting students' intention to use Edmodo can be investigated in this way. Selecting the external variables depends on the context such as technology, users, and area of use (Iqbal & Ahmed Bhatti, 2015). We considered course activities, students' physiological statements and abilities, and social environment when using Edmodo. Through this regard, we extended the model by

adding external variables in addition to ordinary TAM constructs. We borrowed subjective norms and output quality as affecting PU as well as perceptions of external control, perceived enjoyment, technological complexity and self-efficacy as affecting PEOU from other acceptance models such as TAM2, TAM3, and related literature.

PU is defined as "the degree to which a person believes that using a particular system would enhance his/ her job performance," and PEOU is defined as "the degree to which a person believes that using a particular system would be free of physical and mental effort" (Davis, 1989, p. 320). ATT is defined as an individual's positive or negative feelings about performing the behavior (Fishbein & Ajzen, 1975). According to this model, PU and PEOU directly predict ATT. In addition, PU and ATT have direct effects on BI. Additionally, PEOU is the predictor of PU. In this research context, if students believe that the use of Edmodo in their learning process is beneficial, their attitudes and intentions would be higher. Furthermore, when students perceive Edmodo as easy to use, this positively affects their PU and ATT directly and BI indirectly through ATT. These relationships were corroborated by previous studies (Chang *et al.*, 2015; Davis *et al.*, 1989). Hence, in the current study, it is hypothesized that:

H1: PU has a positive effect on BI to use Edmodo.
H2: PU has a positive effect on ATT toward Edmodo.
H3: PEOU has a positive effect on ATT toward Edmodo.
H4: PEOU has a positive effect on PU.
H5: ATT toward Edmodo has a positive effect on BI to use Edmodo.

Subjective norms (SN), which are defined as "an individual's perception that most people who are important to her think she should (or should not) perform a particular behavior" (Fishbein & Ajzen, 1975, p. 302) are one of the direct determinants of PU (Venkatesh & Bala, 2008). In this study, students' perceptions toward Edmodo are shaped by significant others such as peers, instructors, and university administrators. For example, referring to its Facebook-like environment and other affordances, significant others can encourage students to use Edmodo, and thusly students may consider Edmodo as a beneficial tool for their learning. (ie, perceived usefulness). In the literature, this relationship is confirmed in different contexts such as LMS acceptance (Teo, Zhou, Fan, & Huang, 2019), acceptance of web 2.0 technologies (Teo, Sang, Mei, & Hoi, 2019), and technology acceptance of students (Teo, 2010). Accordingly, the following hypothesis is formulated:

H6: SN has a positive effect on PU.

Output quality (OUT) is defined as the degree of an individual's perception of how well the system performs the tasks (Venkatesh & Davis, 2000). Learning environments' contribution to have enhanced effectiveness and productivity in learning is related to the OUT (Teo, Zhou, *et al.*, 2019). In the current study, students' perception that Edmodo is capable of performing the tasks in a good manner may affect their PU. Research showed that Edmodo fosters students' interest and learning, as it provides multiple resources and more effective interaction with enhanced participation (Ateş Çobanoğlu, 2018), which may influence their OUT perception. Previous studies validated the link between OUT and PU (Teo, Zhou, *et al.*, 2019; Venkatesh & Bala, 2008). Hence, the following hypothesis is proposed:

H7: OUT has a positive effect on PU.

Perceptions of external control (PEC) or facilitating conditions is defined as "the degree to which an individual believes that organizational and technical resources exist to support the use of the system" (Venkatesh *et al.*, 2003, p. 453). Students' perceptions of PEC are considered to be enablers or barriers when using the system (Teo, 2010), which can be organizational and technical supports and resources to facilitate the use of a system (Venkatesh & Bala, 2008). In the current

study, features or practices that are linked with PEC are as follows: Supporting multilanguage, Edmodo has a help center available to assist users. Besides, students can send messages to their instructors, initiate a discussion related to a topic in case they need help. Furthermore, in the current study, students received an orientation at the first meeting of the class that provided an overview of the student panel. Consequently, the following hypothesis is formed:

H8: PEC has a positive effect on PEOU.

