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Investigating the factors that influence higher education instructors' decisions to adopt a flipped classroom instructional model

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Abstract

The flipped classroom is an instructional model which allows for more advanced learning activities during in-class time while introduces subject knowledge to students prior to class. To address a gap in the recent research regarding higher education instructors' experiences, perceptions and adoption decisions of the flipped classroom instruction, this study aimed at investigating the critical factors which were predictive of a higher education instructor's decision to adopt a flipped classroom instructional model through exploratory factor analysis (EFA) and multiple regression in a US university. The results revealed that performance expectancy and technology self-efficacy were significant predictors. Although facilitation condition was significantly correlated with instructors' adoption decisions, it was not a significant predictor. This study suggests that in order to improve higher education instructors' adoption decisions of the flipped classroom and other active learning instructional models, it is of priority for institutions to remove the internal barriers to instructors' adoption decisions of these instructional models, such as improving their performance expectancy and technology self-efficacy.

Introduction

The flipped classroom is an instructional model in which subject learning information is introduced to students before class typically using technology, and allows more advanced learning activities during in-class time, meaning students have more opportunities to participate in meaningful interactive activities such as Q&A, discussions and explanations of advanced concepts, and collaborative projects (Boucher, Robertson, Wainner & Sanders, 2013). Research has shown that as an innovative, student-centered, active learning instructional model, the flipped classroom can have a positive impact on students' learning in higher education (Elmaadaway, 2018; Kim & Park, 2017; Sun, Xie & Anderman, 2018). However, much of the recent research

Practitioner Notes

What is already known about this topic

- The flipped classroom is well known for enhancing teaching and learning in various disciplines.
- Students' learning performances and attitudes can be improved in the in-class active learning activities in their flipped classroom learning.

What the paper adds

- This study adds to the previous literature by focusing on investigating the critical factors which are predictive to the adoption decisions of the flipped classroom of instructors in a US university.
- Performance expectancy is the strongest predictor of higher education instructors' adoption decisions of the flipped classroom, followed by technology self-efficacy.
- Although facilitation condition is significantly correlated with higher education instructors' adoption decisions of the flipped classroom, it is not a significant predictor.

Implications for practice and/or policy

- Professional development for higher education instructors should help them understand how innovative instructional approaches could help to solve the problems in instruction, in order to enhance their performance expectancy.
- Rather than providing external facilitation condition, institutes should pay more importance on removing the internal barriers, such as technology self-efficacy, to improve higher education instructors' adoption of instructional innovations.

on the flipped classroom is based on students' self-reported data regarding their experiences, attitudes and perceptions during their flipped classroom learning, and typically focus on a specific and single flipped classroom course (Elmaadaway, 2018; Lopes & Soares, 2018). Research focused on a higher education instructor's experience and perceptions of using the flipped classroom still lacks. Nevertheless, all instructional innovations are instructor-led that instructors make the decisions of adopting the innovations and implement them (Ertmer, 2005). Therefore, understanding the factors which impact an instructor's adoption decision of the innovations can help to tailor the professional support regarding these innovations and to increase their usage among instructors. This leads to an understanding that critical factors which influence instructors' adoption decisions of the flipped classroom could help to enhance its popularization in higher education.

Research has shown that an instructor's decision to adopt a new technology is influenced by a series of factors, such as openness to change and technology self-efficacy (Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003). Among the theoretical models which are used to examine a user's acceptance of a new technology and to organize the factors critical to his/her adoption decision, Unified Theory of Acceptance and Use of Technology (UTAUT) Model is a frequently used one (El-Masri & Tarhini, 2017; Venkatesh *et al.*, 2003). According to UTAUT and other related studies, performance expectancy, effort expectancy, facilitation condition, social influence, technology self-efficacy and openness to change, are predictive of a user's technology adoption decision. Considering the flipped classroom is typically technology-enhanced (Brame, 2013), the studies about instructors' decisions to adopt a new technology may be relevant and can help to understand instructors' decisions to adopt the flipped classroom. Therefore, this study aimed at filling the gap in the current research by examining the critical factors which influence a higher education instructor's decision to adopt the flipped classroom in a large research university in the US, using UTAUT as a theoretical lens.

