Computers & Education 141 (2019) 103608

Contents lists available at ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu

How the flipped classroom affects knowledge, skills, and engagement in higher education: Effects on students' satisfaction

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ARTICLE INFO

Keywords:
Flipped classroom
Knowledge
Skills
Engagement
Satisfaction
Higher education

ABSTRACT

The aim of this research is to present a successful flipped classroom proposal in higher education to better understand its influence in terms of knowledge, skills and engagement. The reason why we focus on these three dimensions is because of their core roles in the international learning conceptual frameworks presented above to increase the employability of Generation Z students in the digital society of the 21st century. In doing so, first, we first develop a measurement scale (4D_FLIPPED) to explore the degree of flipped classroom presence in our higher education learning experience. Then, we present a structural equation model to analyze the causal relationships of knowledge, skills, and engagement with students' satisfaction. The empirical results point out that there are four fundamental dimensions that should be present in the flipped classroom to be successful in the 21st century with Generation Z. This study also confirms that the flipped classroom has positive effects on students' knowledge, skills, and engagement. Our research provides useful recommendations and insights for academia.

1. Introduction

Traditionally, there has been a gap between what students have learned and the skills that they have acquired in the university and what companies have required when hiring new employees (Moore & Morton, 2017; Pang, Wong, Leung, & Coombes, 2019; Hayter & Parker, 2019). Despite having identified this gap, many universities continue using traditional learning methodologies focused on the lecturer rather than on the student, thus hindering the development of essential skills required in the workplace (Chaudhry & Rasool, 2012; Lai, Hsiao, & Hsieh, 2018; Pelger & Nilsson, 2018).

In contrast to this generalized stream of teaching practice in higher education, the first benefit of this research is the providing of guidelines for implementing a successful active learning setup in the university context, centered on the student and particularly effective in compensating for the difference between knowledge and skills that characterizes most of the teaching and learning methodologies still commonly used in higher education.

The Assessment and Teaching of 21st Century Skills (ATC21S; Care, Griffin, & Wilson, 2018), the Bologna process and the European Higher Education Area (EHEA; Zahavi & Friedman, 2019), or the Partnership for 21st Century Learning (P21; Van Laar, van Deursen, Van Dijk, & de Haan, 2017) form part of an international movement focusing on conceptual learning frameworks, oriented toward the skills required for students to succeed in a fast-changing digital society. In this context, the engagement of the student

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https://doi.org/10.1016/j.compedu.2019.103608
Received 15 October 2018; Received in revised form 12 June 2019; Accepted 16 June 2019
Available online 21 June 2019
0360-1315/

with the teaching-learning process plays a fundamental role (Boekaerts, 2016; Guo, 2018; Lei, Clemente, & Hu, 2019). Engagement is helped by any of these 21st century skills frameworks awarding students with an active role in their own learning. In doing so, they can acquire a series of abilities also associated with content-knowledge learning that will make them more employable when leaving the university (Daellenbach, 2018; Fletcher, Sharif, & Haw, 2017).

Following this international movement, in recent years, there has been a change in the way lectures in higher education are being delivered, going from the traditional instructor-based teaching model to active and student-centered learning experiences that generate engagement and contribute both to the acquisition of knowledge and the skills necessary to enter into the labor market. Game-based learning (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012; Sousa & Rocha, 2019), cooperative learning (Azizan, Mellon, Ramli, & Yusup, 2018; Johnson & Johnson, 2009), problem-based learning (Loyens, Jones, Mikkers, & van Gog, 2015; Schmidt, Van der Molen, Te Winkel, & Wijnen, 2009), and the flipped classroom (Awidi & Paynter, 2019; Lage, Platt, & Treglia, 2000) are some of the most remarkable examples.

Among the above student-centered learning examples, the flipped classroom stands out especially for its flexibility and adaptability when used together with other active learning methodologies (Schwarzenberg et al., 2018; Zainuddin, 2018) and for the digital and audio-visual component that it has, generating an emotional connection with Generation Z students, toward whom it is directed in higher education (Priporas, Stylos, & Fotiadis, 2017; Turner, 2015). It is also worth mentioning that Generation Z is intimately linked to aspects of immediate satisfaction with consumed experiences (Sackin, 2018). Hence, it is also crucial in any learning methodology aimed at this generation to consider and analyze its level of satisfaction. Despite its relevance, satisfaction has not been sufficiently examined in the past. The second benefit of this research is to analyze Generation Z's satisfaction with the use of the flipped classroom in higher education. In doing so, this research presents an explicit quantitative analysis of how knowledge, skills, and engagement exert a causal effect on students' levels of satisfaction.

The flipped classroom has found to be effective in terms of acquiring the knowledge (Lopes & Soares, 2018; Love, Hodge, Grandgenett, & Swift, 2014) and essential skills (Gerstein & Friedman, 2016; Elmaadaway, 2018) required for 21st century workplaces. Moreover, as a student-centered approach, the flipped classroom promotes the quality of face-to-face time spent in classrooms (Ozdamli & Asiksoy, 2016) and provides time and opportunities for the development of active learning setups (Jensen, Kummer, & Godoy, 2015; Lombardini, Lakkala, & Muukkonen, 2018) oriented toward exploring student engagement and satisfaction (Awidi & Paynter, 2019; Zainuddin, 2018).

Considering all the aforementioned point, the objective of this research is to present a successful flipped classroom proposal to better understand its influence in terms of knowledge, skills, and engagement. In doing so, we use the methodological approach of Hair, Hult, Ringle, and Sarstedt (2016, 2017) "to assess latent variables at the observation level (outer or measurement model) and test relationships between latent variables on the theoretical level (inner or structural model)" (Hair, Sarstedt, Ringle, & Mena, 2012, p. 414), and we employ variance–based partial least squares structural equation modeling (PLS-SEM). The use of this methodological approach has become a standard in many fields of research (Babin, Hair, & Boles, 2008; Bagozzi & Yi, 1989; Hulland, 1999), specifically in educational research studies such as Sánchez-Franco, Martínez-López, and Martín-Velicia (2009), Terzis and Economides (2011), Goggins and Xing (2016), Seman, Hausmann, and Bezerra (2018), and Lung-Guang (2019).

In the context of Hair et al. (2016, 2017) methodological approach and in terms of qualitative methods, in our research, we created a questionnaire following established protocols (Churchill, 1979; Dillman, 2011; Rudd, Greenley, Beatson, & Lings, 2008). The questionnaire was prepared after conducting an extensive literature review. Prior to the administration of the questionnaire, we conducted a *pretest* in accordance with recommendations and in-depth interviews with senior and knowledgeable academic scholars about the issues under study. Conversely, in terms of quantitative methods, we first develop a measurement scale (4D_FLIPPED) to explore the degree of flipped classroom presence in our higher education learning experience. Then, we present a structural equation model to analyze the causal relationships of knowledge, skills, and engagement with students' satisfaction. The reason why we focus on these three dimensions is because of their core roles in the international learning conceptual frameworks presented above to increase the employability of Generation Z students in the digital society of the 21st century.

To date, no study has formally stated and tested together these three core 21st century higher education dimensions regarding the effectiveness of the flipped classroom in a university context. Hence, in terms of a third benefit of this research compared with previous work, new and key managerial and theoretical implications arise for the first time in the literature, concerning, on the one hand, the effect of the flipped classroom on students' knowledge, skills, and engagement and, on the other hand, the effect of students' knowledge, skills, and engagement on students' satisfaction.

