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The role of motivation, ability, and opportunity in university teachers' continuance use intention for flipped teaching

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ABSTRACT

On-site teaching practice is changing due to the development of digital technology. Traditional lecturing has long focused on instructor-based teaching but now has transitioned to a flipped classroom that emphasizes student learning. In the past, quasi-experimental methods or qualitative interviews were primarily used to explore learners' learning performance, learning satisfaction, and the interaction between teachers and students. Studies on teachers' points of view are rare, as are studies on factors that influence teachers to continue flipped teaching. Thus, the empirical results of this innovative teaching strategy must be assessed to confirm the expectations of practice and theory. Drawing on theories of self-determination and motivation-opportunity-ability, this paper proposes and empirically supports the notion that teachers' motivational factors, perceived self-efficacy, and supportive flipped teaching resources interact to perpetuate flipped teaching in the higher education context. To test the proposed research model, a survey was conducted among 169 university teachers. The results indicate that intrinsic challenge motivation and extrinsic compensation motivation are critical predictors of teachers' continuance use intention for flipped teaching. Perceived self-efficacy was also shown to critically moderate teachers' continuance use intention for flipped teaching. Specifically, when teachers have high perceived self-efficacy, challenge motivation leads to continuance use intention. Conversely, when teachers have low perceived self-efficacy, compensation motivation leads to continuance intention. Further, the results also suggest that teachers' continuance use intention for flipped teaching is highest when challenge motivation, perceived self-efficacy, and supportive flipped teaching resources are all sufficient and mutually reinforcing.

1. Introduction

Digital technologies have spread rapidly worldwide, and flipped teaching has emerged as an innovative teaching and learning method for higher education institutions (Steed, 2012). This method has created a virtual space for the provision of online video lessons while also encouraging students to actively participate in the lessons (Fidalgo-Blanco, Martinez-Nuñez, Borrás-Gene, & Sanchez-Medina, 2017). Accordingly, the practical sites used for teaching have changed. The traditional teaching method, which has typically focused on teaching theories and practices, has been transformed into a flipped classroom technique in which student-

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centered teaching has become paramount (Calimeris & Sauer, 2015; Hao, 2016; Lai & Hwang, 2016; Sohrabi & Iraj, 2016). A flipped classroom constitutes a reversal of traditional teaching. Students are first exposed to new material outside class, usually via reading or video lessons prepared by the teachers; class time is then devoted to the harder task of assimilating the new material through strategies, such as collaborative discussions, peer interaction sessions, problem-solving exercises, in-depth experiments, or simulations (Calimeris & Sauer, 2015; Hao, 2016).

Flipped classrooms are also referred to as *flipped teaching* or *flipped learning*, but the terms denote the same novel instructional strategy (Fidalgo-Blanco et al., 2017). In this study, we use the term *flipped teaching* to emphasize teachers' teaching strategies, of which the core concept is active learning (Calimeris & Sauer, 2015; Reyna, 2015). This innovative concept was proposed neither by a theoretical curriculum nor by teaching experts, but instead by two senior high school chemistry teachers. Flipped teaching has three advantages: First, it allows students who learn slowly to review lessons repeatedly in the classroom in order to meet the requirements; thus, such students become more willing to read teaching materials than under the traditional teaching method (Hung, 2015). Second, interactions between teachers and students in the classroom become more frequent; consequently, students have more opportunities to develop higher-order thinking (Hung, 2015; Kim, Kim, Khera, & Getman, 2014; Lai & Hwang, 2016). Third, teaching materials are easier to save, manage, and transfer, allowing teachers to reflect on the whole course design and thus, improve the course content (Hwang, Lai, & Wang, 2015). The digital video environment of flipped teaching is more convenient and provides more accessible content resources for learning (Hao & Lee, 2016; Hao, 2016). Last, the environment has the capacity to facilitate the development of new teaching strategies in educational innovation.

Flipped teaching, however, is not without difficulties for teachers. First, it dramatically changes the practical operation of teaching activities and teachers' instructional patterns. Accordingly, teachers must devote substantial time to implement flipped teaching. Extra time is needed, for instance, to develop video lessons in addition to more careful planning and preparation (Reyna, 2015; Wanner & Palmer, 2015). Unfortunately, many teachers are too busy to take on extra work (Wanner & Palmer, 2015). Second, each teacher has his or her own teaching style and preferences. Some teachers prefer teacher-directed practices, while others prefer student-to-student collaboration and problem solving. These preferences can influence a teacher's style and efficiency, which, in turn, can influence students' learning efficiency (Frunză, 2014). Flipped teaching not only includes video lessons in the teaching curriculum but also, and more importantly, incorporates effective classroom interaction with students (Sams & Bergmann, 2013). Teachers may not be familiar with this flipped teaching model. Third, the implementation of flipped teaching may not receive full support from schools (Hao & Lee, 2016; Wanner & Palmer, 2015).

The benefits of flipped teaching for students have been questioned by many teachers, along three lines. First, students may be accustomed to passive learning. Traditional classrooms do not incorporate active previews, and thus, the flipped teaching strategy could fail if students do not watch or refuse to watch the video lessons in advance (Chen, Wang, Kinshuk, & Chen, 2014; Hao & Lee, 2016; Hao, 2016; Lai & Hwang, 2016). Second, it may be very difficult for students to adequately prepare for each course if all courses use the flipped teaching method (Hao, 2016; Wanner & Palmer, 2015). Third, some students may not have the digital skills needed to manage a technology-integrated environment (Hao & Lee, 2016).

At present, educational institutions are diligently working to promote the flipped teaching method and reward teachers who implement flipped teaching strategies. That said, relevant research in this area is lacking in two respects: First, previous research related to flipped teaching paid too much attention to the use of quasi-experimental and interview methods to understand how to implement flipped teaching, practically apply the relevant tools, and gauge students' satisfaction and learning performance. Although media reports, Google searches, and campus seminars demonstrate the frequency with which discussions on flipped teaching occur, research on teachers' behaviors in flipped teaching programs from a theoretical perspective is lacking. Therefore, this study attempts to understand the empirical results of this innovative teaching strategy to verify the practical and theoretical expectations. Second, although teachers play an important role in promoting flipped teaching, the relevant factors that affect teachers' behaviors in conducting flipped teaching have rarely been discussed. Therefore, a comprehensive analysis must be performed to gain an in-depth understanding of teachers' continuance use intention for flipped teaching.

