Student Characteristics and Learning and Teaching Factors Predicting Affective and Motivational Outcomes in Flipped College Classrooms

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Abstract

The flipped classroom has become a popular pedagogical approach in higher education with its capability to promote students' active engagement in higher-order tasks; nevertheless, studies have shown that the flipped classroom is not always successful. The purpose of this study was to investigate factors including student characteristics as well as learning and teaching factors that influence students' affective and motivational outcomes in flipped classrooms in higher education. A total of 350 university students in 12 different flipped classrooms completed survey instruments at the end of the semester that assessed their experience with flipped classrooms, emotional experiences, and motivation. Results indicated that enjoyment was predicted by the perception of preview materials, teacher facilitation, and participation in learning activities. Boredom was predicted by the perception of preview materials and participation in learning activities. Self-efficacy was significantly explained by both student characteristics and learning and teaching factors. Further discussion and implications are provided.

Keywords: flipped learning, academic emotion, motivation, self-efficacy, teacher facilitation

Declaration of Interest Statement: The authors declare that they have no conflict of interest.

Student Characteristics and Learning and Teaching Factors

Predicting Affective and Motivational Outcomes in Flipped College Classrooms

In recent years, flipped classrooms have been recognized as an innovative teaching strategy that enables a student-centered environment and engages students in meaningful learning (Akçayır & Akçayır, 2018). In the typical flipped classroom, course materials are made accessible to students online prior to in-class sessions in a video or conventional format, such as book chapters and research articles, so that in-class time can be freed up for more active and higher-order learning activities (Bergmann & Sams, 2012). During in-class hours students participate in group work and collaborative activities, and teachers can spend more in-class time monitoring and facilitating student progress and providing adaptive feedback to students. After class students are expected to reflect on and apply the acquired knowledge and skills in real problem-solving situations (Bergman & Sams, 2014).

Much early research on this strategy has been focused on comparing students' achievement in flipped classrooms to that of students in traditional classrooms, but it yielded mixed results (Betihavas, Bridgman, Kornhaber, & Cross, 2016; Chen, Lui, & Martinelli, 2017; Karabulut-Ilgu, Cherrez, & Jahren, 2018). Some researchers reported that students in flipped classrooms outperformed those in traditional classrooms (e.g., Al-Zahrani, 2015; Chiang & Wang, 2015; Davies, Dean, & Ball, 2013; Yelamarthi, Member, & Drake, 2015), but others found no significant differences (e.g., Baepler, Walker, & Driessen, 2014; Talbert, 2014; Velegol, Zappe, & Mahoney, 2015).

The findings of these studies suggested that flipped classrooms are not always effective in facilitating student performance, but because many university instructors are interested in employing this technique, identifying factors that determine the success of students in flipped classrooms is of considerable importance. In this study, we investigated student characteristics as well as learning and teaching factors that led to successful learning in flipped classrooms—in particular affective and motivational outcomes. We focused on affective and motivational outcomes because very little research has been conducted on this topic despite its significance.

Affective and Motivational Outcomes in Flipped Classrooms

Employing flipped classrooms in higher education is a beneficial approach in which class time is reserved for student-centered learning activities, providing opportunities for students to participate in higher-order tasks, interact with teachers and peers, and make choices and decisions (Bergman & Sams, 2012). The active participation and student autonomy fostered in flipped classrooms are presumed to yield enhanced engagement, which will in turn result in better academic performance (Davies et al., 2013; Lai & Hwang, 2016). Given the presumed benefits of this approach for engagement, students' affective and motivational outcomes in flipped classrooms are important indicators of the success of this approach. Without the achievement of such outcomes, any improvement expected in student performance is unlikely, putting at risk the sustainability of flipped classrooms in higher education.

Affective learning outcomes entail the emotional experiences of students. As they participate in student-centered learning activities in flipped classrooms with support for their autonomy, students are expected to demonstrate greater engagement and enjoyment in learning

as suggested in the control-value theory (Baepler et al., 2014; Pekrun, 2006). Positive emotions like enjoyment and pride are usually connected to superior academic behaviors and achievement (Kim, Park, & Cozart, 2014), whereas negative emotions like boredom and anger are related to low academic performance (Ahmed, Minnaert, van der Werf, & Kuyper, 2010; Trautwein, Niggli, Schnyder, & Lüdtke, 2009); furthermore, enjoyment in flipped classrooms significantly correlated with students' motivation and learning outcomes (Huang & Lin, 2017).