Our purpose is that our learning experience setup can be generalizable to other university contexts that might be interested in developing active and student-centered learning environments and engagement and satisfaction generators with potential for the acquisition of the knowledge and skills necessary to successfully face the workplace. A study that describes the student experience with the flipped classroom will provide useful insights for course coordinators. With these insights, course coordinators can consider how a flipped classroom approach can be incorporated into a learning design for their own courses.

It is well known that the literature about knowledge, skills, engagement, and satisfaction in the educational sciences in general and in higher education in particular is broad and sometimes susceptible to diverse and varied meanings and interpretations. The quantitative nature of the analysis and the modeling of our study impel us to be precise and concise in the definition of the constructs used for each of these terms. Hence, in this study, when we refer to the term *knowledge* we are denoting acquired knowledge in terms of the students' capacity to better understand the module contents and be better prepared for exams (Hernández-López, García-Almeida, Ballesteros-Rodríguez, & De Saá-Pérez, 2016; Roach, 2014). By skills, we are denoting students' ability to work in groups (O'Flaherty & Phillips, 2015; Strayer, 2012), to listen to others' opinions (Murillo-Zamorano & Montanero, 2018; Van Ginkel, Gulikers, Biemans, & Mulder, 2015), to self-learn (Baars & Wijnia, 2018; Cárdenas-Robledo & Peña-Ayala, 2019), to apply knowledge in practice (Botma, Van Rensburg, Coetzee, & Heyns, 2015), to synthesize information (Goldman & Scardamalia, 2013) and to analyze information (D'Alessio, Avolio, & Charles, 2019). Engagement is understood as the action of engaging more actively in the module and making it easier for students to follow it (Fredricks et al., 2016; Shernoff et al., 2016). Finally, we understand students' general level of satisfaction as a positive affective state that results from the evaluation of the lecturer, the module, and the capacity of the teaching and learning method to generate a better understanding than the traditional teacher-centered approach would have (Awidi & Paynter, 2019; López-Sánchez et al., 2011).

The flipped classroom was first used by Lage et al. (2000) and later popularized as an active teaching method by Bergmann and Sams (2012). Both research studies considered that inverting or flipping the classroom implies the acceptance that many of the activities that were normally developed previously inside the classroom now occur outside it, and *vice versa*.

The definition provided by Bergmann and Sams (2012) has been the basis of the most recent flipped classroom literature. It defines this method in general terms as an approach in which the place where the different tasks are performed changes so that students watch the lectures on their own time outside the classroom. Instead, in the classroom, they perform the activities that have traditionally been considered homework, focusing on the parts of the material causing them difficulty (Hung, 2015; O'Flaherty & Phillips, 2015; He, Holton, Farkas, & Warschauer, 2016). As highlighted by Hung (2015), the students' preparation before the class is very important for them to be able to become more involved and to achieve more rewarding results.

The consideration of the flipped classroom as only a simple rearrangement of activities has been criticized in the literature. For example, Bishop and Verleger (2013) pointed out that a definition of the new method with more added value would not only switch activities but would also include a series of additional tasks both inside the classroom (such as problem solving in groups, Chiang, 2017) and outside the classroom (such as answering questionnaires and performing practical exercises, Porcaro et al., 2016). The completion of questionnaires based on the students' readings outside the classroom was also previously considered by Moravec, Williams, Aguilar-Roca, and O'Dowd (2010). They established that these activities could be used by the instructor to update the lecture material based on what the students misunderstood or needed to improve. Additionally, instructors can use this information to provide students with appropriate feedback, which is known to be crucial when assessing how students learn (Roehl, Reddy, & Shannon, 2013; Elmaadaway, 2018) and as a key determinant of students' performance (Butt, 2014).

In addition to the feedback that the instructor provides the students, the literature has also identified as being important the feedback that students themselves provide about the flipped classroom method so that it can be determined whether the method has been perceived as an effective and helpful tool in learning (Frisby & Martin, 2010). In terms of the fourth benefit of our research, we empirically test and include as an additional dimension of our flipped classroom proposal the feedback that students directly report to the instructor with key information about the elements of the didactic material previously delivered by the instructor that needs further explanation. This two-way feedback strategy combines the students' and teacher's work and enhances the effect of the flipped classroom by providing an effective link between out-of-class and in-class activities.

In defining the flipped classroom, several authors have also emphasized the role of technology, the interactive use of which is considered to be crucial in the process of moving the lecture outside the classroom and conducting more practical activities inside the classroom (Elmaadaway, 2018; Huang & Lin, 2017; Wang, Jou, Lv, & Huang, 2018). Technology allows for more flexible and student-centered education (Eid & Al-Jabri, 2016; Wanner & Palmer, 2015). However, when discussing technology, the previous literature has mainly referred to online videos. The fifth benefit of the present research comprises the use (and empirical testing) of such online videos in conjunction with mobile devices, social networks, and cloud computing applications during the entire flipped classroom teaching-learning process.

Previous definitions of the flipped classroom have also included such elements as interaction with peers so that debates can be generated (Schwarzenberg et al., 2018; Kim, Kim, Khera, & Getman, 2014; Baepler, Walker, & Driessen, 2014; Kong, 2014, 2015) and interaction with the instructor (Baepler et al., 2014; McLaughlin et al., 2014) to respond to questions, provide feedback, motivate the study of fundamental ideas, and guide the process overall. Findlay-Thompson and Mombourquette (2014) described the flipped classroom as a "reversed teaching model" in which students watch lectures outside of class time using different forms of technology, such as prerecorded videos, with the aim of creating a collaborative learning environment in which they work under their teacher's supervision with their peers' support.

The existence of a flexible environment in which students can organize their time has been considered another essential element for the success of the flipped classroom (Wanner & Palmer, 2015). A flexible environment allows students to devote as much time as they need to perform different activities so that they can better understand the content of the course (Roach, 2014; Kim et al., 2014; Love et al., 2014; O'Flaherty & Phillips, 2015). Further benefits are related to the learners' ability to catch up with any material that they might have missed (Roach, 2014), and the method makes it easy for both teachers and students to offer help to those who most need it (Love et al., 2014).

Implementing the flipped classroom as an element of the Internet of Things (IoT) integrated into the teaching-learning process, Mohamed and Lamia (2018) revealed statistically significant relationships that explain why individuals choose the flipped classroom and why they continue to use it. In line with their findings and based on theories of self-determination and motivation-opportunity-ability, Lai et al. (2018) suggested that teachers' continuance use intentions for the flipped classroom are highest when challenge motivation, perceived self-efficacy, and supportive teaching resources are all sufficient and mutually reinforcing. Based on the self-determination theory, Zainuddin (2018) presented a flipped classroom enriched with gamification (Deterding, Dixon, Khaled, & Nacke, 2011). The study survey results revealed that the gamified version of the flipped classroom fostered better motivation and engagement. Awidi and Paynter (2019) examined the effects of the flipped classroom on several aspects of student learning, identifying those associated with student confidence, engagement, and motivation. They found a high level of correspondence between the perceptions of the students and those of the course coordinators with the following three aspects of the flipped classroom: access to information; assessment and feedback; and knowledge construction. Focusing on the relationship between activity-based learning and the flipped classroom, Schwarzenberg et al. (2018) observed that the flipped classroom increases the opportunities for peer instruction when in-class activities promote active learning, helping to reduce the effects of individual students' prerequisite knowledge. They concluded that the design of the flipped classroom should consider the effects of different implementation features and select the most appropriate ones for a particular context.