Perceived enjoyment (PE) is defined as "the extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use" (Venkatesh, 2000, p. 351). PE emphasizes the pleasure, satisfaction, or enjoyment related to system use. If students enjoy using the system, they might perceive the system as easy to use. Therefore, PE can be thought of as a motivation-oriented construct that influences PEOU (Venkatesh, 2000). Students find SNSs more enjoyable compared to traditional learning as they feel more relaxed and willing to participate (Hamid, Waycott, Kurnia, & Chang, 2015). In addition, users may find websites more enjoyable that offer interactivity (Rauniar, Rawski, Yang, & Johnson, 2014). Considering that SNSs provide interactive social activities, users may enjoy with Edmodo's features. In the current study, as students enjoy using Edmodo, they might have a perception that Edmodo is easy to use. Therefore, it can be hypothesized that:

H9: PE has a positive effect on PEOU.

Technological complexity (TC), refers to the degree to which a system is considered to be difficult to use (Thompson, Higgins, & Howell, 1991), The effect of TC on PEOU was supported by certain studies (Son, Park, Kim, & Chou, 2012; Teo, Zhou, *et al.*, 2019). In the current study, although the student panel was introduced to the students at the first meeting of the class and although Edmodo shares similar features with SNSs, students might have difficulties in using it, as it is a relatively new technology. Finally considering that Internet access via mobile phone is very common among university students, it is probable that students may have some technical difficulties (eg, screen compatibility, downloading/uploading files), while using Edmodo through their mobile phones (Al-Said, 2015), and this may affect their perception of PEOU. Regarding this issue, the following hypothesis is formulated:

H10: TC has a negative effect on PEOU.

In adoption and acceptance studies, the term computer self-efficacy was used as an individual's belief about his or her capability to use a computer system (Venkatesh & Bala, 2008). Teo, Sang, *et al.* (2019) used web 2.0 self-efficacy as a predictor of teachers' PEOU of web 2.0 technology. As a result, it was found that participants' SE levels influenced their perception of PEOU. In Edmodo, students' beliefs of their abilities to send/replay messages, join a class through a code, participate in discussions, submit assignments, access to the library and edit profiles are related to context-specific SE that may influence their PEOU. If students have a high level of SE in using Edmodo, they will find the Edmodo as easy to operate. Regarding this issue, the following hypothesis is formulated.

H11: SE has a positive effect on PEOU.

Based on the aforementioned hypothesis, the proposed model was illustrated in Figure 1.

Method

This study aimed to examine the factors that influence students' behavioral intention to use Edmodo for learning with the extended TAM. In order to achieve this aim, a cross-sectional survey design as one type of survey research was employed in the current study. The cross-sectional