Literature review

Flipped classroom

Conversed to a traditional instructor-centered, lecture-based instructional model in which the students listened to the instructors' lectures in class and apply the knowledge by doing homework alone at home, the flipped classroom provides more interactive and advanced learning activities during in-class time while lectures are typically administered online before class, where students can view them on their own time and as often as they want (Bishop & Verleger, 2013; Boucher *et al.*, 2013; Burke & Fedorek, 2017). The flipped classroom differs from the earlier blended learning model in that it consists of two types of learning, which form the two learning phases (Bergmann & Sams, 2012; Bishop & Verleger, 2013). The first phase is the pre-class individual learning phase, during which the students are exposed to the learning content through a variety of media formats, such as video and text (Bergmann & Sams, 2012; Bishop & Verleger, 2013; Mohamed & Lamia, 2018; Sun *et al.*, 2018). The second phase is the in-class interactive learning phase, in which students have various types of interactive learning activities, such as Q&A, explanation of advanced concepts, discussions, problem solving and collaborative projects (Long, Cummins, & Waugh, 2017; Kim & Park, 2017; Lee, Lim & Kim, 2017). In the flipped classroom, students are transformed from passive learners to active learners (Kim & Park, 2017; Sun *et al.*, 2018). In the pre-class learning phase, students can control their learning pace (Bergmann & Sams, 2012; Sun *et al.*, 2018). The in-class interactive learning activities not only offer students more responsibilities for their own learning, but also require more complex thinking and reasoning skills (Elmaadaway, 2018; Kim & Park, 2017). These activities can engage students in higher-order thinking and problem-solving experiences (Kim & Park, 2017; Lee, Lim *et al.*, 2017). Students' problem-solving skills, collaborative skills, capacities in conflict management, time management and team building can be improved in the flipped classroom learning (Mohamed & Lamia, 2018). Moreover, the flipped classroom can be flexibly used that a wide range of technical approaches and various designs of learning activities can be selected, combined and used when instructors adopt the flipped classroom in various disciplines, and in various settings (Long *et al.*, 2017; Elmaadaway, 2018; Kim & Park, 2017).

Most of the recent research on the flipped classroom is typically focused on students' experiences, attitudes and perceptions regarding their flipped classroom learning in a specific flipped classroom course (Long *et al.*, 2017; Elmaadaway, 2018; Lopes & Soares, 2018). Research focused on higher education instructor's adoption decision of the flipped classroom, especially the predictive factors of their adoption decisions, still lacks.

The UTAUT framework

The UTAUT framework, which is a unified model that was developed by Venkatesh et al (2003) based on the social cognitive theory, is one of the most significant models about user acceptance of technology or technical innovations (Ifenthaler & Schweinbenz, 2013; Nikou & Economides, 2018). It was used to explain user acceptance of a technology, and to facilitate the understanding of factors impacting user acceptance of it (Venkatesh *et al.*, 2003). According to UTAUT, a user's acceptance of a technology, or a technological innovation, can be explained by several key determinants, which are performance expectancy (the degree to which a technology user believes that using this technology will provide benefits in job performance), effort expectancy (the degree of ease associated with the use of a technology), social influence (the extent to which individuals believe that others think they should use the technology) and facilitation condition (how technology users believe that outside support exists to help them use the technology). These key determinants are direct predictors of a user's behavioral intention or usage behavior.

Although UTAUT is recognized to be well-meaning and thoughtful, it has been criticized for showing bias across different contexts (Negahban & Chung, 2014; Teo, 2009), and still leaving out important variables (Bagozzi, 2007). Therefore, the UTAUT framework has also been modified and employed to examine the user acceptance of a variety of technologies among various user groups, and still has been widely used as a theoretical lens in empirical studies on users' technology adoptions (Chopdar, Korfiatis, Sivakumar, & Lytras, 2018; Khan *et al.*, 2018; Lee, Kim, & Wang, 2017; Shaw, Ellis, & Ziegler, 2018).

Theoretical framework

The goal of this study was to investigate the predictive variables on higher education instructors' adoption decisions of a flipped classroom instructional model. Although it is a mistake to conceptualize the flipped classroom based on the presence or absence of technology (Brame, 2013), a flipped classroom model is typically technology-enhanced (Long *et al.*, 2017; Lee, Kim *et al.*, 2017). Therefore, UTAUT may be employed as a theoretical lens in this study that instructors' decisions to adopt new technologies may be relevant to their decisions to adopt the flipped classroom.

Studying the impact of the UTAUT key determinants not only contributes to the theory development but also helps in facilitating the adoptions of innovative instructional approaches. This study hypothesized that the four determinants in the UTAUT framework, which are performance expectancy, effort expectancy, social influence, facilitation condition, were predictive to higher education instructors' adoption decisions of the flipped classroom. Two other factors, technology self-efficacy, and openness to change, were added in the proposed framework because they could directly affect instructors' decisions to adopt technological innovations in related studies (Koral Gümüşoğlu & Akay, 2017; Lee, Kim *et al.*, 2017; Shaw *et al.*, 2018).