Accordingly, this study constructed a predictive model of teachers' continuance use intention for flipped teaching derived from self-determination theory (SDT) and motivation-opportunity-ability (MOA). The motivations for teachers' continuance use intention for flipped teaching were examined in three dimensions: individual motivation, external environment, and individual ability. Individual motivation can be either extrinsic or intrinsic, and each type might lead to very different behaviors (Ryan & Deci, 2000). Intrinsic motivation refers to stable personality traits, including challenge motivation, whereas extrinsic motivation includes compensation motivation (Amabile, Hill, Hennessey, & Tighe, 1994). Here, the external environment comprises flipped teaching resources. Last, individual ability in this study constitutes teachers' perceived self-efficacy. With these foci in mind, the following research questions were addressed.

RQ1. To what extent do motivational factors (i.e., challenge and compensation) affect teachers' continuance use intention for flipped teaching?

RQ2. How do ability factors (i.e., teachers' perceived self-efficacy) operate in conjunction with motivational factors to influence teachers' continuance use intention for flipped teaching?

RQ3. How do opportunity factors (i.e., supportive flipped teaching resources) operate in conjunction with motivational factors and perceived self-efficacy to influence teachers' continuance use intention for flipped teaching?

Table 1
Summary of selected previous research on flipped teaching and massive online open courses.

Study	Focus		Subject		Method
	Flip	MOOCs	Teacher	Student	
Li, Wang, and Tan (2018)		v		v	Survey
Tsai, Lin, Hong, and Tai (2018)		v		v	Survey
Hsieh et al. (2017)	v			v	Mixed method
Fidalgo-Blanco et al. (2017)	v			v	Quasi-experiment
Lai and Hwang (2016)	v			v	Quasi-experiment
Hao (2016)	v			v	Mixed method
Hao and Lee (2016)	v		v		Survey
Littlejohn et al. (2016)		v		v	Mixed method
Sohrabi and Iraj (2016)	v			v	Mixed method
Phan, McNeil, and Robin (2016)		v		v	Survey
Alraimi, Zo, and Ciganek (2015)	v			v	Quasi-experiment
Calimeris and Sauer (2015)	v			v	Mixed method
Hung (2015)	v		v	v	Scoping review
O'Flaherty and Phillips (2015)		v		v	Survey
Wanner and Palmer (2015)	v		v	v	Mixed method
Chen et al. (2014)	v			v	Mixed method
Hew and Cheung (2014)		v	v	v	Constant comparative method
Mason et al. (2013)	v			v	Quasi-experiment
Critz and Knight (2013)	v			v	Survey

Note: MOOC = massive open online course.

2. Literature review

2.1. Flipped teaching and massive online open courses (MOOCs)

Massive online open courses (MOOCs) have been used to improve the effectiveness of teaching and learning. Moreover, MOOCs have global influence, allowing students of different ages, nationalities, backgrounds, abilities, and interests to participate. Such courses and their materials have become an effective teaching method; thus, many teachers have implemented MOOCs in flipped teaching (Brahimi & Sarirete, 2015). As shown in Table 1, previous studies mainly focused on students' learning effectiveness, readiness, and satisfaction, as well as interactions between teachers and students via flipped teaching strategies, by using the quasi-experimental method (Calimeris & Sauer, 2015; Fidalgo-Blanco et al., 2017; Hung, 2015; Lai & Hwang, 2016; Mason, Shuman, & Cook, 2013), the survey method (Chen et al., 2014; Critz & Knight, 2013; Hao & Lee, 2016; Hao, 2016; Hsieh, Huang, & Wu, 2017), qualitative interviews (Chen et al., 2014; Hsieh et al., 2017; Hung, 2015; Littlejohn, Hood, Milligan, & Mustain, 2016), or platform system log (Chen et al., 2014). However, little is known about teachers' perspectives, despite teachers' important role in the implementation of flipped teaching. In addition, the relevant factors that affect teachers' continuance use intention for flipped teaching have not been fully studied. A deeper understanding of the empirical results of this innovative teaching strategy is necessary to verify its practical and theoretical expectations.

2.2. Main themes of implementing flipped teaching

Flipped teaching is premised on the following conditions: First, the environment in which flipped teaching occurs must be flexible, allowing students the freedom to choose the time and place to study autonomously. Second, to create richer learning opportunities, more class time must be allocated to explore the main course themes, through the student-centered teaching approach. Third, teachers must be capable of carefully selecting and assessing the content of the video lessons. Fourth, teachers must not be replaced by flipped teaching. On the contrary, they must assume an even more important role in the flipped classroom model (Chen et al., 2014). In addition to these conditions, students' relevant experiences and the type of online learning platform, among other factors, must be considered (Chen et al., 2014). Table 2 summarizes the relevant studies, main arguments, and major themes of implementing flipped teaching.

2.3. Motivation-opportunity-ability (MOA) theory

The theoretical focus of this study is based on MOA theory, the basic tenets of which first emerged in the 1950s with Lawshe (1945) discussion of factory management, training courses, and topics in industrial psychology. In the famous book *Field Theory in Social Science*, Lewin (1951) advocated field theory with particular attention to MOA theory. However, interest in this topic stagnated in subsequent years, until a number of social psychologists began widely applying MOA theory in studies and discussions of the social sciences, consumer behaviors, and marketing. Ultimately, MOA theory became a foundation for interpreting work efficiency (Blumberg & Pringle, 1982).

Since then, MOA theory has been invoked in a wide range of areas, including behavioral studies on topics such as consumers'

Table 2
Main themes of implementing flipped teaching.

Main themes	Arguments
The design activities of flipped teaching	The course preview activities that can be integrated into classroom discussion must be redesigned. If interaction or connectivity is lacking, students will not have a motivation to preview the classroom materials. If a student is able to understand the subject of the class and preview the relevant materials before class, then the student can mitigate his or her cognitive load (Sohrabi & Iraj, 2016).
The average length of digital videos	In the majority of courses, video content from online resources is used or is designed from scratch (Sohrabi & Iraj, 2016). The recommended length of time for conducting extracurricular activities (including watching videos, examinations, participating in discussions, and browsing supplementary materials) is between 10 and 20 min (Fidalgo-Blanco et al., 2017).
Online learning platform	When integrating flipped teaching with an online learning platform, all activities in the classroom can be automatically recorded, and students can read the course content at any time without limitations. Students also can store, discuss, and collaborate on assignments through this platform (Chen et al., 2014).
Teachers' roles	Some traditional teaching strategies can still be applied to flipped teaching. Flipped teaching is implemented daily (24/7), teachers must make more effort, and flipped teaching doubles the workload (Chen et al., 2014; Wanner & Palmer, 2015).
Students' roles	Students may be restricted to the passive habits of traditional teaching methods. Students who have not watched a film will not be able to discuss its content with other students in the classroom. Thus, unprepared students could fall behind their learning schedule for long periods of time (Chen et al., 2014).