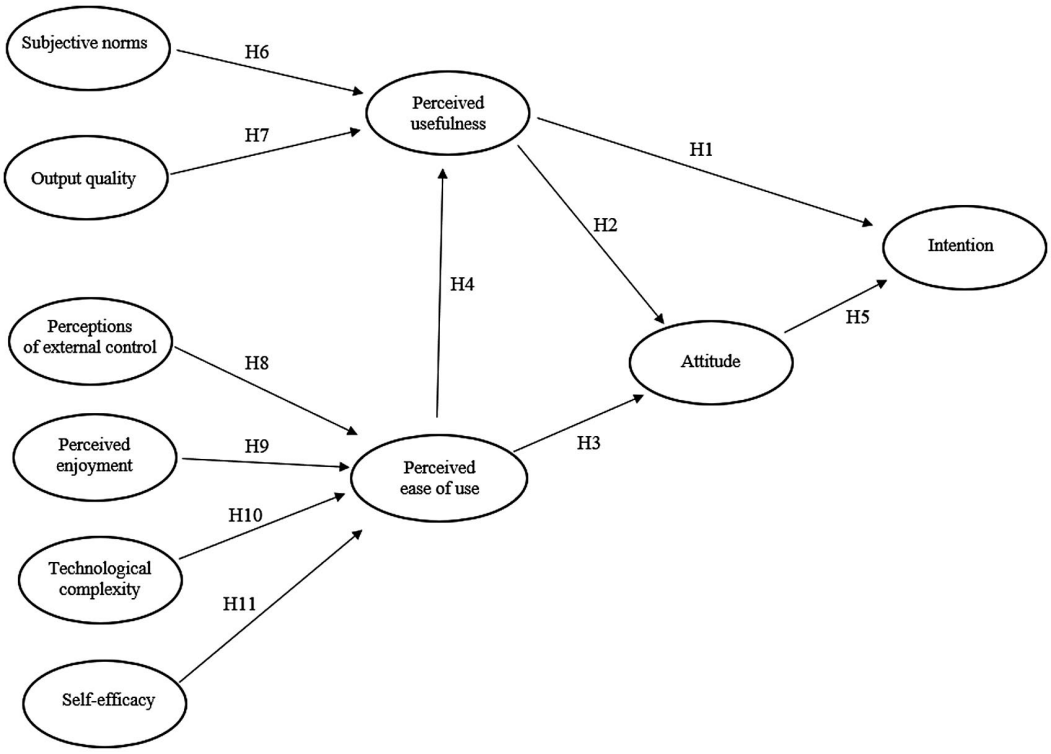

Figure 1: Research model of the study

survey design is used to collect data from a determined sample at one point in time (Creswell, 2012; Fraenkel, Wallen, & Hyun, 2012).

Participants

This study was carried out at a state university in the Aegean part of Turkey during the spring term of 2018–2019 academic year. The participants were 218 students from the faculty of education. Edmodo was utilized in the course having different sections for the departments. Among the participants, 69.7% (n = 152) were female and 30.3% (n = 66) were male. The mean age of participants was 20.9 with ranging from 19 to 33. 71.1 % (n = 155) of the participants have used Edmodo for less than one year, 28.9 % (n = 63) of the participants have used it for more than 1 year. In addition, 55% (n = 120) of the participants reported using Edmodo for 0–1 hour in a week, whereas 45% (n = 98) of them used it for 2–4 hours. 45 % (n = 99) of the participants reported that they had an experience through social network supported learning, while the remaining 55 % (n = 119) had no experience about social network supported learning.

Data collection tool and procedure

The data collection tool consisted of two parts. The first part included demographics such as gender, age, Edmodo usage on a year base, experience with social network learning and weekly usage of Edmodo. The second part included 35 items rated on a 7-item Likert type scale (1 = strongly disagree to 7 = strongly agree). This part aimed to determine students' intention to use Edmodo for learning through extended TAM. The items of scale have been modified from previous studies

Table 1: Items and constructs of the scale

Construct	*Items*	*Reference*
Perceived usefulness	PU1	Davis (1989)
	PU2	
	PU3	
	PU4	
	PU5	
Perceived ease of use	PEOU1	Davis (1989)
	PEOU2	
	PEOU3	
	PEOU4	
Attitude	ATT1	Davis (1989); Taylor and Todd (1995)
	ATT2	
	ATT3	
Behavioral intention	BI1	Bhattacherjee (2001a, 2001b)
	BI2	
	BI3	
Subjective norms	SN1	Fishbein and Ajzen (1975); Teo *et al.* (2018)
	SN2	
	SN3	
Output quality	OUT1	Jan and Contreras (2016); Teo, Zhou, *et al.*, (2019); Venkatesh and Davis (2000)
	OUT2	
	OUT3	
	OUT4	
Self-efficacy	SE1	Liaw (2008)
	SE2	
	SE3	
Perceptions of external control	PEC1	Venkatesh and Bala (2008)
	PEC2	
	PEC3	
	PEC4	
Perceived enjoyment	PE1	Venkatesh and Bala (2008)
	PE2	
Technological complexity	TC1	Teo (2009); Thompson *et al.* (1991)
	TC2	
	TC3	

in the literature to fit this research and are presented in Table 1. The selected items which were previously validated were translated into Turkish by two experts from the field of educational technology having proficiency in both two languages. Then an expert from the field of English Language Teaching and an expert from the field of Turkish Language Teaching controlled the translated version of the scale to ensure the Turkish version was consistent with the original scale. Furthermore, the scale was administered to 10 students from the faculty of education to evaluate clarity. Based on the experts' suggestions and students' evaluations, slight modifications were done to achieve content and face validity. As a result, the researchers modified the items and made the final form of the scale.

In general, the organization of the course through Edmodo is as follows. First, instructors create a class and an access code is generated. This code is shared with students, who are supposed to take the course. Then, students join the class generated on Edmodo. The students participating in this study were enrolled in the course of Information Technology. In this course, the students learned the basics of information technology, the use of the Internet and e-mail, office tools,

ethical use of computer technologies, using the Internet in education, secure Internet usage, and the effect of the Internet on children and adolescents. Edmodo was used to share course materials (e.g., presentations, documents, and videos) and other resources (links and textbooks), organize homework and exercises, discuss topics, and make announcements. At the end of the semester, the data collection tool was administered to the students via Google Forms.