In line with this context adaptation requirement and as a sixth benefit of this research, the empirical analysis presented in this investigation points out four essential dimensions that should be presented in the flipped classroom to be successful in 21st century higher education with Generation Z. The quantitative research conducted in this study develops a theoretical framework with these dimensions with which to analyze how the flipped classroom affects knowledge, skills, engagement, and satisfaction in higher education. To the best of our knowledge, this study is the first time that this task is undertaken in the literature. In doing so, we present a four-dimension flipped classroom measurement scale (4D_FLIPPED) that consists of: (i) out-of-class activities; (ii) feedback; (iii) in-class activities; and (iv) the use of technology. Out-of-class activities pretend that students can attain an understanding of the content of the module in advance, with these activities done in a flexible environment in which students can devote as much time as they need to the comprehension of the different concepts. Their feedback provides instructors with key information about the elements of the material that give their students greater difficulty so that instructors can spend more time explaining these concepts. In-class activities are designed to help improve students' autonomous learning and acquisition of competencies. The use of technology is conceived to enhance the entire learning process.

This study is also the first time that this theoretical framework for the flipped classroom in higher education is proposed, examined and tested by means of a partial least squares (PLS) approach for structural equation modeling (SEM). This process allows us to identify new managerial and theoretical implications. Furthermore, we provide empirical evidence about the relationships among knowledge, skills and engagement and how together they all influence students' satisfaction, following the paths specified in Fig. 1. The reasoning underlying all of these associations is explained more specifically in Section 2 below.

The rest of the paper is organized as follows. First, Section 2 presents an overview of the flipped classroom literature and how this approach to instruction affects knowledge, skills, and engagement. We also examine how these three variables influence each other, as well as satisfaction. Then, in Section 3 we present the main characteristics defining the teaching experience that implemented, describing in detail the procedure followed, the development of the measurement scale, and the methods used to test the scale empirically. Section 4 presents the findings. Section 5 discuss the implications and identifies the limitations of the study. Finally, Section 6 concludes the paper and points out future research directions.

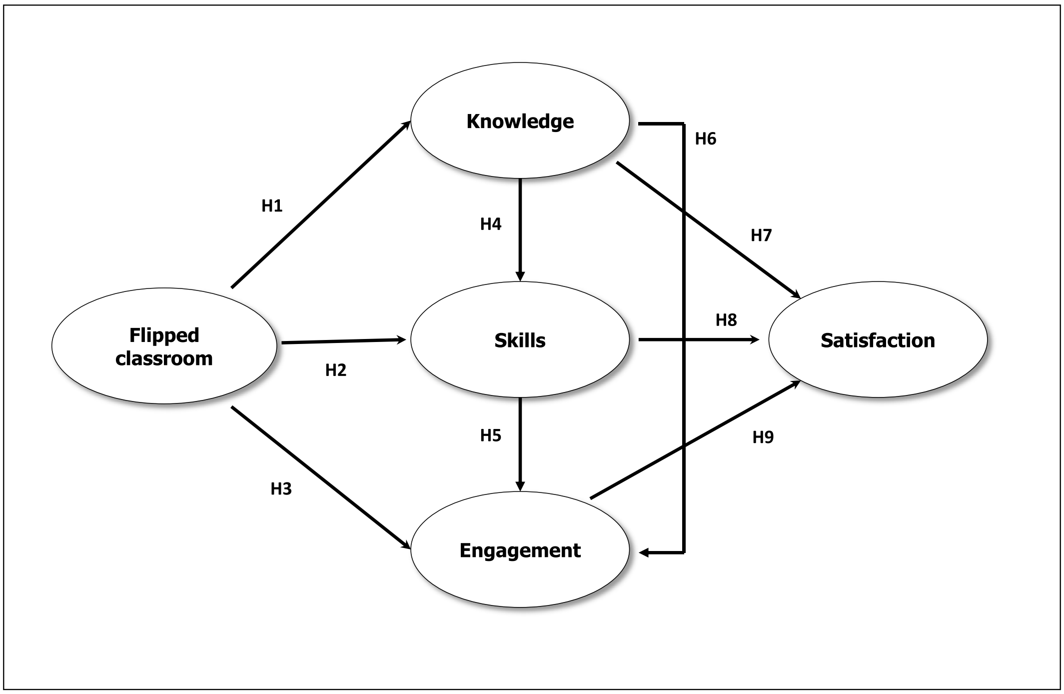

Fig. 1. Theoretical framework and hypotheses.

2. Theoretical framework and hypotheses

2.1. Effects of the flipped classroom on knowledge, skills, and engagement

In this section, we analyze how flipping the classroom affects students' knowledge, skills, and engagement. The first of these three, i.e., how the application of the flipped classroom impacts knowledge, has been widely considered in the literature, with most studies pointing to the positive effects that a flipped classroom has on students' acquired knowledge. Flipping the classroom helps students to better understand and prepare material and to learn more about the course (Baepler et al., 2014; González-Gómez, Jeong, Airado Rodríguez, & Cañada-Cañada, 2016; Sahin, Cavlazoglu, & Zeytuncu, 2015). Additionally, students themselves report that the flipped classroom allows them to identify where they need more support and helps them to be better prepared for examinations (Butt, 2014; Chiang, 2017; McLaughlin et al., 2014). All of these outcomes were also reflected in a literature review by Bishop and Verleger (2013), who concluded that students' learning was better with a flipped classroom than with a traditional approach. More recently, Akçayir and Akçayir (2018) revealed that the most frequently reported advantage of the flipped classroom is the improvement of student learning performance. The flipped classroom generally helps them to prepare for lectures and examinations, with this preparation reflected in their final marks (Ferreri & O'Connor, 2013; Love et al., 2014; Zainuddin, 2018). Based on these considerations, we hypothesize that:

H1. Flipped classrooms directly and positively affect students' knowledge.

The previous literature has found that students in a flipped classroom benefit in terms of skills development and acquisition. More precisely, Love et al. (2014) pointed out that students in this active learning context develop a higher level of ability to work in groups (Karabulut-Ilgu, Yao, Savolainen, & Jahren, 2018). According to O'Flaherty and Phillips (2015), the ability to work in groups is developed by the interactivity created in the classroom as the result of having implemented a flipped method. Additionally, when compared to the traditional classroom, Strayer (2012) found that students in the flipped classroom are more prepared to cooperate with their peers and to work in groups. The literature also shows that flipped classrooms help students to improve their ability to learn on their own (Baars & Wijnia, 2018; Butt, 2014; Cárdenas-Robledo & Peña-Ayala, 2019; Chen, Wang, & Chen, 2014; Kim et al., 2014; Roach, 2014) since they can cover the material at their own pace, with emphasis on the aspects that they are finding troublesome (Roach, 2014, Kim et al., 2014). They therefore understand where they need help (Butt, 2014) and return to any material that they might have missed (Bergmann, Overmyer & Wilie, 2013). Other authors have pointed to the existence of a positive relationship between flipping the classroom and the students' ability to apply the knowledge that they have acquired (Botma et al., 2015; Roach, 2014). For example, they can pause the videos and do the exercises contained in them before the answers are revealed. Finally, the literature has also noted that flipped classrooms positively influence students' ability to analyze and synthesize course material (D'Alessio et al., 2019; Kim et al., 2014; Kong & Song, 2015). Considering all of the above, we hypothesize that:

H2. Flipped classrooms directly and positively affect students' skills.