Self-efficacy for learning is one of the critical motivational outcomes strongly associated with performance (Cho & Heron, 2015; Greene, Miller, Crowson, Duke, & Akey, 2004), and perceptions of students about their competence as learners, or self-efficacy, are commonly developed as a result of successful learning experiences (Bandura, 1997). Thus, with the active participation and timely feedback provided in flipped classrooms, students are likely to develop high self-efficacy beliefs toward learning. Several studies have shown that students developed stronger self-efficacy beliefs after engaging in a flipped classroom as compared to those in traditional learning environments (Chyr, Shen, Chiang, Lin, & Tsia, 2017; Ibrahim & Callaway, 2014; Lai & Hwang, 2016).

Student Characteristics Influencing Learning Experiences in Flipped Classrooms

Previous studies have indicated that gender, age, and prior academic achievement influence the performance of students in flipped classrooms. Gender is one of the personal factors commonly associated with academic performance, especially in the mathematics domain (Duckworth & Seligman, 2006; Weis, Heikamp, & Trommsdorff, 2013). Studies on flipped learning have also shown gender differences with regard to students' perceptions of learning in

flipped classrooms. Female students were less confident than males in terms of readiness for flipped learning, and they were less likely to appreciate the value of instructional videos provided as preview learning materials (Hao, 2016; Moore & Chung, 2015). With regard to the effect of age, previous research has shown that older students preferred a flipped learning approach, placing higher value on preview learning materials (Hao, 2016; Moore & Chung, 2015). Older students may have a greater capacity for self-regulated learning, a skill critical for success in flipped classrooms (Hao, 2016; Yilmaz & Baydas, 2017). The level of prior academic achievement has also had an influence on students' learning experiences in flipped classrooms in that as compared to high achievers, low achievers favored the use of video as a learning tool and perceived greater learning (Nouri, 2016).

Learning and Teaching Factors Influencing Learning Experiences in Flipped Classrooms

The literature on flipped learning typically includes four factors associated with learning and teaching likely to influence student experiences in flipped classrooms: (a) the quality of preview learning materials, (b) peer interactions, (c) teacher facilitation, and (d) student participation in learning activities. First, preview learning materials are provided to students prior to in-class sessions as a medium for acquiring the basics of the content. Because the preview learning materials are a core element in the flipped classroom approach, a number of researchers have studied various forms of preview materials (Lai & Hwang, 2016; Huang, Hew, & Lo, 2018; Hwang & Lai, 2017). These studies have shown that student performance in flipped classrooms was influenced by the design and presentation of the preview learning materials. For example, elementary students demonstrated higher self-efficacy and greater math achievement when they

used interactive online materials to learn math concepts in a flipped classroom, compared to using ordinary video resources (Hwang & Lai, 2017). The more positive the attitudes students have had toward preview materials in a flipped classroom, the higher the motivation, engagement, and commitment they demonstrate as learners (Arshad & Irman, 2013; Nouri, 2016).

Another distinct feature of flipped classroom is that students engage in group learning activities, interacting and collaborating with their peers. Interaction with others in a flipped classroom creates a dynamic physical environment in which students can internalize their knowledge (Sun & Wu, 2016). Through interaction with others in the classroom, students can clarify and articulate their understanding and achieve meaningful learning, leading to greater learning outcomes (Lai & Hwang, 2016; Sun & Wu, 2016); furthermore, students have demonstrated greater motivation and positive emotions when they perceived that their peers made meaningful contributions to the group (Huang & Lin, 2017).

Another important factor in flipped learning experiences may well be related to the instructor. In a flipped learning environment teachers serve as facilitators, and students take control of their own learning processes (Bergman & Sams, 2012). Besides preparing preview materials, teachers are expected to monitor students, provide feedback, and assess student work during in-class sessions (Flumerfelt & Green 2013; Yilmaz & Baydas, 2017). Teacher facilitation helps students overcome misconception as well as develop positive attitudes towards flipped learning (Raths, 2014). Without proper guidance from teachers, students may feel lost, frustrated, and overwhelmed with a workload put on them both in and outside the class (Hall & DuFrene,

2016; Mason, Shuman, & Cook, 2013). A recent empirical study indicated that students' perceived support from instructors significantly predicted their achievement (Yoon, Kim, & Kang, 2018).