choice behaviors (Maclnnis, Moorman, & Jaworski, 1991) and corporate-level decision-making behaviors (Wu, Balasubramanian, & Mahajan, 2004). MOA theory contends that the occurrence of a specific behavior is primarily influenced by individual characteristics (motivation or ability) and the external environment (opportunity). In this theory, “motivation” implies behaviors derived from an individual's values and beliefs, “ability” refers to behavioral decisions under the constraints of available resources and knowledge, and “opportunity” refers to behaviors under external environmental constraints. Rothschild (1999) suggested that although an individual's behavior is determined by motivation, the environment (or another background mechanism) facilitates the behaviors and thus, constitutes an opportunity. Ability, in contrast, refers to behavior-related skills or knowledge. According to the MOA framework, motivation can directly affect the occurrence of individual behaviors, with ability and opportunity exerting a moderating effect on the behaviors (Maclnnis & Jaworski, 1989).

2.4. Self-determination theory

SDT is a widely used theory of motivational development and psychological needs that can be utilized to understand how and why an individual's behaviors occur (Deci & Ryan, 1985). Extrinsic and intrinsic motivations are the primary force responsible for encouraging an individual's creativity and willingness to engage in certain activities, both of which lead to different behaviors and outcomes (Ryan & Deci, 2000). Investigating an individual's motivational differences can help illuminate and predict behaviors (Amabile et al., 1994).

Deci and Ryan (1985) explained that intrinsic motivation is based solely on one's own interests or preferences and thus, depends on the instinctual demand for competence and self-determination. An individual's intrinsic motivation drives the development of new skills, exercises creativity, and strengthens his or her work ethic (Amabile et al., 1994). Amabile et al. (1994) suggested that intrinsic motivations stimulate curiosity and the pursuit of interests, satisfaction, and self-challenges at work, which can be observed from the amount of pleasure and the scope of challenges one assumes while working. The more an individual is willing to accept new challenges, the more apparent his or her intrinsic motivations become.

In terms of extrinsic motivation, Deci and Ryan (1985) believed that some people are motivated by the outward results or rewards of an activity; thus, for these individuals, behavioral decisions are usually based on personal values and expectations. Amabile et al. (1994) argued that extrinsic motivations can be measured in terms of substantial rewards (such as money) and non-substantial rewards (such as the affirmation of others), and that the more an individual is encouraged by such rewards, the more likely he or she is to be driven by extrinsic motivations.

3. Research model and hypotheses

3.1. Research model

Based on the SDT and MOA theories, a research model was constructed that explored the direct effects and interactions of individual motivation, personal ability, and external opportunities. The proposed model for predicting teachers’ continuance use intention for flipped teaching is shown in Fig. 1.

3.2. Research hypotheses

3.2.1. Challenge motivation

As adopted from SDT, challenge was examined as an intrinsic motivation. In this study, challenge was defined as the extent to

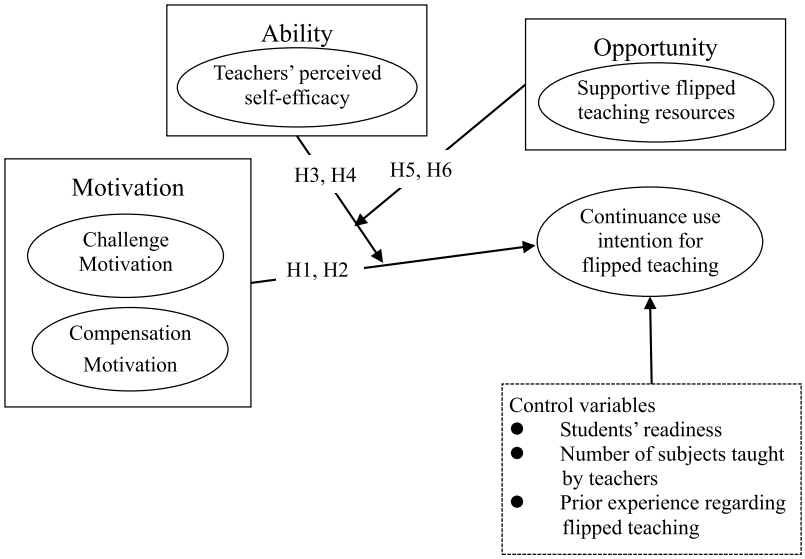

Fig. 1. Research model.

which teachers preferred to seek out complex, difficult tasks (Amabile et al., 1994). Although contemporary educational systems recognize the importance of applying information technology in teaching activities, the ever-changing nature of such technology poses a great challenge to teachers (Copriady, 2015).

In flipped teaching, teachers must alter their traditional teaching methods. Teachers must provide interaction time in the classroom to complete homework and video lessons or textbooks for students to preview before class. This study proposed that when a teacher is motivated to accept a new challenge, he or she will become more willing to continue to implement flipped teaching. This notion led to the following hypothesis:

H1. Teachers' challenge motivation is positively associated with continuance use intention for flipped teaching.

3.2.2. Compensation motivation

Another concept adopted from SDT was compensation, an extrinsic motivation. Here, compensation was defined as teachers' concerns about salaries or promotion opportunities while engaging in flipped teaching activities (Amabile et al., 1994). Previous studies emphasized that school administrators encourage teachers to incorporate technology into their traditional classrooms and provide strong incentives to do so (Howell, Saba, Lindsay, & Williams, 2004). Kelley and Kimball (2001) argued that financial gains are an initial attraction for teachers. Thus, we expected that the higher the compensation for teachers, the higher the continuance use intention to perform flipped teaching. Accordingly, we proposed the following:

H2. Teachers' compensation motivation is positively associated with continuance use intention for flipped teaching.

3.2.3. Interaction between teachers' motivation and perceived self-efficacy

Implementing flipped teaching requires substantial effort by teachers, who play a critical role in the flipped classroom environment (Wanner & Palmer, 2015). A student-centered flipped classroom requires many teaching strategies, such as small-group problem-solving, cooperative learning, and group discussions. Creating this environment is a challenge because teachers are not necessarily sufficiently prepared to apply new pedagogies to support student-centered learning strategies (Kim et al., 2014). Previous studies revealed that instructor readiness has a significant, positive influence on the application of information technology to teaching activities (Copriady, 2015).