Performance expectancy

Performance expectancy (PE) is defined as "the degree to which an individual believes that using the technology will help him or her to attain gains in job performance" (Venkatesh *et al.*, 2003, p. 447). In other words, performance expectancy is the expected impact of a technology's functional advantage on job performance and outcome (Kang, 2014). It is the extent to which a user believes that using a technology, or a technological innovation, will provide benefits in performing some tasks (Kang, 2014). In this study, performance expectancy refers to the degree to which an instructor believes that using the flipped classroom can improve his/her performance in instruction, such as enhancing students' learning achievements. Instructors who implemented the flipped classroom were typically with high-performance expectancy for helping their students to meet the course and work force requirements (Long *et al.*, 2017). Instructors' performance expectancy that the flipped classroom could improve students' grades, problem-solving skills, critical thinking skills, practical skills and collaborative skills, was also significantly influential to their adoption decisions (Long *et al.*, 2017; Sun *et al.*, 2018).

Effort expectancy

Effort expectancy is the extent to which a user believes using a technology will help to free his/her effort in working (Venkatesh *et al.*, 2003). Whether an instructor believes a technology can free his/her time and effort, and whether s/he thinks the time and effort spent on this technology deserve, are directly related with an instructor's willingness to afford time and effort on the technological innovation, then have a direct impact on his/her decision to adopt it (El-Masri & Tarhini, 2017). Instructors had to invest a huge amount of time to develop learning materials, to reorganize the learning content, and to design student-centered active learning activities for their flipped classroom instruction (Long *et al.*, 2017). Therefore, effort expectancy might predict an instructor's decision to adopt a flipped classroom model.

Facilitation condition

Facilitation condition is defined as the degree to which a user believes that support exists for his/her use of a technology (Venkatesh *et al.*, 2003). Instructors' perceived existence of the institutional and technical facilitations strongly predicted their adoption decisions of technological innovations (Chopdar *et al.*, 2018; Khan *et al.*, 2018). The institutional and technical facilitations include the institutional policies and the superior requirements, institutional funding support, Internet access and Internet connection speed, equipment in the classroom, access to digital resources and tools, technical support provided by the institution, and training workshops and other support services (Long, Logan, & Cummins, 2016; Long *et al.*, 2017; Baylor & Ritchie, 2002; El-Masri & Tarhini, 2017).

Social influence

Social influence is defined as the degree to which a user believes that others around him/her believe s/he should use the technology (Koral Gümüşoğlu & Akay, 2017; Khan *et al.*, 2018; Venkatesh *et al.*, 2003). In this study, social influence also includes the extent to which an instructor believes the existence of the peer assistance among instructors, including encouragement, critiques, and help, might help them to use the flipped classroom in an effective and efficient way.

Technology self-efficacy

Self-efficacy is defined as "people's judgments of their capability to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, p. 391). Technology self-efficacy is an instructor's belief that s/he can use the instructional technology to improve students' learning experiences (Compeau & Higgins, 1995). Previous studies identified technology self-efficacy as a factor that significantly influenced an instructor's decision to integrate technologies into his/her classrooms (Khan *et al.*, 2018; Shaw *et al.*, 2018). Internet-based, multimedia, and mobile technologies, were typically and widely used in the flipped classroom courses to enhance students' pre-class self-directed subject matter knowledge learning and in-class practices (Long *et al.*, 2016; Brame, 2013; Lee, Lim *et al.*, 2017; Lopes & Soares, 2018). An instructor's technology self-efficacy would potentially influence his/her decision to adopt the flipped classroom.

Openness to change

An instructor's openness to change was defined as an instructor's predisposition for trying new instructional innovations, and the belief that s/he can take the risks in instruction (Baylor & Ritchie, 2002). Recent studies showed that higher education instructors who had adopted the flipped classroom were usually the ones with higher levels of openness to change (Long *et al.*, 2017; Kim & Park, 2017; Mohamed & Lamia, 2018).

Technology adoption decision

A user's decision to adopt a new technology is measure by his/her behavioral intention and the user behavior in the UTAUT framework. Venkatesh *et al.* (2003) suggested that a user's behavioral intention to use a technology has a significant influence on his/her usage behavior. However, when studying a user's adoption of a technology, it is usually difficult to measure the actual usage behavior because there is no tangible initiative of the technology, so the behavioral intention is measured instead of the usage behavior when examining a user's technology adoption decision (Aldunate & Nussbaum, 2013; Koral Gümüşoğlu & Akay, 2017).