Finally, students' active participation is also critical to successful learning in the flipped classroom (McCallum, Schultz, Sellke, & Spartz, 2015). When students are deeply engaged in learning, they demonstrate greater satisfaction and perceived learning (Yoon et al., 2018). Especially in a flipped learning environment students who are better engaged in preview learning materials are more likely to participate actively in classroom learning (Mason et al., 2013). Students' active participation also contributes to enhanced confidence in learning and a decrease in anxiety (Teo, Tan, Yan, Teo, & Yeo, 2014).

Purpose of the Study

The overarching purpose of this study was to identify meaningful factors of the flipped classroom that predict students' affective and motivational outcomes. In particular, the study was focused on three student factors—gender, age, and prior achievement—and four learning and teaching factors: (a) the quality of preview materials, (b) peer interactions, (c) teacher facilitation, and (d) student participation in learning activities. Affective and motivational outcomes examined in the study comprised (a) enjoyment in flipped learning, (b) boredom in flipped learning, and (c) self-efficacy for learning. Specific research questions follow:

1. To what extent do student characteristics and learning and teaching factors predict student enjoyment in flipped classrooms?
2. To what extent do student characteristics and learning and teaching factors predict

student boredom in flipped classrooms?

3. To what extent do student characteristics and learning and teaching factors predict student self-efficacy for learning in flipped classrooms?

Method

Participants

Participants in this study were 350 students at a comprehensive university in South Korea, recruited from 12 courses taught with flipped learning approaches. The school was one of the top-tier comprehensive universities in South Korea, where admission was highly competitive. Although varying across disciplines, the typical mode of instruction at the university was lecture. The subject areas of the 12 courses in the study were diverse, ranging from social science and art to mathematics and engineering. A list of the specific courses appears in Table 1. Among the 350 students, female and male students numbered 85 (24.3%) and 265 (75.7%), respectively. The average age of the participants was 21.85 (SD = 2.31), and the average of self-reported GPAs was 3.47 on a 4.5 scale (SD = 0.58). The majority of the students (n = 303, 86.6%) reported that they had no prior experience with a flipped learning environment, whereas 38 students (10.9%) reported they had previously taken one course with a flipped learning approach.

Insert Table 1 here

Contexts

The instructors participating in this study used a flipped learning approach throughout the entire semester (16 weeks). Although the format varied slightly across the courses, they shared some common characteristics. In all 12 courses, students learned from preview materials (e.g.,

instructor-created videos, YouTube videos, and news or research articles) prior to class. During class hours, students engaged in activities and group discussions. Students also had a long-term group project that they were expected to work on after class hours.

For example, an instructor in a chemical engineering course called Heat and Mass Transfer created 12 two-hour video lectures, segmented into two or three videos each and posted them in a course management system. After watching the instructor-created preview videos before the class began, students were given a quiz on the contents of the videos so that the instructor could check their understanding of the preview materials. In addition, students spent the majority of class time working on problem-solving activities in groups. Each group of students was required to demonstrate their problem-solving process to the entire class while interacting with peers by answering questions and receiving feedback. The instructor facilitated the discussions and provided feedback if necessary. To solve the problems, students had to understand, interpret, and apply theories. Solving problems was critical to achieving the course learning goals. Outside class, students were also required to complete a semester-long project, such as the design of a Gallium nitride chemical vapor deposition reactor, intended to facilitate students' higher-order thinking and deepen their understanding. At the end of the semester, members of each group presented their design project to the class.

Instruments

A survey, "Student Experiences with a Flipped Classroom" was used in the study. It consisted of three parts: (a) student background information, (b) perceptions of the flipped classroom, and (c) learning outcomes. The section on student background information covered

age, gender, previous GPA, and prior experience with flipped classrooms. The section on perceptions of flipped learning was designed to assess students' perceptions of the preview learning materials, interactions with peers, teacher facilitation, and their participation in flipped learning activities. The total number of items was 15 with each subscale comprising three to five items.