Finally, to focus on the relationship between flipped classrooms and students' engagement, we would highlight the seminal study of Lage et al. (2000), who indicate that students in a flipped classroom experience appear to be more engaged and to feel more responsible for their learning. Hung (2015) investigated whether a fully structured flipped classroom and a semistructured flipped classroom have significant effects on participants' perceived learning engagement compared to the traditional classroom, finding that such a relationship does indeed exist for the case in which the flipped method is fully developed in class. Elmaadaway (2018) also examined the effects that the flipped classroom has on engagement, finding that students enrolled in a flipped course are more engaged than those attending lectures under a traditional teaching method. More recently, Loveys and Riggs (2019) evaluated student engagement in two core undergraduate science courses, observing significant decreasing failure rates and higher levels of engagement with course materials. In light of the above, we hypothesize that:

H3. Flipped classrooms directly and positively affect students' engagement.

2.2. Effects of knowledge on skills and engagement

Research has suggested the existence of a clear relationship in which knowledge influences skills. Perfetti (2013, p. 33) established that, if a student must acquire reading competency, it is necessary for him or her to already possess the phonemic knowledge that will help to develop the ability to read. Root and Ngampornchai (2013) described the competencies acquired by students when they spend a short time abroad. They noted that students who were familiar with the language of the country of destination developed the ability to become even more fluent in the language. However, students without previous knowledge of the language developed other types of abilities to be able to communicate in the different language. Hasan (2017) pointed out that there is a significant influence of knowledge on both students' listening comprehension and their reading comprehension. Murillo-Zamorano and Montanero (2018) analyzed the competence of a sample of economics and business studies students in orally presenting academic content. Students' knowledge in terms of their capacity to provide peer feedback, as part of a peer assessment process, was confirmed as being effective in improving oral presentation skills. These findings indicate that the existence of appropriate knowledge does indeed influence students' skills. Thus, we hypothesize that:

H4. Students' knowledge directly and positively affects students' skills.

The literature has also explored the relationship between skills and engagement. There has been much research focused on the impact that the skills developed by students has on their level of engagement. For instance, Wang and Holcombe (2010) noted that certain skills, such as the students' sense of autonomy in school, positively contribute to a series of outcomes, one of which is classroom engagement. Kahu (2013) established a series of antecedents and consequences of student engagement. Among these antecedents, students' skills were considered to be among the aspects influencing how engaged that they were. More recent research by Fredricks et al. (2016) and Shernoff et al. (2016) also examined the association between these two variables. Fredricks et al. (2016) conducted a series of interviews with students and teachers to determine their perceptions of engagement in relation to math and science. Some of their findings indicated that, according to both the students and the teachers, skills such as understanding different perspectives and the ability to follow others' ideas or to explain class content to their peers are indicators of students' engagement. The students also mentioned that working with their peers influences their levels of engagement. Shernoff et al. (2016) reviewed a set of studies analyzing the association between engagement and certain skills, finding that such aspects as the existence of encouraging types of relationships among students or the students' ability to be autonomous yield a higher level of engagement. Connolly and McGuinness (2018), chap. 7 explored the digital literacy skills of young people in the European context, investigating where and how digital skills can support the inclusion, engagement and participation of young people in the digital world. In line with their study, Hong et al. (2018) suggested that is necessary to provide further efforts to understand the influences of digital skills on students' engagement. In accordance with this line of reasoning, we state the following hypothesis:

H5. Students' skills directly and positively influence students' engagement.

Finally, we also analyze the relationship between knowledge and engagement. The recent literature has found an association between these two elements in which knowledge directly influences engagement. Fredricks et al. (2016), for example, considered a series of aspects related to teaching math and science. In the case of math, students stated that the concepts that they acquired led them to become more engaged since the way in which the subject is taught requires them to "build on what they had already learnt" (p. 10). This outcome therefore suggests that the knowledge that they acquired directly affected their engagement. Similarly, Shernoff et al. (2016) found students' engagement to be flexible and influenced by their learning environment, and they therefore considered that the knowledge acquired in such a learning environment could influence how engaged the students are. Zhao, Lin, Sun, Zheng, and Yin (2018) investigated whether knowledge diversity would impact students' engagement in small-group learning in a science classroom. They confirmed that mixed knowledge groups had significantly higher behavioral, emotional, and social engagement and better group performance than did the low-prior-knowledge groups. Based on the above arguments we expect that:

H6. Students' knowledge directly and positively influences students' engagement.

2.3. Effects of knowledge, skills, and engagement on students' satisfaction

In this section, we focus on how knowledge, skills, and engagement exert causal effects on the students' levels of satisfaction. In analyzing the characteristics that can influence students' satisfaction, much research has focused on the students' sociodemographic characteristics, such as gender or age (Hoang, 2016, Li, Marsh, & Rienties, 2016), or on environmental variables (Liaw, 2008). Awidi and Paynter (2019) pointed out that student satisfaction with the learning experience is associated with student motivation, confidence and engagement. Despite the existence of a great deal of literature studying a broad range of elements that influence students' levels of satisfaction, to the best of our knowledge there has been no explicit quantitative research on how acquired knowledge impacts satisfaction. However, we believe that the relationship between these two variables is worth studying. Lombardini et al. (2018) argued that further research should focus on "the relationship between the degree to which a course is flipped and its impact on learning outcomes and students' satisfaction" (p. 25). In this context, an approximation of this relationship can be established on the basis of studies using elements related to the activities developed in class that directly and positively influence satisfaction, such as the quality and attitude of the teaching staff, the implementation and characteristics of the course, the teaching methods, the learning environment, and the effectiveness of the education that the students are attaining (Hoang, 2016; Li et al., 2016; Lin, Lin, & Laffey, 2008; Marzo-Navarro, Pedraja Iglesias, & Rivera Torres, 2005). We believe that all of these elements are related to knowledge and that, if they have a positive impact on satisfaction, then knowledge will also directly and positively influence satisfaction. In fact, we understand that the theoretical or practical understanding of a subject facilitates the fulfillment of one's expectations, wishes and needs; i.e., it promotes students' satisfaction. Based on the above arguments we expect that:

H7. Students' knowledge directly and positively affects students' satisfaction.