Data analysis

To test the model, Partial Least Square Structural Equation Modelling (PLS-SEM) was employed. In this study, the reason to use PLS-SEM is twofold. First, PLS-SEM is a more preferred technique in exploratory research studies, which aim to identify the relationship between constructs (Hair, Hult, Ringle, & Sarstedt, 2014). As the main purpose of this study is to explain factors that influence students' intention to use Edmodo rather than confirming theories, PLS-SEM is regarded to be a more appropriate technique. Second, considering the sample size of the current study PLS-SEM was used rather than covariance-based—structural equation modeling (CB-SEM), as it is less subject to violation of the normality assumption. Before conducting the analysis, the minimum sample size should be estimated. The minimum sample size is suggested to be 10 times the largest number of structural paths directing a particular latent variable anywhere in the model (Hair *et al*., 2014), which is four (PEOU) in the current study (see Figure 1). Accordingly, the minimum sample size required is 40 (10 × 4). Additionally, a statistical power analysis was conducted using G*Power software (Faul, Erdfelder, Buchner, & Lang, 2009). A power of 0.80 and a medium effect size ($f^2 = 0.15$) with the PEOU variable that received the maximum number of predictors (four) were used as parameter values. Results yielded a minimum sample size of 85. After all, having 218 cases, this study was considered as having a sufficient sample size. SmartPLS 3.2.7 program was used to test the developed model. The analyses were conducted in two steps. The measurement model, which is known as the outer model was tested in terms of the reliability and validity of the constructs and their measures. Then the structural model, which is known as the inner model was evaluated in terms of relationships between constructs.

Results

Testing measurement model

Table 2 shows evidence related to internal consistency reliability and convergent validity. All items had satisfactory factor loadings, which were above the recommended threshold value (0.50) (Fornell & Larcker, 1981). Internal consistency reliability was evaluated through Composite Reliability (CR), Cronbach's Alpha, and Dijkstra-Henseler's rho values. The recommended threshold value is 0.70 (Hair *et al*., 2014, Nunnally, 1978). According to Table 2, all dimensions were above the threshold value suggesting that internal consistency reliability was established.

The average variance extracted (AVE) values of all constructs were greater than the recommended value of 0.50 (Fornell & Larcker, 1981), showing that convergent validity was met.

To assess discriminant validity, Fornell and Larcker's (1981) criteria and Hetrotrait–Monotrait (HTMT) ratio of correlations method were employed. According to Fornell and Larcker (1981), the square root of an AVE value for a construct should be greater than all correlations between that construct and other constructs. Besides the HTMT ratio of correlations should be lower than 0.90 (Henseler, Ringle, & Sarstedt, 2015). Table 3 shows that all values met the suggested criteria. Thus, discriminant validity was met. In sum, the measurement model was found to have sufficient reliability and validity values. Hence, we proceeded to analyze the structural model.

Table 2: Results of the testing measurement model

Construct	*Item*	*Loading*	*AVE*	*CR*	*Alpha*	*Rho_A*
Attitude			0.862	0.950	0.920	0.922
	ATT1	0.926				
	ATT2	0.942				
	ATT3	0.919				
Behavioral intention			0.858	0.948	0.917	0.917
	BI1	0.941				
	BI2	0.943				
	BI3	0.894				
Output quality			0.833	0.952	0.933	0.935
	OUT1	0.922				
	OUT2	0.927				
	OUT3	0.885				
	OUT4	0.916				
Perceived ease of use			0.684	0.896	0.844	0.859
	PEOU1	0.867				
	PEOU2	0.871				
	PEOU3	0.860				
	PEOU4	0.697				
Perceived enjoyment			0.904	0.966	0.947	0.955
	PE1	0.965				
	PE2	0.957				
	PE3	0.931				
Perceived usefulness			0.777	0.946	0.928	0.930
	PU1	0.837				
	PU2	0.880				
	PU3	0.922				
	PU4	0.904				
	PU5	0.861				
Perceptions of external control			0.760	0.927	0.895	0.895
	PEC1	0.840				
	PEC2	0.895				
	PEC3	0.893				
	PEC4	0.888				
Self-efficacy			0.878	0.956	0.931	.937
	SE1	0.933				
	SE2	0.934				
	SE3	0.944				
Subjective norms			0.793	0.920	0.870	0.885
	SN1	0.871				
	SN2	0.907				
	SN3	0.893				
Technological complexity			0.877	0.955	0.930	0.945
	TC1	0.914				
	TC2	0.957				
	TC3	0.938				

Note. AVE = Average Variance Extracted, CR = Composite Reliability, rho_A = Dijkstra-Henseler's rho.