Research question

Based on the review of related studies, UTAUT was a strong theoretical framework that is widely used to measure educators' adoption decisions of technological innovations. Therefore, the authors proposed the following research question: Among Technology self-efficacy, Openness to change, Performance expectancy, Effort expectancy, Facilitation condition, and Social influence, which are predictive of a higher education instructor's perceived likelihood of adopting a flipped classroom instructional model?

Methodology

Participants

A total of 287 instructors with a variety of majors, ranks and teaching experiences responded to the solicitation to participate in this study. All were recruited from a large research university in the Southeastern US, which is a typical large four-year one in the US. A total of 227 valid responses were received (see respondents' demographic information in Table S1). A total of 128 (56.4%) respondents had more than 10 years teaching experience at college/university level, with a mean of 16.2 years (*SD* = 12.3). The majority of the respondents had used multimedia technologies, Internet-based technologies, and student-centered learning activities in instruction. Up to 129 (56.8%) reported having used the flipped classroom before, and 69 (30.4%) reported "frequently use" or "always use." The variety of the participants' demographic information, experiences or knowledge of the flipped classroom and the student-centered, technology-enhanced instruction, helped to enhance the representativeness of the participants and the validity of their responses regarding the flipped classroom.

Instrument

A questionnaire was employed to examine the six factors which might influence instructors' decisions to adopt the flipped classroom and their adoption decisions. The items in this questionnaire were adapted from previous studies related to UTAUT (Chopdar *et al.*, 2018; Koral Gümüşoğlu & Akay, 2017; Lee, Kim *et al.*, 2017; Venkatesh *et al.*, 2003) which tailored to the adoption of the flipped classroom. The questionnaire was divided into four sections. First section includes three questions for collecting the participants' demographic information, such as the subject content in which they taught, teaching experiences and ranks. Second section consists of five questions addressing the participants' prior experience of using Internet-based technologies, multimedia learning resources, student-centered instructional approaches and their prior experience with the flipped classroom instruction. Third section contains 43 items to identify the six factors (performance expectancy, effort expectancy, facilitation condition, social influence, technology self-efficacy, openness to change) that which might influence an instructor's decision to adopt the flipped classroom. Fourth section contains 10 items that were used to identify the participants' adoption decisions of the flipped classroom. Items in third and fourth sections were adapted from recognized studies and were modified to fit the context of this study (Aldunate & Nussbaum, 2013; Chopdar *et al.*, 2018; Khan *et al.*, 2018; Lee, Lim *et al.*, 2017; Shaw *et al.*, 2018; Venkatesh *et al.*, 2003). A five-point Likert scale was used as the measurement scale for all questions in third and fourth sections as following: "Strongly Disagree," "Disagree," "Neutral," "Agree," to "Strongly Agree."

The instrument was pilot tested with six faculty members and four Ph.D. candidates in Instructional Technology prior to being used for data collection. These pilot evaluators had either used the flipped classroom in their own instruction or had rich understandings on it. Feedback from these pilot evaluators was used to refine the instrument and to improve its readability and content validity.

Data collection

Data collection was administrated online via a university listserv, in which all faculty, lecturers and GTAs of the university subscribed. An invitation email, which included a brief description of the flipped classroom and the link to the questionnaire, was emailed to the potential participants. No personal information that might permit the identification of the respondent was collected.

Data analysis

SPSS was used for the statistical analysis. Data analysis began with generating a descriptive analysis of all the items. Next, Exploratory Factor Analysis (EFA) was used to establish validity by determining the factor structure among the items from the instrument to determine the factor structure. Cronbach's alpha was computed to determine the internal consistency of the instrument. Then a multiple linear regression analysis was used. The factors determined from EFA were used as the predictor variables, to determine which of them were better predictors of a higher education instructor's adoption decision of the flipped classroom.

Results

Analysis of measurement

To achieve the construct validity, the data were examined using EFA as the exaction technique and oblique as the rotation method (Meyer, Gamst, & Guarino, 2011). With a cut-off loading of 0.40 and an eigenvalue greater than 1.0 (Cronbach, 1951; Meyer *et al.*, 2011), the best solution was a three-factor model, which was conducted by deleting all crossloaded items and items with factor loadings under 0.40. Thus, a 3-factor maximum likelihood extraction and oblique rotation procedure generated the strongest factor structure._In the 3-factor EFA solution, the three factors cumulatively accounted for 58.84% of the total variance associated with an instructor's adoption decision of the flipped classroom.