The relationship between the skills developed by students and their satisfaction has been addressed extensively in the literature (Eom & Ashill, 2016; Martín-Rodríguez, Fernández-Molina, Montero-Alonso, & González-Gómez, 2015; Liaw, 2008; Lin et al., 2008; So & Brush, 2008; Eom, Wen, & Ashill, 2006; Swan, 2001). To be more specific, Eom et al. (2006) considered how satisfaction is impacted by a series of variables, some of which are related to the students' skills. Their findings indicated that the development of skills significantly influences the students' satisfaction. Kuo, Walker, Belland, and Schroder (2013) studied some predictors of students' satisfaction, pointing out that skills such as the ability to interact with the instructor or with the material are good predictors of this satisfaction. In addition, Lin et al. (2008) found that students' ability to communicate with each other and to maintain an active discussion positively influences students' satisfaction. Lin et al. (2008) proposed a flipped classroom with a smart learning diagnostic system providing evidence that students had stronger problem-solving abilities, enhancing their perceptions of the pleasure derived from this process. Lopes and Soares (2018) studied a flipped classroom environment with a student-centered approach and identified that the class success rate was higher than that obtained in the traditional class in terms of students skills for being more responsible for their own learning processes. In line with the above arguments, we therefore posit:

H8. Students' skills directly and positively affect students' satisfaction.

Finally, we examine whether engagement is related to students' satisfaction. The existence of a positive relationship between these two constructs has been well documented in the literature (Kahu, 2013; Chen, Gonyea, & Kuh, 2008; Eom et al., 2006). Satisfaction of basic psychological needs at school, behavioral engagement, and academic achievement formed a complex, dynamic system among elementary school students (Wang et al., 2018). Eom, Wen & Ashill (2006), for example, identified engagement as learning through a series of perceived interactions – between participants and material, between participants and instructors, and among the participants themselves – finding that users' satisfaction is influenced by the existence of a large number of such interactions, i.e., by engagement. Another approach to engagement is that given by Chen et al. (2008), for whom it can take many forms, including the students' interactions with the faculty or their perceptions of a supportive learning environment. All of these forms of engagement are related to the desired outcomes of higher education, among which these authors include satisfaction. Kahu (2013) found that engagement is seen as a construct that captures such elements as the time dedicated to tasks, social and academic integration, and teaching practices, all of which are related to student satisfaction and achievement. Gray and DiLoreto (2016) also found a positive effect of students' engagement on students' satisfaction. Based on the above arguments, we hypothesize that:

H9. Students' engagement directly and positively affects students' satisfaction.

3. Methodology

3.1. Participants

The teaching experience presented in this paper was conducted in the Faculty of Business and Economics at the University of Extremadura (Spain). The participants were 160 students enrolled in the Macroeconomics module taught in the two existing groups of the Degree in Business Administration & Management (Group 1 and Group 2) and in the dual-degree program in Management & Law and Business Administration (Group 3). The sizes of the groups of students in our research follow the criteria of natural academic groups according to the registration process established by the university. The most numerous group was Group 3, which consisted of 76 students – 48 in Group 1, and 36 in Group 2. The participants were selected on the basis of their membership to the different teaching groups in the corresponding academic year. Of the total number of undergraduates, 54.38% (87) were female, and 45.62% (73) were male. The majority (143 or 89.38%) were 18–22 years old, 8.12% (13) were between 23 and 29 years old, and only 4 (2.50%) were older than 30.

With reference to the modes of course content delivery, the Macroeconomics module on which our study was developed following a blended learning setup (Owston, York, & Malhotra, 2019). It was the result of a combination of face-to-face work with students in the classroom and online work combining the Internet and digital media, in which students were able to control factors such as place, time and workspace. All of our students belonged to the same nationality. Once the lectures were finished and before the final examination, the instructor distributed a self-perception questionnaire to the students about their experience with the flipped classroom used during the course. More details on this procedure are outlined in Section 3.3. The instructor in charge of developing the experience was the same in the three participating groups to minimize the effect of the "unobserved teacher characteristic in the students' academic performance" (Rockoff, 2004; Rivkin, Hanushek, & Kain, 2005). This instructor is experienced, with more than 20 years of lecturing in higher education and has been awarded for teaching excellence.

3.2. Procedures

The Macroeconomics module on which we centered our research consisted of 60 teaching hours distributed over 30 2-h sessions over the 15 weeks of the course. During this time, eight topics related to the module were address, as well as an introductory topic zero, which was devoted to familiarizing the students with the flipped classroom and with the necessary information and communication technologies (ICTs) that they would need to appropriately follow the course. Table 1 lists the distribution of the course time across these nine topics.

Table 1
Distribution of the workload for the Macroeconomics module.

Topics	Weeks	Sessions	Hours
Topic 0. Flipped Classroom and ICTs	1.5	3	6
Topic 1. Gross Domestic Product	2	4	8
Topic 2. National Accounting and Employment	2	4	8
Topic 3. Prices	1.5	3	6
Topic 4. Exchange Rates	1.5	3	6
Topic 5. Growth and Economic Cycles	1.5	3	6
Topic 6. Consumption and Savings	1.5	3	6
Topic 7. Deficit and Public Debt	1.5	3	6
Topic 8. Introduction to Economic Policy	2	4	8
Total	**15**	**30**	**60**

Once the instructor had devoted the appropriate time to the explanation of the theoretical foundation of the experience and the tools that would be needed during the course (topic 0), the teaching and learning procedure for the remaining eight topics was structured in terms of the following essential dimensions: (i) out-of-class activities; (ii) feedback; (iii) in-class activities; and (iv) technology. In the following, we shall detail the main characteristics of each of these dimensions, as well as the roles played by the instructor and the students in each of them.

3.2.1. Out-of-class activities

Before the beginning of the course, the instructor posted the Macroeconomics module to the Virtual Learning Environment (VLE) system, as well as to a Virtual Learning Community on Google+. All of the materials required for the adequate development of the course were uploaded by the instructor to the VLE system. The Google + online community was configured as a learning space in which both the instructor and the students could interact – sharing additional resources, resolving any questions or doubts, publishing news, attending events about the module content, and coevaluating the resolution of problems and practical exercises.

Once the term had started and one week before the start of each of the module's topics, the students had access to a series of videos about the main content of the module. The number of videos ranged from three to six depending on the topic, and their average duration was 5 min. All of them were made available by the teacher on the online platform Blendspace and uploaded to the VLE system. Students were allowed four or five days to watch and summarize the videos and to answer an online questionnaire about their main contents. The summary, in PDF format and with a maximum length of one page, had to be uploaded to the VLE. Its completion was a requirement to be able to participate in other activities implemented in class.

The online questionnaire, uploaded to Google Drive and accessible to the students through the VLE, contained information related to the students, the devices that they had used to complete the questionnaire, the aspects of the topic that they had found the easiest and hardest to understand, the first question that they wanted the teacher to clarify in class, and the time that they had devoted to watching the videos and completing the questionnaire. The online questionnaire also asked the students to write a quiz-type question (with four alternatives, of which only one was correct) about the concepts contained in the videos on each topic. Table 2 lists the average time that the students devoted to watching the videos and answering the online questionnaires for each topic.

3.2.2. Feedback

The second element was based on the principles of Just-in-Time Teaching (JiTT) (Novak, Patterson, Gavrin, & Christian, 1999). This strategy combines the students' and teacher's work and enhances the effect of the flipped classroom by means of providing an effective link between out-of-class and in-class activities. It is a method in which, by means of preliminary questionnaires similar to those used in the out-of-class activities, the instructor identifies the students' main comprehension problems and redesigns the teaching activities in accordance with their doubts and questions just in time, before actually beginning the topic. For the experience developed in the present study, one week after the deadline given to the students to upload their summaries and to complete the online questionnaires, the instructor collected all of the information, transferred it to a datasheet, and analyzed the information obtained from it. Subsequently, during class time, he commented on the feedback that he had received, answered some of the students' first questions, and explained to them how he would adjust the lectures to develop in depth the concepts that the students had identified as being the most complex. The time at the start of each topic devoted to this feedback ranged from 20 to 30 min.