As discussed above, challenge and compensation motivations have a direct and positive influence on the continuance use intention for flipped teaching. However, this relationship might be affected by the moderating role of teachers' perceived self-efficacy, which, according to Bandura (1986), is defined as an individual's judgment of his or her own capacity to organize and execute the courses of action required to attain a designated type of performance (p. 395). For most experienced teachers, their expertise in learning and teaching is well established before they become involved with information technology; however, the introduction of new teaching tools might challenge such expertise (Finlayson & Perry, 1995; Rogers & Finlayson, 2007). Teachers' perceived self-efficacy is considered an ability insofar as perceived self-efficacy can encourage or inhibit the internalization and regulation of a behavior. Should inhibition occur, a teacher might find an excuse not to perform a behavior (Ryan & Deci, 2002). Conversely, high perceived self-efficacy leads to more active and confident effort (Bandura, 1977). To make flipped teaching successful, teachers must have strong teaching beliefs (Hwang et al., 2015). Thus, this study proposed that teachers' high perceived self-efficacy might strengthen the relationship between teachers' motivation for and continuance use intention for flipped teaching.

H3. Teachers' challenge motivation is positively associated with continuance use intention for flipped teaching under the condition of high perceived self-efficacy.

H4. Teachers' compensation motivation is positively associated with continuance use intention for flipped teaching under the condition of high perceived self-efficacy.

3.2.4. Interaction among teachers' motivation, perceived self-efficacy, and supportive flipped teaching resources

Successful implementation of flipped teaching includes the development of face-to-face and online platforms, as well as the technical skills needed to implement flexible teaching activities. Therefore, technical support, such as appropriate education and training programs, as well as instrument-operational guidelines, is needed from schools (Wanner & Palmer, 2015). Teachers may be reluctant to change their teaching methods due to a real or perceived lack of sufficient ability, which, in turn, may have resulted from improper education and training. Therefore, schools should provide opportunities, such as investing in teachers' training programs, to improve teachers' abilities to create a dynamic, interactive learning community (Howell et al., 2004; Roberson & Klotz, 2002). In the process of implementing flipped teaching, teachers likely require different types of teaching materials and platforms, such as devices for recording video lessons, as well as video post-production, editing, and uploading. Summarily, if schools are equipped with adequate facilities, the schools can ensure flipped teaching is implemented successfully.

Adequate motivation and ability are needed to fully exploit an opportunity (Reinholt, Pedersen, & Foss, 2011). Based on the previous discussion, we propose that when teachers are motivated, have high perceived self-efficacy, and are supported with the requisite online resources, the continuance use intention for flipped teaching is improved. Thus, we hypothesize:

H5. Mutual interaction occurs among teachers' challenge motivation, perceived self-efficacy, and supportive flipped teaching resources for the continuance use intention for flipped teaching: The continuance use intention is highest when all three variables are maximized.

H6. Mutual interaction occurs among teachers' compensation motivation, perceived self-efficacy, and supportive flipped teaching resources for the continuance use intention for flipped teaching: The continuance use intention is highest when all three variables are maximized.

4. Research method

4.1. Data collection and participants

This study focused on university teachers who had experience with flipped teaching. Purposive sampling, which is inexpensive, convenient, and less time-consuming than other sampling strategies, was used to obtain a representative sample. In addition, purposive sampling results present a good probability sampling (Smith & Albaum, 2012). First, participants were selected from scholars highlighted in magazine articles, YouTube, and workshop speakers. Second, Google Scholar was used to find teachers whose research focused on flipped teaching. Third, university teachers were asked to identify other teachers engaged in flipped teaching. If the university teachers met one of these criteria, the teachers were invited to participate by completing a questionnaire, either online or on hard copy. Out of the total number of teachers contacted (N = 312), 174 responded, although five were excluded from the sample for providing invalid questionnaire responses. Therefore, the response rate was 54.17%, or 169 usable questionnaires. The sample consisted of 71 men (42%) and 98 women (58%). Most of the respondents were aged 31–40 years (33.7%) or 41–50 years (32.5%). Most of the respondents were assistant professors (55.6%) or associate professors (20.7%). These teachers' teaching schools include national universities (31.4%), national science and technology universities (17.8%), private universities (28.4%), private science and technology universities (21.3%), and private technology institute (1.2%). We used a one-way analysis of variance (ANOVA) to analyze the differences among the means of the academic positions and teaching schools for the continuance use intention for flipped teaching. There were no statistically significant differences in the continuance use intention for flipped teaching (p = 0.159 for academic positions and p = 0.637 for teaching schools). All respondents had implemented flipped teaching for at least one semester. Table 3 lists the respondents' demographic information. Table 4 lists definitions of the variables.

To examine the representativeness of the participating teachers, we assessed the nonresponse bias by comparing the early (65%) and late (35%) respondents (Armstrong & Overton, 1977). A t-test of the two independent variables, two moderators, and one dependent variable revealed no statistically significant differences between the 110 early and 59 late respondents in terms of challenge motivation (p = 0.757), compensation (p = 0.878), teachers' perceived self-efficacy (p = 0.396), supportive flipped teaching resources (p = 0.197), students' readiness (p = 0.181), and continuance use intention for flipped teaching (p = 0.133), suggesting a minimal nonresponse bias. In addition, we examined the potential common method bias by conducting a Harman's single-factor test using principal components analysis (PCA; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). No one factor explained the majority of variance (only 34.10%) in the indicators, suggesting a minimal common method bias.

4.2. Measurement

The present study defined flipped teaching as a blended learning method in which the typical order of traditional teaching activities conducted in the classroom and homework completed after school was reversed and often integrated with instructional

Table 3
Demographic information (N = 169).

Demographic variable		Count	%	Demographic variable		Count	%
Gender	Male	71	42.0	Number of teaching subjects	1 subject	20	11.8
	Female	98	58.0		2 subjects	54	32.0
Age	< 30 years	33	19.5		3 subjects	68	40.2
	31–40 years	57	33.7		4 subjects	26	15.4
	41–50 years	55	32.5		≥5 subjects	1	0.6
	51–60 years	21	12.4	Academic positions	Lecturer	21	12.4
	> 60 years	3	1.8		Assistant Professor	94	55.6
Teaching school	National universities	53	31.4		Associate professor	35	20.7
	National science and technology universities	30	17.8		Professor	19	11.2
	Private universities	48	28.4	Flipped teaching experience	1 semester	72	42.6
	Private science and technology universities	36	21.3		2 semesters	46	27.2
	Private technology institute	2	1.2		3 semesters	24	14.2
					4 semesters	12	7.1
					≥5 semesters	15	8.9

Table 4
Operational definitions of the variables.