Testing structural model

To test hypothetical relationships, a bootstrapping resampling routine with 5000 subsamples was performed. R^2 values, beta coefficients (β), significance of the path coefficients, and t values

Table 3: Results of discriminant validity

	ATT	*BI*	*OUT*	*PEOU*	*PE*	*PU*	*PEC*	*SE*	*SN*	*TC*
ATT	**0.929**	0.825	0.798	0.763	0.826	0.784	0.719	0.797	0.437	0.083
BI	0.760	**0.926**	0.755	0.607	0.769	0.733	0.580	0.611	0.558	0.096
OUT	0.741	0.700	**0.913**	0.765	0.752	0.863	0.716	0.683	0.573	0.106
PEOU	0.678	0.545	0.686	**0.827**	0.653	0.790	0.842	0.799	0.496	0.235
PE	0.772	0.716	0.707	0.591	**0.951**	0.738	0.651	0.671	0.454	0.047
PU	0.727	0.676	0.804	0.711	0.690	**0.881**	0.661	0.655	0.607	0.085
PEC	0.655	0.528	0.656	0.730	0.603	0.606	**0.872**	0.800	0.436	0.153
SE	0.741	0.565	0.638	0.709	0.632	0.611	0.735	**0.937**	0.378	0.114
SN	0.396	0.498	0.524	0.428	0.413	0.552	0.390	0.348	**0.890**	0.099
TC	−0.079	0.065	−0.100	−0.212	−0.031	−0.075	−0.143	−0.110	0.083	**0.937**

Note. Bold diagonal: square root of AVE, below diagonal: Fornell and Larcker, above diagonal: HTMT ratio of correlations. ATT = Attitude, BI = Behavioral intention, OUT = Output quality, PEOU = Perceived ease of use, PE = Perceived enjoyment, PU = Perceived usefulness, PEC = Perceived complexity, SE = Self-efficacy, SN = Subjective norms, TC = Technological complexity.

Table 4: Results of hypothesis testing

Hypothesis	*Relationship*	β	*t*	*p*	f^2	*Decision*
H1	PU → BI	0.262	4.225	***	0.083	Supported
H2	PU → ATT	0.495	5.945	***	0.289	Supported
H3	PEOU → ATT	0.327	3.945	***	0.126	Supported
H4	PEOU → PU	0.281	4.715	***	0.142	Supported
H5	ATT → BI	0.570	9.112	***	0.393	Supported
H6	SN → PU	0.154	2.598	**	0.059	Supported
H7	OUT → PU	0.530	9.313	***	0.451	Supported
H8	PEC → PEOU	0.392	4.498	***	0.173	Supported
H9	PE → PEOU	0.154	2.337	*	0.035	Supported
H10	TC → PEOU	−0.117	2.896	**	0.035	Supported
H11	SE → PEOU	0.311	3.696	***	0.103	Supported

Note. ATT = Attitude, BI = Behavioral intention, OUT = Output quality, PEOU= Perceived ease of use, PE = Perceived enjoyment, PU = Perceived usefulness, PEC = Perceived complexity, SE = Self-efficacy, SN = Subjective norms, TC = Technological complexity.
*$p < .05$; **$p < .01$; ***$p < .001$.

Table 5: Predictive relevance and explained variance

Endogenous variables	R^2	Q^2
ATT	0.581	0.472
BI	0.610	0.491
PEOU	0.623	0.396
PU	0.711	0.514

Note. ATT = Attitude, BI = Behavioral intention, PEOU= Perceived ease of use, PU = Perceived usefulness.

were reported. Table 4 demonstrates the results of the testing structural model. Results showed that all hypotheses were supported. Table 5 shows the explained variance (R^2) and predictive relevance (Q^2) of each endogenous variable. R^2 values of .67, .33, and .19 indicate the strong, moderate, and weak model (Chin, 1998). Accordingly, the strength of the model in predicting endogenous variables was found to be moderate to strong. The model accounted for 61% of the variance in explaining students' behavioral intention to use Edmodo. The accounted variances on ATT, PEOU, and PU were 58%, 62%, and 71% respectively (Table 5).

The results of the whole model were depicted in Figure 2.