3.2.3. In-class activities

Redesigning the lectures led, first, to a reduction in the number of teacher-centered learning hours and, second, to the development of a series of student-centered active-learning activities conducted in class using a combination of mobile devices, social networks, and cloud-computing applications. These activities were oriented toward the students' self-learning of the module content and to the development of a series of competencies and skills especially relevant for business administration and management students (ability to work in groups (SKI1), ability to listen to others' opinions (SKI2), self-learning ability (SKI3), ability to apply knowledge in practice (SKI4), analytical ability (SKI5), and ability to synthesize (SKI6)).

The student-centered learning activities consisted of the following: (i) cocreation of multiple-choice questionnaires (topics 1, 5, 7, and 8); (ii) intervention in social events online (topics 2, 4, 5, 6, and 8); (iii) participation in gamification competitions (topics 3, 6, and 7); and (iv) resolution of online questionnaires (topics 1, 2, 3, and 4). The multiple-choice questionnaires prepared by students

Table 2
Mean and total times devoted to watching the videos and completing the questionnaires.

Topics	Watch videos	Complete questionnaires	Total time
Topic 1	44 min	33 min	77 min
Topic 2	45 min	36 min	81 min
Topic 3	45 min	34 min	79 min
Topic 4	46 min	34 min	80 min
Topic 5	42 min	36 min	78 min
Topic 6	43 min	32 min	75 min
Topic 7	42 min	35 min	77 min
Topic 8	47 min	34 min	81 min
Total time	**354 min**	**274 min**	**628 min**

Table 3
Type of learning and time distribution.

Topic	Teacher-centered learning	Student-centered learning	Feedback	Total
Topic 1	270 min	190 min	20 min	480 min
Topic 2	180 min	270 min	30 min	480 min
Topic 3	135 min	200 min	25 min	360 min
Topic 4	135 min	200 min	25 min	360 min
Topic 5	100 min	230 min	30 min	360 min
Topic 6	200 min	140 min	20 min	360 min
Topic 7	200 min	140 min	20 min	360 min
Topic 8	270 min	180 min	30 min	480 min
Total	**1490 min**	**1550 min**	**200 min**	**3240 min**

were developed using cooperative learning techniques (Aronson, 1978) and were supported by a rubric specifically designed by the instructor for the adequate development of the activity. The different events were initiated by the instructor on the Google + social network with the aim of solving problems and practical exercises related to the module contents. Students' responses were coevaluated in the Google + virtual learning community. The gamification competitions were developed by means of the resolution of online questionnaires located on the *Kahoot* educational platform. Finally, the multiple-choice questionnaires were aimed at self-evaluation of the material presented in the specific videos. These questionnaires and some of the videos were prepared by the instructor and were made available to the students through the VLE system. Table 3 presents the temporal distribution by type of learning and feedback for each of the topics.

3.2.4. Technology

There was a technology component present in each of the previous stages of the flipped classroom. In this sense, the out-of-class activities included the Google + online community configured as a space for the instructor and the students to interact, the Blendspace platform on which the videos were located, and Google Drive on which the instructor made the questionnaires available that the students had to complete after having watched the videos.

For the in-class activities, the essential technology elements were the combined use of mobile devices, social networks, and cloud-computing applications. They also included a Google + virtual learning community in which the students' responses were coevaluated.

3.3. Sample, data collection and questionnaire administration

In this subsection, we have followed the methodological approach of Hair et al. (2016, 2017), and in terms of the qualitative methods associated with this methodological approach, we have elaborated on a questionnaire about the students' experiences with the flipped classroom, following established recommendations (Churchill, 1979; Diamantopoulos, 1994; Dillman, 2011; Rudd et al., 2008). The questionnaire, with responses scored on a 7-point Likert scale, was created after conducting an extensive literature review, and prior to its administration, we performed a pretest in accordance with the above-established recommendations. In particular, we conducted in-depth interviews with four senior and knowledgeable academic scholars about the issues under study. The information provided by these scholars was useful for refining the wording of some items and confirming that the measurements covered the conceptual domain of the latent variables examined.

The questionnaire was completed by students through the VLE system, after the lectures were finished and before the final examination. The students were informed that their responses would remain anonymous and strictly confidential and that the data would only be employed in aggregated form (Dillman, 2011). The administration of the questionnaire concluded with a total of 112 valid responses, and the equivalent response rate was of 70% (160/112). We also performed *ex-ante* and *ex-post* procedures to control for common method variance (Podsakoff et al., 2012): on the one hand, the anonymity of respondents, the issue that no right or wrong answers exist and that criterion and predictor variables were clearly separated within the questionnaire helped us to exclude this issue; and on the other hand, Harman's single-factor test did not reveal any problems either. To conclude, common method variance was not a problem in this study.

3.4. Measurement scales

The aforementioned questionnaire, designed to evaluate the students' perceptions of the course, is presented in the Appendix. It was structured as eight blocks of questions. The initial four (Blocks 1 to 4) were related to the four dimensions of our 4D_FLIPPED classroom measurement scale. This study is the first time that such a measurement scale is formally stated and tested in higher education, including simultaneous out-of-class activities (Block 1), feedback (Block 2), in-class activities (Block 3), and the use of technology (Block 4). Blocks 5 to 7 focused on the analysis of the influence of the flipped classroom on the students' knowledge, skills, and engagement. The last block, Block 8, collected information about the students' level of satisfaction.

In particular, Blocks 1 and 3 concern the out-of-class (OOC) and in-class (ICL) activities – core elements of the method (Bishop & Verleger, 2013). The feedback (FBK) elements needed to connect these two sets of activities (Elmaadaway, 2018; Butt, 2014; Roehl et al., 2013) are addressed in Block 2. Block 4 refers to the information and communication technologies (TCH) involved closely with the flipped classroom (Huang and Lin, 2017; Elmaadaway, 2018; Findlay-Thompson & Mombourquette, 2014; Wanner & Palmer, 2015; Butt, 2014; Berrett, 2012; Strayer, 2012). More precisely, in Block 1 (out-of-class activities dimension), we ask the participants about the availability of the video tutorials for their early study of the module contents (OOC1) and about the online questionnaires aimed at evaluating their comprehension of the content being studied (OOC2). Block 2 (feedback dimension) consists of three items related to whether the instructor had commented in class on the results of the online questionnaires (FBK1), whether the questionnaires helped to identify the aspects that were more difficult to understand (FBK2), and whether the teaching and learning process was adapted accordingly (FBK3). The block of questions related to in-class activities dimension, Block 3, inquired into the utility of these activities in terms of self-learning (ICL1) and the development of competencies (ICL2). Finally, Block 4 referred to the quality of the whole procedure with the use of mobile devices in class (TCH1), cloud computing applications (TCH2), and social networks (TCH3).