Variables	Definition	Reference
Challenge motivation	The extent to which teachers prefer to perform more complex and difficult flipped teaching tasks	Amabile et al. (1994)
Compensation motivation	The extent to which teachers are concerned about salaries or promotions while dedicating themselves to flipped teaching	Amabile et al. (1994)
Teacher' perceived self-efficacy	The extent to which teachers judge their own capacity to organize and perform flipped teaching tasks	Bandura (1986)
Supportive flipped teaching resources	The extent to which teachers perceive their universities expend more resources on flipped teaching	Chang, McKeachie, and Lin (2010)
Students' readiness	The extent to which teachers are willing to prepare and implement flipped teaching because they believe that it could be handled by their students	Cheon et al. (2012)
Continuance use intention for flipped teaching	The extent to which teachers are willing to continue conducting flipped teaching	Ajzen (1991)

videos (Hung, 2015). More specifically, students were exposed to video lessons or other new materials in advance, outside class, and subsequent class time was devoted to harder tasks via more traditional strategies, such as homework, in-depth laboratory experiments, and collaborative discussions.

To ensure content validity, most items used in this study had been previously validated, while self-developed measurements were pre-tested with a panel of three professionals to ensure the items were suitable for flipped teaching. The pre-test also ensured that no syntactic or semantic biases occurred during the translation from English to Chinese. The questionnaire was then translated back into English to ensure proper translation. A pilot test with 30 university teachers from one university revealed no problems with the questionnaire, confirming its reliability and validity. All research variables were measured using a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). As the amount of flipped teaching experience and the number of teaching subjects may have affected the teachers' continuance use intention for flipped teaching, two control variables were included. Another control variable, students' readiness, which reflected how prepared students were to embrace flipped teaching (Hao, 2016), was adapted based on Cheon, Lee, Crooks, and Song (2012) work and was measured using the same five-point Likert scale (see Table 5).

5. Results

5.1. Reliability and validity

The constructs were assessed for reliability and validity. Internal consistency for all constructs was investigated using Cronbach's alpha and composite reliability. Table 6 shows that the Cronbach's alpha for each construct ranged from 0.881 to 0.960, all well exceeding the cutoff value of 0.70 (Nunnally, 1978). The composite reliability for each construct ranged from 0.888 to 0.962, also well above the cutoff value of 0.70 (Fornell & Larcker, 1981).

Confirmatory factor analysis (CFA) was conducted to determine the convergent and discriminant validity. CFA was performed via the AMOS program with a maximum likelihood estimation. The chi-square, normalized by degrees of freedom, was 1.511, which was lower than the normally accepted threshold of 3.00; while the comparative fit index (CFI), goodness of fit index (GFI), and root mean square error of approximation (RMSEA) were satisfactory (0.974, 0.866, and 0.055, respectively). Convergent validity is confirmed when indicator factor loadings (λ) are statistically significant and exceed the acceptable value of 0.5 on their corresponding constructs, as recommended by Hair, Black, Babin, Anderson, and Tatham (2006), and when the average variances extracted (AVEs) for

Table 5
Measurement of variables.

Variables	Question items	Source
Challenge motivation	1. I enjoy trying to use flipped teaching. 2. I enjoy the flipped teaching method that is completely new to me. 3. Curiosity is the driving force behind much of what I do in flipped teaching. 4. The more difficult the flipped teaching task, the more I enjoy trying to solve it.	Adapted based on Amabile et al. (1994)
Compensation motivation	1. I am strongly motivated by the money, awards, or promotions I can earn from doing flipped teaching. 2. As long as I can do flipped teaching, I'm not that concerned about exactly what awards I can earn. (reverse coded) 3. I seldom think about money, awards, or promotions for flipped teaching. (reverse coded) 4. I care about what incentive mechanism exists to reward quality flipped teaching.	Adapted based on Amabile et al. (1994) Self-developed
Teacher' perceived self-efficacy	1. I could complete the flipped teaching task if there was no one around to tell me what to do as I go. 2. I could complete the flipped teaching task if I could call someone for help if I got stuck. 3. I could complete the flipped teaching task if I had a lot of time to execute flipped teaching. 4. I have sufficient ability to prepare teaching materials for the flipped teaching tasks in advance (such as recording videos and collecting educational resources on the Internet).	Venkatesh, Morris, Davis, and Davis (2003) Self-developed
Supportive flipped teaching resources	1. The university provides facilities and resources for flipped teaching. 2. The university provides technology and software resources for flipped teaching. 3. The university provides facilities and resources to help me improve students' flipped learning. 4. The university provides tutoring or coaching resources for students' flipped learning.	Chang et al. (2010)
Continuance use intention for flipped teaching	1. I intend to continue to use flipped teaching. 2. My intentions are to continue using flipped teaching rather than using only traditional teaching. 3. If I could, I would like to continue my use of flipped teaching.	Adapted based on Bhattacherjee (2001)
Student readiness (control variable)	1. I think my students would be in favor of utilizing flipped teaching in their class. 2. I think my students would believe that flipped teaching could be a useful educational method in their class. 3. I think my students possess adequate technical skills to use flipped learning.	Adapted based on Cheon et al. (2012)
Flipped teaching experience (control variable)	"Have you ever implemented flipped teaching?" This variable was classified into five categories, including "One semester," "Two semesters," "Three semesters," "Four semesters," and "Five or more semesters."	
Number of teaching subjects in the semester (control variable)	"How many subjects did you teach this semester?" This variable was classified into five categories, including "One subject," "Two subjects," "Three subjects," "Four subjects," and "Five or more subjects."	

constructs are greater than 0.5, exceeding the threshold value suggested by Fornell and Larcker (1981). In the present study, all λ values in the CFA model exceeded 0.5 in the corresponding constructs. The AVEs of all constructs exceeded the threshold value of 0.5, which confirmed their convergent validity. Discriminant validity is demonstrated when the square root of the AVEs is greater than the inter-construct correlations, as suggested by Fornell and Larcker (1981). Table 7 shows that the square root of the AVEs was greater than the inter-correlations, indicating acceptable discriminant validity.