The EFA results show that the factor loading of the remaining 24 items in third section varied from 0.420 to 0.917. Among the remaining items in third section, 10 items formed a performance expectancy construct, which was related with the performance expectancy factor, 9 items formed a technology self-efficacy construct, which was related with the technology self-efficacy factor, and the rest 5 items formed a facilitation condition construct, which was related with the facilitation condition factor. One of the 10 items in fourth section was deleted due to a factor loading value less than 0.40. The factor loading of the remaining nine items varied from 0.661 to 0.977.

Cronbach's alpha reliability was employed to determine the internal consistency of all the remained items addressing the performance expectancy, technology self-efficacy, facilitation condition and adoption decision. The Cronbach's alpha for these constructs were 0.92, 0.88, 0.80 and 0.80. An inventory is considered to be highly reliable if the overall Cronbach alpha coefficients for each scale are larger than 0.70 (Meyer *et al.*, 2011). With the range of alpha values between 0.80 and 0.92, we concluded that the constructs were reliable and that the data were suitable for future analysis. The factor loadings of the remaining items, and the descriptive analysis results, and the Cronbach's alpha values of the constructs of the remained three factors and the adoption decision are presented in Tables S2 and S3.

Multiple regression results

A regression analysis was used with the measure of the performance expectancy, technology self-efficacy and facilitation condition as the independent variables and adoption decision as the dependent variable. The results of the regression analysis are shown in Table 1. The prediction model was statistically significant, $F\ (3, 205) = 141.76$, $p < .001$. The squared multiple correlation coefficient, R^2, was 0.675, which means the three independent variables, performance expectancy, technology self-efficacy and facilitation condition, accounted for 67.5% of the adoption decision of the instructors in the south-eastern US university. Table 2 shows that all the correlations between each of the three independent variables and the dependent variable are statistically significant.

Table 3 shows that in this south-eastern US university, an instructor's adoption decision of the flipped classroom is primarily predicted by Factor 1: Performance Expectancy, and to a lesser extent by Factor 2: Technology Self-efficacy. With the sizeable correlations between the predictors, the unique variance explained by each of the variables indexed by the squared semi-partial correlations was quite low. Inspection of the structure coefficients suggests that, with the possible exception of Factor 3: Facilitation Condition, the other significant predictors were strong indicators of the latent variable described by the model.

Discussion

This study explored the relevance of the key factors to a higher education instructor's adoption decision of the flipped classroom in a large research university in the Southeastern US, which is a unique contribution to the current research on the flipped classroom, as prior research has not focused on exploring the factors related to an instructor's adoption decision. The results of this study indicate that in this university, instructors' performance expectancy and technology self-efficacy are significant predictors of their adoption decisions of the flipped classroom. Although facilitation condition is not a significant predictor, the relationship between it and instructors' adoption decisions is also significant.

Table 1: The results of regression of performance expectancy, technology self-efficacy and facilitation condition on adoption decision

Model	*SS*	*df*	*MS*	*F*	*Sig.*
Regression	56.875	3	18.958	141.756	0.000
Residual	27.416	205	0.134		
Total	84.291	208			

IV = performance expectancy, technology self-efficacy, facilitation condition.
DV = adoption decision.

Table 2: Correlations among the variables in multiple regression analysis

		Adoption decision	*Performance expectancy*	*Technology self-efficacy*	*Facilitation condition*
Pearson Correlation	Adoption decision	1.000	0.813	0.432	0.229
	Performance expectancy	0.813	1.000	0.408	0.292
	Technology self-efficacy	0.432	0.408	1.000	0.301
	Facilitation condition	0.229	0.292	0.301	1.000
Sig. (1-tailed)	Adoption decision	–	0.000	0.000	0.000
	Performance expectancy	0.000	–	0.000	0.000
	Technology self-efficacy	0.000	0.000	–	0.000
	Facilitation condition	0.000	0.000	0.000	–
N	Adoption decision	209	209	209	209
	Performance expectancy	209	209	209	209
	Technology self-efficacy	209	209	209	209
	Facilitation condition	209	209	209	209

Table 3: Standard regression results

Model	*b*	*SE-b*	*Beta*	*Person r*	*sr²*	*Structure coefficient*
Constant	0.584	0.183				
expectancy*	0.700	0.040	0.771	0.813	0.477	0.842
self-efficacy*	0.129	0.045	0.128	0.432	0.013	0.139
facilitation	–0.031	0.038	0.034	0.229	0.001	–0.100