Q^2 and f^2 were used to report predictive relevance and effect size (Hair *et al.*, 2014). Q^2 values above zero indicate that the model has predictive relevance (Hair *et al.*, 2014). As Table 5 demonstrates, all endogenous variables had adequate predictive relevance. Considering effect sizes (f^2), values of .02, .15, and .35 imply small, moderate, and strong effects (Cohen, 1988). Accordingly, PU had a small to moderate impact ($f^2 = 0.083$), whilst ATT had a quite strong impact on BI ($f^2 = 0.393$). The impact of PU on ATT was moderate to strong ($f^2 = 0.289$), while PEOU had a moderate effect on ATT ($f^2 = 0.126$). Considering the impact of PEOU on PU, a moderate effect size was observed ($f^2 = 0.142$).

Lastly, the model fit was evaluated by SRMR (Standardized Root Mean Square Residual). The calculated SRMR (0.053) was less than the recommended threshold value (≤0.08) (Hu & Bentler, 1999), showing a good fit.

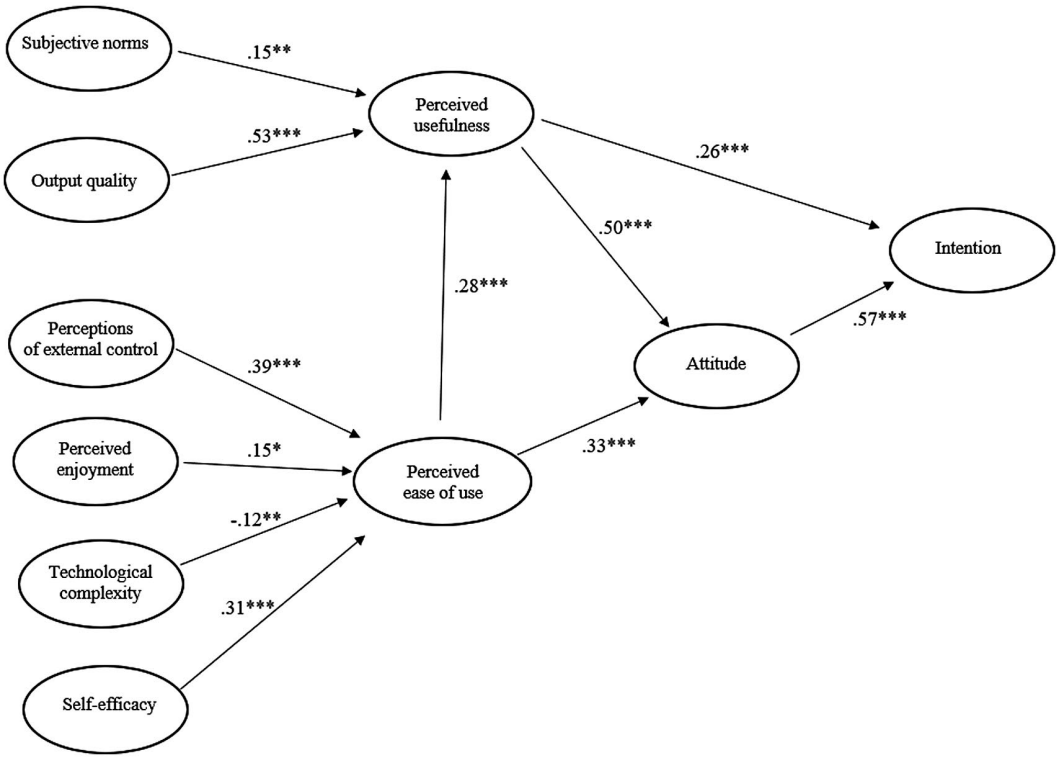

*Figure 2: Results of the structural model. Note. *p < .05; **p < .01; ***p < .001*

Discussion

This paper examined factors affecting students' behavioral intention to use Edmodo, which is an educational social network. A research model was developed based on extended TAM. Through this aim, students, who registered in Edmodo supported course, participated in the study. Results postulated that the formulated model was reliable and valid. Besides, all of the hypotheses were supported. Having a moderate to strong explanation rate, the whole model accounted for 61% of the variance in explaining students' behavioral intention to use Edmodo.