The segment on learning outcomes included questions on students' self-efficacy for learning and emotional outcomes (i.e., enjoyment and boredom) experienced in the flipped learning courses. The self-efficacy survey included four items adapted from the self-efficacy scale of the Motivated Strategies for Learning Questionnaire (Pintrich, Smith, Garcia, & McKeachie, 1993). The enjoyment survey was comprised of items adapted from the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1987). For boredom, we adapted five items from Artino (2009). Appendix A contains the entire survey. All the items were assessed on, 5-point Likert scales ranging from 1 (*not at all true of me*) to 5 (*very true of me*). Cronbach's alphas for the survey in this study ranged from .73 to .94 (see Table 2).

Procedures

Upon approval by the Institutional Review Board (IRB) and permission from instructors, one of the researchers visited the 12 flipped classrooms to recruit study participants and administer the online survey at the end of the semester. The researcher explained to students that their participation in the research was voluntary and would not affect their grades. Students were also informed that they could withdraw at any time without penalty. The students who agreed to participate in the study completed the online survey—Student Experiences with a Flipped

Classroom—via either a mobile device or a computer either in or outside class.

Results

Descriptive Statistics

Table 2 presents means and standard deviations of student characteristics, learning and teaching factors, and learning outcomes. Means for age, gender (1 = female, 2 = male), and previous GPA were 21.85 (*SD* = 2.31), 1.76 (*SD* = 0.43), and 3.47 (*SD* = 0.59), respectively. Means for the perception of preview materials, student experiences with peer interactions, perception of teacher facilitation, and participation in learning activities were 3.78 (*SD* = 0.93), 3.79 (*SD* = 0.88), 3.88 (*SD* = 0.71), and 3.70 (*SD* = 0.75), respectively. In addition, means for enjoyment, boredom, and self-efficacy were 3.80 (*SD* = 0.82), 2.13 (*SD* = 0.86), and 3.81 (*SD* = 0.92), respectively.

Insert Table 2 here

Bivariate Correlations

Pearson correlations were calculated to examine bivariate relationships among three learning outcomes and student characteristics and four learning and teaching factors (see Table 2). The correlation analyses showed that enjoyment was positively related to two of the student characteristics—age ($r = .20$, $p < .01$) and previous GPA ($r = .14$, $p < .01$)—but not gender. In addition, enjoyment positively correlated with the perceptions of preview materials ($r = .58$, $p < .01$), peer interactions ($r = .50$, $p < .01$), teacher facilitation ($r = .63$, $p < .01$), and participation in learning activities ($r = .63$, $p < .01$).

In the case of boredom, a negative relationship with age ($r = -.23$, $p < .01$), gender ($r =$

-.03, $p > .05$) and previous GPA ($r = -.05$, $p > .05$) emerged; however, only age was significantly correlated with boredom. In addition, all four learning and teaching factors negatively correlated with boredom: the perceptions of preview materials ($r = -.48$, $p < .01$), peer interaction ($r = -.37$, $p < .01$), teacher facilitation ($r = -.46$, $p < .01$), and participation in learning activities ($r = -.47$, $p < .01$).

Self-efficacy significantly correlated with both student characteristics and learning and teaching factors. Specifically, age ($r = .27$, $p < .01$), gender ($r = .14$, $p < .05$), and previous GPA ($r = .13$, $p < .05$) had positive relationships with self-efficacy for learning. The perceptions of preview materials ($r = .41$, $p < .01$), peer interactions ($r = .43$, $p < .01$), teacher facilitation in flipped classroom ($r = .41$, $p < .01$), and participation in learning activities ($r = .57$, $p < .01$) also positively correlated with self-efficacy.