5.2. Hypotheses testing

Skewness for the scale items ranged between −0.70 and −0.36, and kurtosis ranged between −1.36 and 0.96 (both within the −2 to +2 range), which suggested good distributional properties for the data (Bhattacherjee, 2002). Data quality was also checked, and the standardized residuals among the individual scale items ranged between −2.51 and 2.39, well below the cutoff threshold value of 3.00 (Bhattacherjee, 2002). The hypotheses were tested using moderated multiple regression (MMR). MMR is a hierarchical procedure; in this study, four hierarchical regression models were utilized. The control variables were inputted in Model 1, and the independent variables and moderating variables were inputted in Model 2. Then, the two-way interaction terms, computed by multiplying an independent variable and a moderating variable, were added in Model 3, and three-way interaction terms were added in Model 4. We followed Cronbach's (1987) suggestion that mean centering can be used to alleviate collinearity issues in MMR models; thus, the values of all constructs in this study were centered (mean subtracted). When the three-way interaction terms were added in Model 4, the R^2 of 0.448 and the adjusted R^2 of 0.398 ($F = 8.924$, $p < 0.001$) indicated that Model 4 was adequate in explaining the variance in the continuance use intention for flipped teaching. The change in R^2 was 0.030 (change in $F = 4.217$, $p < 0.05$), revealing that the results of Model 4 could be interpreted. The variance inflation factor (VIF) values in Model 4 were between 1.05 and 2.22, well above the conservative cutoff of 2.50 (Allison, 1999), suggesting no multicollinearity problem. Table 8 summarizes the results of the hypothesis tests.

Table 6
Convergent validity and reliability.

Item	Factor loading	Average variance extracted	Composite reliability	Cronbach's alpha
CH1	0.948	0.864	0.962	0.960
CH2	0.903			
CH3	0.941			
CH4	0.926			
CM1	0.723	0.666	0.888	0.881
CM2	0.884			
CM3	0.739			
CM4	0.903			
SE1	0.880	0.847	0.957	0.942
SE2	0.926			
SE3	0.941			
SE4	0.934			
RE1	0.866	0.858	0.960	0.959
RE2	0.955			
RE3	0.960			
RE4	0.921			
SR1	0.811	0.822	0.932	0.930
SR2	0.966			
SR3	0.935			
CI1	0.894	0.868	0.952	0.951
CI2	0.953			
CI3	0.946			

Table 7
Descriptive statistics and discriminant validity.

Construct	1	2	3	4	5	6
1. Challenge motivation	**0.930**					
2. Compensation motivation	0.196*	**0.816**				
3. Teachers' perceived self-efficacy	0.189*	0.165*	**0.920**			
4. Supportive flipped teaching resources	0.233**	0.198**	0.191*	**0.926**		
5. Continuance use intention	0.473**	0.336**	0.181*	0.353**	**0.932**	
6. Student readiness	0.296**	0.096	0.259**	0.265**	0.389**	**0.907**
Mean	3.028	3.414	3.254	3.473	3.491	3.122
S.D.	1.253	0.852	1.281	1.209	1.392	1.191
Skewness	−0.366	−0.699	−0.400	−0.580	−0.492	−0.360
kurtosis	−1.360	0.962	−1.145	−0.854	−1.167	−1.004

Note: **Significant at the 0.01 level. *Significant at the 0.05 level. The diagonal elements (in bold) represent the square roots of the average variances extracted (AVEs). The non-diagonal elements represent the correlations among the constructs.

5.3. Follow-up interviews

The major flipped teaching methods include MOOCs, game-based learning, problem-based learning, YouTube videos, homemade videos, group discussion learning, learning sheets, and Sharestart teaching. In follow-up interviews, we invited three teachers who had implemented flipped teaching to discuss their flipped teaching practices. The teachers concluded that the focus of flipping is not on “watching videos at home or before class.” The purpose is to make the class diverse. Flipped teaching emphasizes teaching that focuses on “student-centered learning” and depends on restarting students’ learning motivation to help them build learning autonomy ability. The results of the interviews are summarized in Table 9.

6. Discussion and implications

6.1. Key findings

The key findings of this study are fivefold. First, the findings indicate that intrinsic challenge motivates teachers’ continuance use intention for flipped teaching. The flipped teaching context increases the challenges faced by teachers, as their efforts must increase before, during, and even after class. It is possible that teachers are intrinsically motivated, such as via challenge motivation, and are consequently willing to continue flipped teaching spontaneously.

Second, the results are consistent with previous research that extrinsic compensation motivation is more effective when people have spent more years in their occupations (Amabile et al., 1994). In the flipped teaching context, extrinsic compensation refers to the extrinsic rewards provided by the school as compensation for the time and effort expended by teachers on flipped teaching tasks.

Third, the relationship between challenge motivation and continuance use intention for flipped teaching is contingent on

Table 8
Results of hierarchical moderated regression analysis.

Variables	Model 1	Model 2	Model 3	Model 4	Hypothesis test
Control variables					
Flipped teaching experience	0.063	0.035	0.015	−0.004	
Number of teaching subjects	−0.051	−0.080	−0.083	−0.067	
Student readiness	0.387***	0.226**	0.203**	0.202**	
Independent variables					
Challenge (CH)		0.319***	0.358***	0.346***	**H1 was supported**
Compensation (CM)		0.228***	0.239**	0.255**	**H2 was supported**
Moderators					
Perceived self-efficacy (SE)		−0.012	0.008	0.039	
Supportive flipped teaching resources (RS)		0.176**	0.180*	0.199*	
Interaction terms					
CH × SE			0.146^{+}	0.243**	**H3 was supported**
CH × RS			−0.020	0.038	
CM × SE			−0.135*	−0.161*	H4 was not supported
CM × RS			0.101	0.083	
SE × RS			−0.046	0.050	
CH × SE × RS				0.224*	**H5 was supported**
CM × SE × RS				−0.081	H6 was not supported
R^2	0.158	0.383	0.418	0.448	
Adjusted R^2	0.143	0.356	0.373	0.398	
R^2 *change*	0.158	0.225	0.035	0.030	
F change	10.319***	14.652***	1.873	4.217*	
VIF range	1.001–1.002	1.012–1.193	1.036–1.954	1.050–2.221	

Note: Standardized coefficients are reported. $^{+}p < 0.1$; $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

perceived self-efficacy. As shown in Fig. 2(A), it appears that teachers' perceived self-efficacy is statistically significant when combined with challenge motivation. Teachers may hope to be challenged by teaching so that their ability improves. Thus, the results show that the simultaneous effect of perceived self-efficacy and challenge motivation is critical for influencing the continuance use intention for flipped teaching.

Fourth, the relationship between compensation motivation and continuance use intention for flipped teaching is contingent on perceived self-efficacy. As shown in Fig. 2(B), when self-efficacy is low, teachers are motivated to continue flipped teaching if they are compensated. Conversely, when self-efficacy is high, compensation motivation is not a driver for continued flipped teaching. Thus, for teachers with low self-efficacy, providing them with tangible compensation for their efforts would be more effective.