As for the distinct effects of extended TAM variables, the attitude was a significant predictor and also had the strongest effect on behavioral intention to use Edmodo, implying that the more students develop positive attitudes toward Edmodo, the more they use it. This result consists fairly well with the literature on acceptance of Moodle (Sánchez & Hueros, 2010), acceptance of social learning systems (Akman & Turhan, 2017), and also with other research on e-learning platforms (Moreno, Cavazotte, & Alves, 2017), demonstrating that attitude was a significant predictor. This result was not surprising considering the fact that attitudes might be shaped by the system characteristics, the extent of system usage, and the individual characteristics of the users (Lee, Cho, Gay, Davison, & Ingraffea, 2003).

In this study, students had been using Edmodo for about one year as well as they might have been using other SNSs before Edmodo, which might have led to the formation of the favorable or unfavorable feelings (ie, attitude). If students have favorable feelings toward Edmodo, they are more likely to be motivated to use it in the future or vice versa.

When the antecedents of attitude were explored, it was found that both perceived ease of use and perceived usefulness significantly and positively impacted attitude. In other words, it can be postulated that the ease of use of Edmodo and the benefits of Edmodo to students' learning influenced attitude toward Edmodo (Chintalapati & Daruri, 2017; Esteban-Millat, Martínez-López, Pujol-Jover, Gázquez-Abad, & Alegret, 2018).

Despite the fact that the majority of students used Edmodo for 1 hour in a week for their learning, positive perceptions regarding ease of use and usefulness may be due to their past social media usage habits. Besides, considering that some of the students already might have been supported through social media for their learning, they might have transferred these habits.

As for the distinct effect of perceived usefulness, it was found a significant and positive impact of perceived usefulness on intention, which is in good agreement with the literature on the intention to use learning management system (Eraslan Yalcin & Kutlu, 2019; Saroia & Gao, 2019) and social network service (Kwon & Wen, 2010; Rauniar *et al.*, 2014). It may be speculated that unlike other social network services, in which students have privacy concerns (Cao *et al.*, 2013), Edmodo offers some useful tools for learning such as file sharing, calendar tool, library, and quiz in a secure way. Therefore, as these tools were used by the students in such an SNS-like environment, they might have believed that the Edmodo platform was a useful tool for their learning and intended to benefit from it for their future learning.

Regarding the antecedents of perceived usefulness, it was found that *output quality, perceived ease of use and subjective norms* were all significant predictors. Out of these factors, *output quality* had the highest effect on perceived usefulness. Students were likely to believe that Edmodo was competent for carrying out learning tasks leading to improved effectiveness and productivity for learning and this might have influenced their perception of usefulness. This lends support to previous findings in the literature (Teo, Zhou, *et al.*, 2019; Venkatesh & Davis, 2000). *Perceived ease of us*e was another significant and positive antecedent of perceived usefulness. To put it differently, higher perceived ease of use tends to lead to higher perceived usefulness, which conforms well with similar studies conducted on social network sites acceptance (Qin, Kim, Hsu, & Tan, 2011) and mobile LMS use (Joo *et al.*, 2016). The significant influence of perceived ease of use on perceived usefulness may be because Edmodo has a similar interface with other SNS, especially with Facebook. Due to these similarities, students might have operated Edmodo without difficulty, when doing any instructional activities. Moreover, through Edmodo, students could post a comment in any discussion activity, access to course related files in the library tool, or use the system with different language options. This may also contribute to the idea that students' perception of perceived ease of use affected their perception of usefulness. Considering the significant and positive influence of *social norms* on perceived usefulness, it could be postulated that as significant others believed that Edmodo would be used as a supportive tool in their course, students were more likely to believe that Edmodo was useful for their learning. In other words, positive encouragement of important people (ie, peers, instructors, and parents) influenced the students' view toward the benefits of Edmodo. This result was also in line with the literature (Choi & Chung, 2013; Cigdem & Topcu, 2015).

As for the antecedents of perceived ease of use, the results highlighted that all predictors were significant and the *perception of external control* was the most influential one. This finding indicated that necessary support or resources were provided to students when they were using Edmodo. For example, Edmodo provides a help center for users, when they confront with any troubles. In this center, there are different help topics such as Edmodo features, account settings, and contact support. In this regard, if students had a problem, there would be many opportunities to overcome it. Besides, students have an opportunity to send messages to their instructors when they need help.