Hierarchical Regression Analyses

Three two-step hierarchical regression analyses were conducted to predict the three affective and motivational outcomes with student characteristics and learning and teaching factors as predictors. The first hierarchical regression analysis was conducted to predict student enjoyment by entering student characteristics in Step 1 of the analysis, followed by entering the four learning and teaching factors associated with a flipped classroom in Step 2 (see Table 3). Results from the first step of regression analysis showed that the student characteristics together explained 4.2% of the variance in enjoyment. In this model, age was the only significant predictor of enjoyment ($\beta = 0.194$, $p < .001$), indicating that older students felt more enjoyment in flipped classrooms than younger students. When the learning and teaching factors were added

in Step 2, the amount of variance explained by the model increased to 51.9%, F (7, 342) = 52.786, $p < .001$. Age became insignificant, but all three learning and teaching factors significantly predicted enjoyment: perceptions of preview materials ($\beta = 0.249$, $p < .001$), teacher facilitation ($\beta = 0.226$, $p < .001$), and participation in learning activities ($\beta = 0.283$, $p < .001$). That is, students experienced more enjoyment in the flipped classroom when they perceived a high value in the preview materials, greater teacher facilitation, and greater participation in learning activities.

Insert Table 3 here

The second regression analysis was conducted to predict student boredom in a flipped classroom (see Table 4). In Step 1, age was the only significant predictor, negatively explaining 5.5% of the variance in boredom ($\beta = -0.228$, $p < .001$). This indicates that younger students felt more boredom in flipped classrooms than older students. In Step 2, age became insignificant, but the perceived value of preview materials ($\beta = -0.261$, $p < .001$) and participation in learning activities ($\beta = -0.177$, $p < .001$) negatively correlated with boredom. That is, valuing preview materials less and low participation in learning activities were more likely to lead to students' experience of boredom in a flipped classroom. The overall model explained 32.3% of the variance in boredom, F (7, 342) = 23.361, $p < .001$.

Insert Table 4 about here

The last hierarchical regression analysis was conducted to predict self-efficacy for learning (see Table 5). In Step 1 of the analysis, age, gender, and previous GPA together explained 11.4% of the variance in self-efficacy. Specifically, students who were older ($\beta =$

0.259, $p < .001$) and had higher GPAs ($\beta = 0.167$, $p < .01$) were likely to demonstrate higher self-efficacy in a flipped classroom; furthermore, male students showed significantly higher self-efficacy than female counterparts ($\beta = 0.132$, $p < .05$). In Step 2 of the analysis, all the student factors remained significant predictors: age ($\beta = 0.148$, $p < .001$), gender ($\beta = 0.105$, $p < .05$), and previous GPA ($\beta = 0.164$, $p < .001$). In addition, three of the learning and teaching factors positively predicted self-efficacy: the quality of preview materials ($\beta = 0.137$, $p < .05$), peer interactions ($\beta = 0.187$, $p < .01$), and participation in learning activities ($\beta = 0.419$, $p < .001$). The overall model explained 41.1% of the variance in self-efficacy for learning in the flipped classroom, F (7, 342) = 34.148, $p < .001$.

Insert Table 5 about here

Discussion

The purpose of the study was to examine the extent to which student characteristics and learning and teaching factors predict student affective and motivational outcomes in a flipped classroom. In particular, we focused on three learning outcomes: enjoyment, boredom, and self-efficacy for learning. The findings indicated that the learning and teaching factors made unique contributions to all three outcomes, but student characteristics were marginally associated with three learning outcomes. Detailed interpretations appear below.

Enjoyment was positively predicted by the perception of preview materials, teacher facilitation, and student participation in learning activities; that is, students experienced enjoyment if they (a) perceived the preview materials as meaningful and helpful, (b) believed the instructors facilitated their learning, and (c) actively participated in learning activities. By

contrast, boredom negatively related to the perception of preview materials and participation in learning. In other words, boredom was more likely reported by students who perceived the preview materials as unhelpful and participated less in learning activities.

These findings are consistent with the control-value theory (Pekrun, 2006), which postulates that people are more likely to experience positive emotions engaging in learning activities when they perceive control over those activities that they consider valuable or important. The common social and environmental antecedents of such appraisals of control and value include quality of instruction, induction of values, achievement feedback, and support of their autonomy (Pekrun, 2006). Thus, the perceived quality of preview materials and teacher facilitation or feedback may have positively influenced students' appraisal of control over learning activities, which led to more positive emotions like enjoyment (Pekrun, Goetz, Daniels, Stupnisky, & Perry, 2010). Similarly, active participation in learning entailing autonomy support may have enabled students' perception of autonomy and control over learning, leading to feelings of enjoyment (Pekrun, Goetz, Titz, & Perry, 2002).