Fifth, the relationship among challenge, teachers' perceived self-efficacy, and continuance use intention for flipped teaching is contingent on supportive flipped teaching resources. Fig. 3 confirms our argument that teachers' continuance use intention for flipped teaching is highest when challenge, perceived self-efficacy, and supportive flipped teaching resources are all high. This finding demonstrates that teachers seem to be driven by intrinsic motivation (such as their challenge motivation); in addition, teachers possess stronger self-efficacy to fully use the flipped teaching resources provided by their school.

6.2. Theoretical implications

This study has several implications for conducting future research in flipped teaching. First, there is a relative lack of flipped teaching research in higher education settings. In response, this study focused on university teachers and accordingly, contributes to the body of flipped teaching in higher education by developing a framework for understanding teachers' perspectives. This understanding may serve as the first step for further research on the role of teachers in flipped teaching.

Second, teachers' work motivation directly affects their performance (Bentea & Anghelache, 2012) and preparedness for using information technology in teaching activities (Copriady, 2015). Thus, this study builds on insights identified from SDT and MOA. We propose that continuance use intention should consider teachers' motivation, ability, and opportunity. However, students' readiness should continue to be ensured and encouraged by teachers. The present study contributes to the relevant empirical results regarding flipped teaching, which has been widely promoted in Taiwanese universities.

Third, in previous research, each determinant of continuance use intention was considered independently, and thus, potential interactions were ignored. In contrast, in this study, mutual interaction among teachers' challenge motivation, perceived self-efficacy, supportive flipped teaching resources, and continuance use intention for flipped teaching was empirically demonstrated using data from university teachers. Thus, an important contribution of this study is that it demonstrated the relations among challenge motivation, perceived self-efficacy, and supportive resources, rather than merely focusing on one of these variables. As flipped teaching becomes increasingly important, these relationships are likely to comprise fundamental components of teachers' continuance use intention.

Table 9
Results of interviews with three teachers.

Major flipped-teaching strategy	Course title	Practice
Sharestart Teaching Method	Chinese Language	***I. Purpose*** After self-digesting, the teacher edits the preparation process as a problem-oriented handout and conducts group cooperative learning in the classroom. The teaching process is performed via "reading and self-studying, discussing and speculating, sharing and expressing" and moves the sovereignty of learning from "narration of the traditional educator" to "active thinking of the learner." ***II. Teaching Process*** **1. Reading Time (Reading and Self-studying, 5–10 min)** The teacher controls the class and guides students to self-regulate which can help the students concentrate while reading the materials. In addition, the teacher also finds that some students will make annotations by themselves. **2. Group Discussion (Reading and Self-studying, 5–10 min)** The students are divided into several groups, and each student is guided to participate and discuss. After several exercises, the students become involved and motivated. The teacher goes around the classroom and listens to the students' ideas for communication and organization. Then, the teacher guides or asks questions during the discussion to keep the group discussion on track. **3. Board report (Reading and Self-studying, 15–20 min)** Students immediately and methodically share the discussion results with their classmates. This method requires more practice and expectations. The teacher believes that the higher the number of published opportunities and frequencies, the more students concentrate on reading and self-studying and focus in the discussion. **4. Teacher's Summary (5–10 min)** Clarify doubts in the learners' discussion, approve the student feedback, and examine self-teaching.
Problem-Based Learning	International Trade	***I. Purpose*** The questions are designed to encourage students to perform group discussion and make students develop capabilities for learning actively, critical thinking, and problem-solving. ***II. Teaching Process*** 1. The teacher provides video lessons or textbooks for students to preview before class (10–15 min). 2. The teacher processes the team groups (seven groups, five students for each group). 3. The teacher prepares the teaching plan beforehand and then presents the lessons to the students who read the teaching plan and content for 10 min. 4. The teacher spends 15–20 min guiding students thinking about the questions listed in the learning content and offering the hypothesis to solve the problem. At the same time, they can briefly discuss how to use various learning resources (such as textbooks, periodicals, the Internet, etc.) and instruct students work together to finish the job. 5. Each group presents 3-min oral reports regarding a solution that the students come up with. 6. Last, the students write a self-evaluation on the learning feedback sheet and offer constructive feedback.
Game-Based Learning	Programming language	***I. Purpose*** Teach the students with structured programming without using the traditional teaching or actual operation method. Through the educational tabletop game, students can learn the principles of programming language. ***II. Teaching Process*** 1. The teacher provides video lessons or textbooks for students to preview before class (10–15 min). 2. In the first class, after explaining the rules of the tabletop game, all the students are divided into several groups to play the game (about 50 min). 3. In the second class, the teacher teaches the course content and the game's rules. Then, the students ponder it (about 50 min). 4. In the third class, the students work together and use problem design to complete the programming work (about 50 min).

6.3. Practical implications

This study has several implications for practice in this subject area. First, the results show a clear relation between challenge and continuance motivations, as well as between compensation and continuance motivations. This relation implies that teachers performing flipped teaching act based on the challenges it represents and/or because of tangible rewards. Challenge was positively correlated with an autonomy orientation, while compensation was positively correlated with a control orientation (Amabile et al., 1994). We suggest that teachers may engage in exploratory, curiosity-driven behavior even without expectations of rewards (Ryan & Deci, 2000). Interestingly, when teachers lack a sense of challenge, providing compensation may provoke action.

Second, for extrinsic compensation motivation, rewards for teachers' flipped teaching performance are likely to directly support the continuance use intention for flipped teaching. Government education authorities may also gain a better understanding of the tendencies and factors that influence university teachers in implementing flipped teaching, which, in turn, could improve teachers' planning and promotion of flipped teaching. In particular, a reward or incentive may have a significant, positive effect on teachers'