As a result, perceptions of external control were positively influenced by students' perceptions of external control beliefs and this link was also in line with the literature (Teo, 2010; Teo, Lee, & Chai, 2008). *Perceived self-efficacy* was found to be another significant factor of perceived ease of use. Consistent with prior studies (Motaghian, Hassanzadeh, & Moghadam, 2013; Fathema, Shannon, & Ross, 2015), students might have believed that they had different abilities to operate Edmodo such as registering, making comments, watching videos, and accessing on the Edmodo via different platforms such as a computer, mobile phone, and tablet. This high level of self-efficacy beliefs may have contributed positively to the students' perceptions of ease to operate Edmodo. As for the significant and positive influence of *perceived enjoyment*, it can be proposed that the more student thinks that Edmodo is enjoyable, the more perceives system as easy to use Enjoyment is conceptualized as an antecedent of perceived ease of use, which grows as user gather experience with the system (Venkatesh, 2000). In this study, students used Edmodo for one term. During this period, they might have enjoyed with Edmodo as it provided interactive activities like other SNSs and they were probably satisfied with this educational SNS, which consecutively might have contributed to their perceived ease of use for learning. These results share a number of similarities with other studies in the literature (Abdullah, Ward, & Ahmed, 2016; Teo, Sang, *et al.*, 2019).

As a final antecedent of perceived ease of use, it was found that *technological complexity* was significantly but negatively associated with the perceived ease of use. This was an expected result when the literature on the issue was examined (Cigdem & Topcu, 2015; Teo, Zhou, *et al.*, 2019). Students who believed that Edmodo is complex to use also reported less inclination to use it in the future.

Implications for theory and practice

A unique contribution of this study is that it is one of the first attempts for employing extended TAM that scrutinizes factors influencing university students' intention to use Edmodo as an educational SNS and LMS. Therefore, the results of this study present some important implications both in terms of theory and practice. Theoretically, this study contributed to the validation of an extended TAM by considering external antecedents of perceived usefulness and perceived ease of use that explain Edmodo adoption. By doing so, a more integrative perspective was achieved. Moreover, our findings appear to be well substantiated by the literature.

Regarding practice, some implications can be suggested. First of all, considering that the attitude was found to have the strongest influence on the intention to use Edmodo, instructors may attach prominent importance to foster students' positive attitudes toward Edmodo use. Instructors may design virtual learning environments with collaborative activities on SNS to increase students' perceived usefulness. As they use Edmodo in their course, students may realize the educational benefits of such a platform.

Considering that this study is carried out with the students of education faculty, a special interest may be devoted to how, when, and why to use different educational SNS(s) within the scope of some courses (e.g., instructional technologies) covered by faculty of education curriculum. Familiarizing students with the output qualities of the system could alter their beliefs of perceived usefulness. Additionally, instructors may also apply for significant others' positive views to promote other students' Edmodo use (Teo, Zhou, *et al.*, 2019). To experience an easy to use the system, technical guidance, support or help should be supported to students, whenever needed. Furthermore, we suggest an orientation program to make students feel more competent in operating the different features of the system. Finally, designers and developers of an educational SNS should design interfaces that should be not only less complex but also more enjoyable.

Limitations and future directions

This research has some limitations, which can lead to future research opportunities. The first limitation of this study was that data were collected from a specific university in Turkey. To enhance the generalizability of the findings, similar research can be carried out with several universities from other countries. Second, students' experiences may be unstable during the usage period of Edmodo and this may affect their adoption behaviors. Therefore, longitudinal studies can be conducted. Third, the current study employed extended TAM. Future studies would extend the model by embracing other theoretical models and factors.

Conclusions

With the growing importance of using SNSs in teaching and learning activities, we investigated factors that influence students' behavioral intention to use an educational SNS, Edmodo, through a well-established theory, extended TAM. Using PLS-SEM, the results provide strong support for our hypotheses.

To sum up, it was found that attitude, which was affected by the qualities of perceived usefulness and ease of use, was the most influential predictor of Edmodo usage intention. Perceived usefulness had a moderate influence on intention. The influence of perceived usefulness and perceived ease of use were evaluated along with their external antecedents. The findings of the study are expected to add to a growing body of literature on educational SNS(s).

Investigating users' adoption, acceptance, or rejection of a particular system is of critical importance in the field of information technology (Venkatesh *et al*., 2003). Therefore, as a concluding comment, we suggest that not only Edmodo but also other educational tools should be tested holistically through user views before they are widely used.

Statements on open data, ethics and conflict of interest

The data used in this study are available upon request.

The participants of this study voluntarily responded to the online questionnaire.

The authors have no conflict of interest.

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