DV = adoption decision, $R^2 = 0.675$, Adjusted $R^2 = 0.670$.
sr^2 is the squared semi-partial correlation.
$^{*}p < .05$

This study found that performance expectancy was the strongest predictor of a higher education instructor's decision to adopt the flipped classroom in this south-eastern US university. This is quite similar to the findings of the previous research that instructors' performance expectancy had a positive influence on their decisions to adopt technological innovations (Chopdar *et al.*, 2018; Lee, Kim *et al.*, 2017). This finding also supported the previous finding that instructors who adopted the flipped classroom typically had high performance expectancy on improving students' learning performance with adopting this instructional model (Long *et al.*, 2017; Elmaadaway, 2018).

This study found that among the instructors in this south-eastern US university, technology self-efficacy also played a significant role in predicting their adoption decisions of the flipped classroom. This result is similar to a concept mentioned in Koral Gümüşoğlu and Akay's (2017) study that technology self-efficacy could significantly influence an instructor's decision to integrate technologies in his/her classroom instruction. However, facilitation condition, including the instructors' perceived existence of the technical support, pedagogical support, training and other faculty's influence, was not found to be a significantly strong predictor to the instructors' adoption decisions of the flipped classroom, although also was a strong predictor. This is similar to Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur's (2012) finding about the barriers prohibit instructors from integrating technologies in instruction. They found that according to the instructors, the internal barriers, including technology self-efficacy and performance expectancy, were the main reason for their lack of technology integration, instead of the external barriers, such as lack of external facilitation condition. Similar to this study, both El-Masri and Tarhini's (2017) and Chopdar *et al.*'s (2018) studies revealed that facilitation condition had an insignificant impact on the adoption decisions of innovative technologies, especially in developed countries and areas. A possible explanation might be that the respondents in those areas were accustomed to new technologies and were self-sufficient in using them, so they did not give much importance to facilitation condition (Chopdar *et al.*, 2018; El-Masri & Tarhini, 2017). This study provides insight into how to improve higher education instructors' adoptions of the flipped classroom and other innovative instructional approaches. According to the findings, this university should focus more on removing the internal barriers to the instructors' adoptions, and improving their performance expectancy and technology self-efficacy. Professional development should be specific to instructors' subject content needs and help them understand how innovative instructional approaches could help to solve the specific problems in instruction and improve their instructional performance. Instructors should be offered more opportunities to experience the implementation of the instructional approaches in a content-specific context, and to experience how they are successfully used to enhance their instruction.

One limitation in this study is that the participants were from a single university, so their experiences and perceptions might be biased due to their similar working environments. Another limitation is that although the UTAUT framework was adopted as a theoretical lens, and the instrument was adjusted from existing instruments, had been validated, and was reliable, three potential factors, openness to change, effort expectancy and social influence, did not enter the multiple regression. Future research should involve a bigger sample from more diverse settings, in order to provide more data not only on the investigation of the factors influencing instructors' adoption decisions, but also on the validity and reliability of the instrument. Future research should also examine the impact of professional development experiences on instructors' use of a flipped classroom model. Moreover, data will be triangulated with other sources of data in future research.

Conclusion

This study investigated the critical factors which could predict higher education instructors' adoption decisions of a flipped classroom instructional model through EFA and multiple regression on a total of 227 valid responses collected from a south-eastern US university. A viable 3-factor model, which included three subscales (ie, performance expectancy, technology self-efficacy and facilitation condition) was generated after an EFA. A follow-up multiple regression was conducted to determine the degree to which the factors predicted the dependent variable (adoption decision). The results revealed that in this south-eastern US university, performance expectancy was the most significant predictor, followed by technology self-efficacy. However, facilitation condition was not a significant predictor. The findings points to the need for future research on the approaches to improve higher education instructors' performance expectancy and technology self-efficacy in professional development, in order to enhance their adoptions of innovative instructional models, such as the flipped classroom.

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Statements on open data, ethics and conflict of interest

This study was approved by the Institutional Review Board of the participating university.

There is no potential conflict of interest related to this study. Any data will be available through direct application to the first author.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Table S1. Demographic information of the participants.
Table S2. Reliability coefficients, descriptive statistics and factor loadings of performance expectancy, technology self-efficacy, and facilitation conditions constructs.
Table S3. Reliability coefficients, descriptive statistics and factor loadings of adoption decision construct.