In contrast, Blocks 5, 6, and 7 asked students about their level of agreement with the teaching and learning methods and whether they helped them to enhance their knowledge (KNO), skills (SKI), and engagement (ENG), respectively. In Block 5, we asked whether the methods helped them to better understand the module contents (KNO1) and better prepared for the final examination (KNO2). The next block asked whether the methods had helped them to improve six types of skills: to work in groups (SKI1); to listen to the opinions of others (SKI2); to learn by themselves (SKI3); to apply knowledge in practice (SKI4); and to analyze (SKI5) and synthesize the material (SKI6). The questions in Block 7 asked about their engagement in terms of whether the methods had helped them to become more actively involved with the module (ENG1) and to be able to follow it more easily (ENG2).

Finally, the questionnaire contained a section asking the students about their level of satisfaction (SAT). Specifically, they were asked to report their satisfaction with the instructor (SAT1), with the module (SAT2), and with the capacity of the teaching and learning methods to generate better understanding than the traditional approach would have (SAT3).

4. Results

We apply partial least squares (PLS) techniques to analyze structural equation modeling (SEM) systems, using the statistical software package *SmartPLS* (Ringle, Wende, & Becker, 2005) for this purpose. The reasons to use PLS-SEM, rather than other methods involving covariance structures, are the following (Hair et al., 2016, 2017): (i) using PLS does not require a great number of observations; (ii) in PLS, the data do not have to have a normal distribution; and (iii) this analysis is an exploratory analysis aimed at developing a new theory. Furthermore, PLS-SEM as a second generation technique seeks "to overcome the weaknesses of the first-generation techniques" (Hair et al., 2016, p. 3), which are represented, for example, by cluster analysis, exploratory factor analysis, and multidimensional scaling. The next subsections present the results in two parts: first examining the measurement models and then focusing on the structural model. We follow established procedures when communicating results from PLS-SEM (Hair et al., 2016, 2017).

4.1. Measurement models

This subsection examines the measurement models for the measurement scales defined in the previous subsection. The reliability and (convergent and discriminant) validity analysis showed our first- and second-order measurement models to be correct.

As one observes in Table 4, for the first-order measurement model, all of the loadings were greater than 0.6. The significance levels of the associated *t*-values were calculated by bootstrapping, using 5000 subsamples with the same number of cases as in the original sample (Hair, Sarstedt, Ringle, & Gudergan, 2017). All of these *t*-statistics were statistically significant (Anderson & Gerbing, 1988). The average variance extracted (AVE) ranged from 0.540 to 0.860, and the composite reliability index (CRI) ranged from 0.892 to 0.945, indicative of satisfactory reliability of these latent variables (Bagozzi & Yi, 1988). The discriminant validity is also supported by each pair of latent variables having a square root of the AVE greater than their correlation (Fornell & Larcker, 1981). Table 5 presents the correlation matrix together with the mean, standard deviation, and square root of the AVE of each of the eight first-order latent variables.

The second-order measurement model related to the 4D_FLIPPED classroom measurement scale was computed using a *repeated indicators approach* (Wetzels, Odekerken-Schroder, & Van Oppen, 2009; Santos-Vijande et al., 2016). Following this procedure, the second-order latent variable was specified with all ten of the underlying indicators of the four first-order latent variables: Block 1, Block 2, Block 3, and Block 4. The values of AVE and CRI for this latent variable were 0.540 and 0.921, respectively (Table 4). The loadings of the first-order latent variables on this second-order latent variable also exceeded the value of 0.6, with statistically significant associated *t*-values. All of the variables are therefore within the limits required to be accepted as reliable.

4.2. Structural model

Given the satisfactory results of the measurement models, we proceeded to evaluate the structural model to analyze the relationships among flipped classrooms, knowledge, skills, engagement and satisfaction (Chin, 1998). We first performed a post hoc power analysis (Marcoulides & Saunders, 2006) using the G + Power3 statistical software package (Faul, Erdfelder, Lang, & Buchner, 2007). The result for our structural model and sample was 0.89. This value is greater than the recommended value of 0.8 (Cohen, 1988). Second, we evaluated the structural model on the basis of the following criteria: (i) the standardized regression coefficients and their associated *t*-values; (ii) the coefficients of determination (R^2) (Falk & Miller, 1992); and (iii) the Stone-Geisser criterion (Q^2)

Table 4
First- and second-order measurement models.

Factor	Loadings [a]	AVE	CRI	Cronbach's alpha
FLIPPED CLASSROOM		0.540	0.921	0.904
Block 1 – Out-of-class activities (OOC)	0.692	0.860	0.925	0.839
OOC1	0.917			
OOC2	0.938			
Block 2 – Feedback (FBK)	0.829	0.747	0.898	0.829
FBK1	0.794			
FBK2	0.896			
FBK3	0.898			
Block 3 – In-class activities (ICL)	0.815	0.833	0.909	0.801
ICL1	0.898			
ICL2	0.927			
Block 4 – Use of technology (TCH)	0.871	0.851	0.945	0.912
TCH1	0.897			
TCH2	0.912			
TCH3	0.957			
Block 5 – Knowledge (KNO)		0.825	0.904	0.788
KNO1	0.915			
KNO2	0.902			
Block 6 – Skills (SKI)		0.591	0.896	0.860
SKI1	0.716			
SKI2	0.634			
SKI3	0.794			
SKI4	0.797			
SKI5	0.839			
SKI6	0.814			
Block 7 – Engagement (ENG)		0.805	0.892	0.759
ENG1	0.878			
ENG2	0.916			
Block 8 – Satisfaction (SAT)		0.739	0.895	0.823
SAT1	0.891			
SAT2	0.888			
SAT3	0.796			

AVE = average variance extracted; CRI = composite reliability index.
[a] The criterion used in PLS-SEM to consider an indicator adequate for a measurement scale is that provided by Chin (1998), Hair et al. (2016, 2017).

Table 5
Descriptive statistics and correlations.

	1	2	3	4	5	6	7	8
1. Block 1 - OOC	*0.927*							
2. Block 2 - FBK	0.474***	*0.864*						
3. Block 3 - ICL	0.476***	0.546***	*0.913*					
4. Block 4 - TCH	0.455***	0.592***	0.614***	*0.922*				
5. Block 5 - KNO	0.421***	0.407***	0.510***	0.420***	*0.908*			
6. Block 6 - SKI	0.245***	0.542***	0.614***	0.521***	0.691***	*0.768*		
7. Block 7 - ENG	0.313***	0.375***	0.477***	0.502***	0.709***	0.681***	*0.897*	
8. Block 8 - SAT	0.413***	0.557***	0.585***	0.683***	0.619***	0.648***	0.661***	*0.860*
Mean	6.009	5.194	5.509	5.420	4.924	4.824	5.156	5.220
S.D.	1.145	1.190	1.061	1.533	1.245	1.082	1.279	1.151

***p < 0.01; **p < 0.05; *p < 0.10.
Correlation coefficients were calculated using the average scores of the indicators included in each of the variables. The square root of AVE is reported in italics along the diagonal.