Although teacher facilitation was positively related to enjoyment, it had no significant relationship with boredom. According to the control-value theory (Pekrun, 2006), students experience enjoyment of learning activities when they expect their actions to produce positive outcomes and they perceive positive value in the activities. By contrast, students experience a feeling of boredom when they perceive *no*—not negative—value in learning activities regardless of whether they have positive outcome expectancies. If effective, teacher facilitation, or teacher feedback, should help students develop confidence in achieving positive outcomes (Schunk &

Swartz, 1993); but it would have little influence on their perception of the value of the learning activities. Thus, teacher facilitation could be more related to enjoyment and not so much to boredom.

Initially, both enjoyment and boredom significantly correlated with age; that is, older students reported more enjoyment and less boredom than younger students did. However, such relationships became insignificant after learning and teaching factors were added into the regression model. In bivariate correlation analyses, age was also significantly and positively associated with all four learning and teaching factors. This finding indicates that older students tended to have more positive perceptions of the flipped classroom approach overall than younger students, which is consistent with the findings in previous studies (Hao, 2016; Moore & Chung, 2015). As suggested in these studies, younger students may not be ready for a student-centered approach to learning and thus unable to fully appreciate its value. Nevertheless, age was not a significant predictor of learning outcomes in flipped classrooms after adding the learning and teaching factors.

With regard to the self-efficacy outcome, all three student characteristics—age, gender, and GPA—were significant predictors. The positive correlation between GPA and self-efficacy found in this study has been commonly reported in past research (Bong, 2001; Feldman & Kubota, 2015; Usher, 2009). In addition, the current study showed that male and older students tended to show higher self-efficacy. This finding also echoes Hao's (2016) study in which male and juniors in college felt more comfortable and confident with a flipped learning approach than their counterparts (i.e., females and freshmen). In particular, females and freshmen reported

discomfort about expressing ideas with their peers in class (Hao, 2016). Males' and older students' higher preferences and perceived readiness for flipped learning may have affected their self-efficacy for learning in flipped classrooms.

In addition, self-efficacy was significantly predicted by three of the learning and teaching factors: the perception of preview materials, participation in learning activities, and peer interaction. As noted above, the perceived high quality of instruction or learning materials enhances students' appraisal of their control over learning, and the perceived control is closely connected with self-efficacy, that is, the beliefs of students about their ability to learn successfully (Pekrun, 2006). High-quality instruction may have facilitated students' mastery learning experience, one source of self-efficacy (Usher & Pajares, 2008). Similarly, students' active participation and engagement signify autonomy in learning. Students who actively participated in learning activities may be more likely to develop high self-efficacy for learning in flipped classrooms. Finally, peer interaction may have engendered two other sources of self-efficacy: vicarious experience and social persuasion. Working with peers during in-class sessions in a flipped classroom, students can observe how similar others perform, perhaps motivating them to perform the task; furthermore, students would have more opportunities to receive constructive and encouraging feedback from peers, which may have heightened their self-efficacy (Usher & Pajares, 2008).

To summarize, learning and teaching factors played a significant role in students' affective and motivational outcomes in the flipped classrooms. In particular, teacher facilitation showed a unique contribution to enjoyment, and peer interaction was exclusively related to the

self-efficacy of students. In addition, the perception of preview materials and students' participation in learning activities showed significant relationships with all three investigated outcomes—enjoyment, boredom, and self-efficacy. These findings combined indicate that the success of the flipped classroom depends on the quality of learning experiences both outside and inside the classroom. Not only is instructors' providing high-quality preview materials and sufficient support and feedback important, but students' actual participation in interactive group activities is also imperative. With proper guidance and opportunities for active engagement in learning, students can experience autonomy and perceive control over learning, resulting in positive affective and motivational experiences (Pekrun, 2006; Ryan & Deci, 2000).