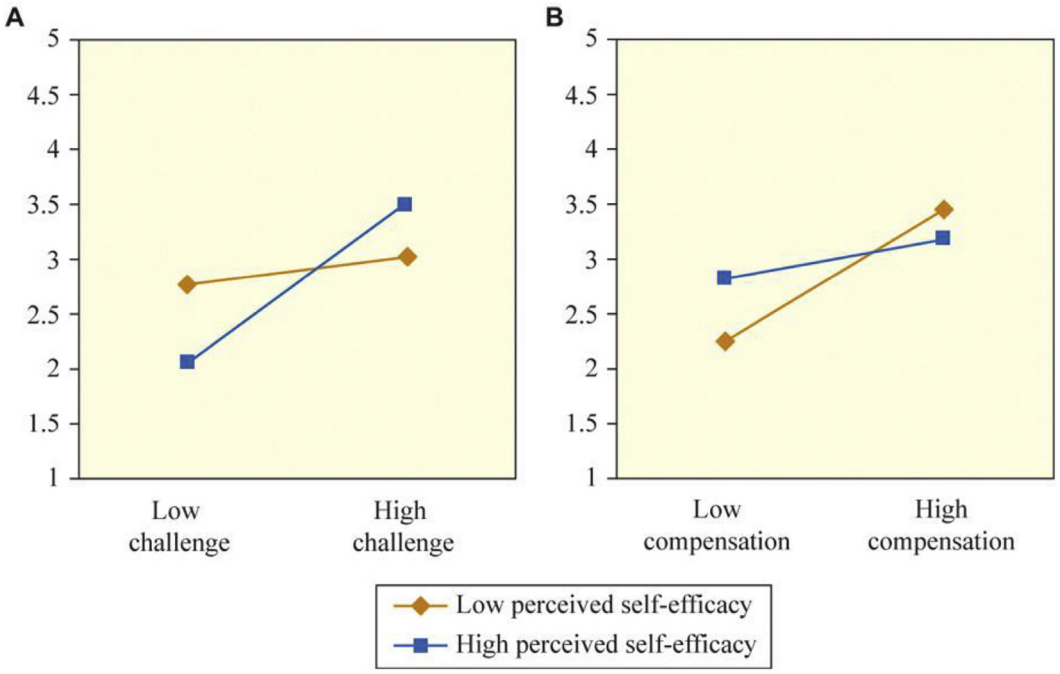

Fig. 2. (A) Two-way interaction effect of challenge and self-efficacy, and (B) two-way interaction effect of compensation and self-efficacy on continuance use intention for flipped teaching.

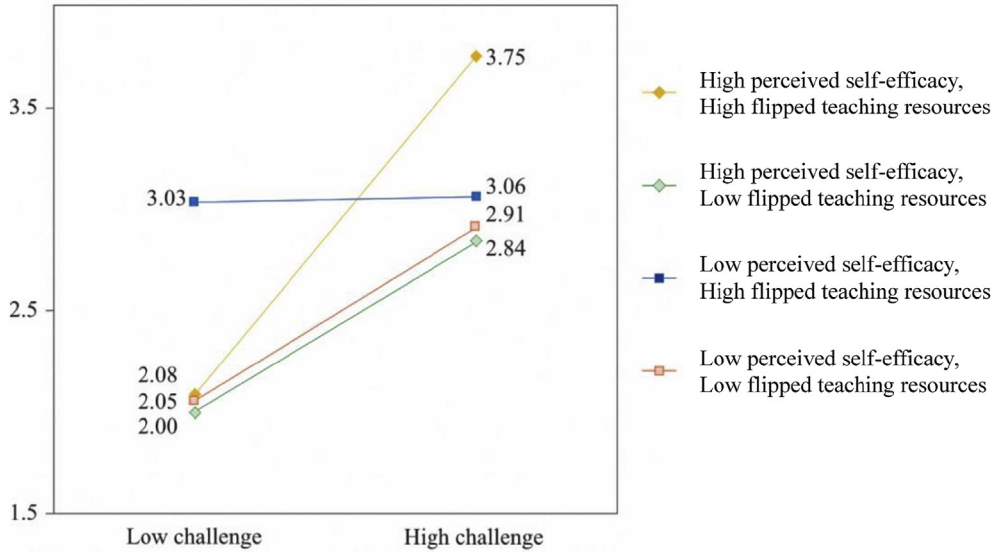

Fig. 3. Three-way interaction effect of challenge, self-efficacy, and supportive resources on continuance use intention for flipped teaching.

continuance use intention for flipped teaching when their perceived self-efficacy is low. School managers should recognize that rewards may serve as a catalyst for enhancing flipped teaching, especially for teachers with low self-efficacy.

Last, we recommend that school managers provide teaching resources, such as video websites, MOOC platforms, and teaching materials, especially for teachers with challenge motivation and high self-efficacy, to help them to continue implementing flipped teaching. We also suggest that developing ways to better integrate teaching resources into pedagogy is much more important than merely providing technology for teachers, for example, by providing peer observation and training courses for teachers. By doing so, their self-efficacy and confidence in implementing flipped teaching may be greatly enhanced.

6.4. Limitations and future research

The contributions of this study should be considered in light of their limitations and can be extended in several aspects in future research. First, behavioral intention was measured instead of actual behavior. Landis, Triandis, and Adamopoulos (1978) pointed out that when a specific habit has yet to be formed, intentions become instrumental in its articulation. When an individual seldom conducts the same behavior in the same environment, future behaviors, in particular, will be driven by intentions (Danner, Aarts, & Vries, 2008). Additionally, Sheppard, Hartwick, and Warshaw (1988) conducted a meta-analysis and showed that the weighted average correlation coefficient between behavioral intention and behavior was 0.53. Thus, behavioral intention had good predictive power for behaviors. In future research, it would be meaningful to extend the present study to actual behavior. Second, cross-sectional data were used in this study. A longitudinal study may be a more effective method for understanding the long-term effects of teachers' motivation, ability, and opportunity. We hope this study contributes to and helps draw attention to flipped teaching research, particularly from teachers' perspectives. Third, using university teachers in Taiwan as research subjects might limit the generalizability of these results in other countries. Considering the increasing use of flipped teaching in other countries, studies on continuance use intention for different countries could be useful for future research and practice. Last, as tangible rewards may diminish intrinsic motivation, to expand the findings of the present study, a two-way interaction in future research is needed.

7. Conclusion

Successful flipped teaching requires teachers and students to actively participate. To better understand the interplay among motivation, ability, and opportunity, as well as teachers' continuance use intention for flipped teaching, this study employed SDT and MOA theory to identify motivation, ability, and opportunity factors to predict teachers' teaching continuance intention. Student readiness was included as a control variable. This study contributes to theory and practice in three ways. First, the study used SDT to select two motivational factors to understand their direct effects on teachers' continuance use intention for flipped teaching. Second, MOA theory was used to explore the moderating role of ability and opportunity factors, thus helping to yield a better understanding of teachers' continuance use intention for flipped teaching. Finally, a survey of university teachers with previous flipped teaching experience was used to test the hypotheses. The survey results showed that intrinsic challenge motivation drives the continuance use intention for flipped teaching for teachers with high perceived self-efficacy. The opposite occurs for teachers with low perceived self-efficacy: Extrinsic compensation motivation is the driver. Teachers' continuance use intention for flipped teaching is highest when intrinsic challenge, perceived self-efficacy, and supportive flipped teaching resources are all high.

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