Implications for Flipped Classroom

The findings of the current study suggest that providing learning materials beforehand and creating opportunities to engage in interactive learning do not simply guarantee that meaningful, satisfying learning occurs (Lai & Hwang, 2016; Strayer, 2012). What matters most genuinely student-centered learning; that is, learning activities should be designed in a way that adequately fosters autonomy and enables students to perceive control over those activities (Bergman & Sams, 2014; Yoon et al., 2018). Well-designed guides for both in- and out-of-class learning activities are critical to students' positive learning experiences.

A number of researchers have investigated various instructional strategies to promote student learning and engagement in flipped classrooms. Some of these approaches include the application of gamification techniques (Huang et al., 2018; Hung, 2017), the use of instant response applications for peer interactions (Hsu, 2018), and the use of interactive e-books for

instant feedback (Hwang & Lai, 2017). Researchers have also devised a scaffolding system to support students' self-regulated learning (Blau & Shamir-Inbal, 2017; Lai & Hwang, 2016). The common underlying process of these approaches involves reinforcement of students' autonomy and control over learning. For example, Hung (2017) transformed question-and-answer activities into a gamified context with the use of clickers, which relinquishes control over learning to students compared to the typical, teacher-led question-and-answer activities. Students in the gamified condition described their flipped learning as fun, interactive, and motivating. Similarly, Huang, Hew, and Lo (2018) integrated game mechanics into preview learning activities, reinforcing students' perception of control over the learning activities, which led to greater completion of the preview activities. In essence, although the flipped classroom provides an environment in which to engage in active learning, the technique must be supported by substantial learning strategies that ensure student-centeredness in order for flipped classrooms to be successful.

Conclusion

The purpose of this study was to identify meaningful factors that determine students' affective and motivational learning experiences in flipped classrooms. We focused on the effects of individual student characteristics and learning and teaching factors on affective and motivational outcomes. As hypothesized, we found that four learning and teaching factors—preview learning materials, interaction with peers, teacher facilitation, and classroom participation—significantly explained students' learning experiences in flipped classroom approaches. We suggest that these four factors be carefully considered in the design of flipped

classrooms and supported by instructors for successful implementation.

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Appendix

Student Experiences with a Flipped Classroom

Student perception of preview materials

1. The choice of learning materials (e.g., videos) for preview was meaningful.
2. The amount of material for preview was reasonable.
3. Preview materials allowed us to learn topics thoroughly.

Student experience with peer interactions

1. Interaction with other students was meaningful in enhancing our understanding of class topics.
2. Because of interaction with other students, I understand the topics or content more thoroughly.
3. The amount of interaction with other students in our class was appropriate.

Teacher facilitation

1. My professor checked our understanding of preview materials.
2. My professor encouraged us to ask questions.
3. My professor motivated us to thinking critically.
4. My professor facilitated interaction among students.
5. My professor monitored our interactions to assure that it related to the class content.

Student participation in flipped learning activities

1. To what extent did you preview the assigned course materials before attending the class?
2. To what extent did you actively participate in interactions during class, including discussions?
3. To what extent did you interact with the instructor?
4. To what extent did you interact with the course materials?

Self-efficacy for learning (adapted from Pintrich et al., 1993)

1. I believe I will receive an excellent grade in this class.
2. I'm certain I can understand the most difficult concepts taught in this course.
3. I'm confident I can do an excellent job on the assignments and tests in this course.
4. Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.

Enjoyment in the classroom (adapted from McAuley et al., 1987)

While taking this course…

1. I enjoyed learning in this course very much
2. I thought this course was fun.
3. I would describe this course as very interesting.
4. I thought this course was quite enjoyable.

Boredom in the classroom (adapted from Artino, 2009)

While taking this course…

1. I was bored.
2. I felt the course was fairly dull.
3. My mind wandered.
4. I was uninterested in the course material.
5. I thought about what else I would rather be doing.

Table 1

The Number of Participants Across the Flipped Learning Courses

No.	Course Title	Number of participants
1	Economics	17
2	Introduction to Solid Mechanics	54
3	Management Accounting	82
4	Introduction to Geometry	41
5	Urban Planning	12
6	Digital Design	12
7	Infrastructure for the Construction of a Smart City	17
8	Drug Abuse	12
9	Discrete Mathematics	23
10	General Physics	60
11	Electromagnetics	9
12	Heat Transfer	11
	Total	350

Table 2

Pearson Correlations Among Flipped Classroom Factors and Affective and Motivational Learning Outcomes

FLIPPED CLASSROOM Factors	M	SD	α	1	2	3	4	5	6	7	8	9	10
1. Age	21.85	2.31		1									
2. Gender (1: Female, 2: Male)	1.76	0.43		.06	1								
3. Previous GPA (on a 4.5 scale)	3.47	0.59		.20**	-.03	1							
4. Preview materials	3.78	0.93	.88	.16**	.03	.13*	1						
5. Peer interactions	3.79	0.88	.87	.12*	.01	.12*	.36**	1					
6. Teacher facilitation	3.88	0.71	.83	.17**	.04	.15**	.58**	.64**	1				
7. Participation in learning activities	3.70	0.75	.73	.21**	.08	.16**	.54**	.59**	.67**	1			
8. Enjoyment in a flipped classroom	3.80	0.82	.94	.20**	.05	.14**	.58**	.50**	.63**	.63**	1		
9. Boredom in a flipped classroom	2.13	0.86	.93	-.23**	-.03	-.05	-.48**	-.37**	-.46**	-.47**	-.67**	1	
10. Self-efficacy for learning	3.81	0.92	.93	.27**	.14*	.13*	.41**	.43**	.41**	.57**	.59**	-.50**	1

Note. 5-point Likert scales were used from Factors 4–10.
* $p < .05$, ** $p < .01$,

Table 3

Model Summaries for Hierarchical Regression Analysis Predicting Enjoyment in Flipped Classrooms

	Step 1			Step 2		
	B	SE	*β*	*B*	SE	*β*
Personal factors						
Age	0.069	0.019	0.194***	0.018	0.014	0.050
Gender	0.078	0.101	0.041	0.017	0.072	0.009
Previous GPA	0.049	0.075	0.035	0.010	0.054	0.007
Instructional Factors						
Preview materials				0.220	0.042	0.249***
Peer interaction				0.084	0.048	0.091
Teacher facilitation				0.260	0.068	0.226***
Participation in learning activities				0.307	0.060	0.283***
Model summary statistics						
R^2		0.042			0.519	
F value for model		5.003**			52.786***	
R^2 Change		0.042			0.478	

* $p < 0.05$, ** $p < 0.01$, *** $p < .001$

Table 4

Model Summaries for Hierarchical Regression Analysis Predicting Boredom in Flipped Classrooms

	Step 1			Step 2		
	B	SE	*β*	*B*	SE	*β*
Personal factors						
Age	-0.085	0.019	-0.228***	-0.045	0.017	-0.121
Gender	-0.035	0.105	-0.017	0.008	0.090	0.004
Previous GPA	-0.069	0.078	-0.046	-0.039	0.067	-0.026
Instructional Factors						
Preview materials				-0.242	0.053	-0.261***
Peer interaction				-0.084	0.060	-0.086
Teacher facilitation				-0.142	0.085	-0.117
Participation in learning activities				-0.202	0.074	-0.177***
Model summary statistics						
R^2		0.055			0.323	
F value for model		6.705**			23.361***	
R^2 Change		0.055			0.269	

* $p < 0.05$, ** $p < 0.01$, *** $p < .001$

Table 5

Model Summaries for Hierarchical Regression Analysis Predicting Self-Efficacy for Learning in Flipped Classrooms

	Step 1			Step 2		
	B	SE	*β*	*B*	SE	*β*
Personal factors						
Age	0.103	0.020	0.259***	0.059	0.017	0.148***
Gender	0.284	0.109	0.132*	0.226	0.090	0.105*
Previous GPA	0.266	0.081	0.167**	0.261	0.067	0.164***
Instructional Factors						
Preview materials				0.136	0.053	0.137*
Peer interaction				0.195	0.060	0.187**
Teacher facilitation				-0.140	0.085	-0.108
Participation in learning activities				0.513	0.074	0.419***
Model summary statistics						
R^2		0.114			0.411	
F value for model		14.870***			34.148***	
R^2 Change		0.114			0.297	

* $p < 0.05$, ** $p < 0.01$, *** $p < .001$