(Hair et al., 2017). The *t*-values were calculated using a bootstrapping procedure that analyzes the significance level of the standardized regression coefficients (Henseler, Ringle, & Sinkovics, 2009). We also applied the Falk and Miller (1992) criterion requiring the R^2 of each of the latent variables to be greater than 0.10. As observed in Table 6, the R^2 values (knowledge, $R^2 = 0.295$; skills, $R^2 = 0.584$; engagement, $R^2 = 0.592$; and satisfaction, $R^2 = 0.547$) were all greater than this threshold. Similarly, the Q^2 values ranged from 0.224 to 0.422 (Table 6), suggestive of acceptable levels of predictive relevance (Chin & Newsted, 1999). We also calculated the “geometric mean of the average communality and the average R^2 " (Tenenhaus, Vinzi, Chatelin, & Lauro, 2005, p. 173) as the overall goodness-of-fit (GoF) for the complete PLS structural equation model (Table 5). The value that we obtained was 0.628, allowing us to establish that the model performs well (Wetzels et al., 2009).

Analyzing the causal relationships in the proposed models (Table 6), one observes for Hypothesis H1 that the influence of the

Table 6
Structural model results.

Causal relationships or specified paths	Standardized coefficient	Bootstrap *t*-value [a]
Control relationships		
Average mark → Knowledge	−0.047	0.713 [n.s.]
Average mark → Skills	0.022	0.400 [n.s.]
Average mark → Engagement	0.075	1.237 [n.s.]
Average mark → Satisfaction	0.074	1.311 [n.s.]
Highest course → Knowledge	0.011	0.156 [n.s.]
Highest course → Skills	−0.030	0.576 [n.s.]
Highest course → Engagement	0.031	0.568 [n.s.]
Highest course → Satisfaction	−0.007	0.108 [n.s.]
Model relationships		
H_1: Flipped classroom → Knowledge	0.545	7.447***
H_2: Flipped classroom → Skills	0.329	3.362***
H_3: Flipped classroom → Engagement	0.084	0.872 [n.s.]
H_4: Knowledge → Skills	0.536	7.672***
H_5: Skills → Engagement	0.335	3.312***
H_6: Knowledge → Engagement	0.428	4.829***
H_7: Knowledge → Satisfaction	0.180	1.872*
H_8: Skills → Satisfaction	0.356	2.811***
H_9: Engagement → Satisfaction	0.276	2.358**
Latent variable	$\mathbf{R^2}$	$\mathbf{Q^2}$
Knowledge	0.295	0.224
Skills	0.584	0.306
Engagement	0.592	0.422
Satisfaction	0.547	0.361

***p < 0.01; **p < 0.05; *p < 0.10; n.s. = not significant.
[a] The bootstrap *t*-value was obtained using 5000 subsamples (Hair et al., 2016, 2017).

flipped classroom on students' knowledge is significant (standardized coefficient = 0.545; *t*-statistic = 7.447; $p < 0.01$); i.e., flipping the classroom positively influences better understanding of the module content and better prepares students for final exams. This result is in line with Bishop and Verleger (2013), who concluded that students' learning was better in the context of a flipped classroom approach than with a conventional perspective. Also confirmed is Hypothesis H2 relative to the significant effect that this variable has on students' skills (standardized coefficient = 0.329; *t*-statistic = 3.362; $p < 0.01$). A higher level of flipped classroom allows students to enhance their ability to work in groups, listen to others' opinions, and improve their self-learning ability. At the same time, it enhances students' ability to apply knowledge to practice, to analyze and to synthesize. As a whole, the confirmation of Hypothesis H2 is in line with previous literature suggesting that flipped classrooms benefit students in terms of skills development and acquisition (Awidi & Paynter, 2019; Butt, 2014; D'Alessio et al., 2019; Love et al., 2014; O'Flaherty & Phillips, 2015; Roach, 2014; Strayer, 2012).

However, with reference to Hypothesis H3, we did not find a significant, direct effect of the flipped classroom on students' engagement (standardized coefficient = 0.084; *t*-statistic = 0.872). To better understand this last result, we explored the mediating effects existing in the relationship between the flipped classroom and the student's engagement, following the procedure developed by Preacher and Hayes (2008) and Hayes, Preaches, and Myers (2011) with a bootstrap of the indirect effect of the sample distribution (Hair et al., 2016, 2017). The results were the following: (i) flipped classroom → knowledge → engagement = 0.233 (0.545 × 0.428), with an associated significant statistic (*t* statistic = 3.752; $p < 0.01$); (ii) flipped classroom → skills → engagement = 0.110 (0.329 × 0.335), with an associated significant statistic (*t*-statistic = 2.296; $p < 0.05$); and (iii) flipped classroom → knowledge → skills → engagement = 0.098 (0.545 × 0.536 × 0.335), with an associated significant statistic (*t*-statistic = 2.808; $p < 0.01$). Therefore, the total indirect effect (i) + (ii) + (iii) = 0.215 + 0.110 + 0.098 = 0.423, leading to the conclusion that knowledge and skills are full mediators in the aforementioned relationship.

For an explanation of this empirical finding, we can argue that a higher level of flipped classroom does not directly influence students' engagement, i.e., involving students more actively in the module and making it easier for them to follow. In fact, a higher level of flipped classroom allows the following. First, students are able to better understand and prepare for final exams, ultimately causing them to engage more actively in the module and being able to follow it (the module) more easily. Second, the positive influence of flipped learning helps students to benefit in terms of skills development and acquisition, leading them to engage deliberately and positively in the module and to follow it (the module) more easily. Third, the flipped classroom generates a chain of effects, which has not been extensively investigated, and it provokes a double-mediating effect in the sense that both students' knowledge and skills help to channel the impact of the flipped classroom on students' engagement.

Examining the effects of students' knowledge, we found that it positively affects students' skills, confirming Hypothesis H4 (standardized coefficient = 0.536; *t*-statistic = 7.672; $p < 0.01$). This causal relationship has not been formally stated and tested in the literature, but research has suggested the existence of this clear relationship (Perfetti, 2013, p. 33; Root & Ngampornchai, 2013). Furthermore, in the case of Hypothesis H6, the effect of students' knowledge is also significant on students' engagement (standardized coefficient = 0.428; *t*-statistic = 4.829; $p < 0.01$). Recent literature has found an association between these two variables (Fredricks et al., 2016; Shernoff et al., 2016), providing fertile ground to suggest that students' knowledge plays a major role in engaging students more actively in modules and making it easier for them to follow it (the module).

Additionally, we observed a direct, positive effect of students' skills on students' engagement, supporting Hypothesis H5 (standardized coefficient = 0.335; *t*-statistic = 3.312; $p < 0.01$). This result confirms that a higher level of students' skills, such as the ability to work in groups, listen to others' opinions, and self-learning, among others, is materialized in higher levels of students' engagement in terms of engaging more actively in the module and making it easier for students to follow it (the module).

If we focus on the antecedents of students' satisfaction, we confirm Hypothesis H7 concerning that students' knowledge positively and significantly affecting this variable (standardized coefficient = 0.180; *t*-statistic = 1.872; $p < 0.10$). This causal relationship has not been formally stated and tested in the past, but several studies have suggested this clear relationship, specifically because, when students better understand the module contents and are able to better prepare for final exams, it is reasonable to believe that their levels of general satisfaction with the lecturer, the module and the teaching method improves (Hoang, 2016; Li et al., 2016; Lin et al., 2008).

Regarding Hypothesis H8, students' skills also impact positively and significantly students' satisfaction (standardized coefficient = 0.356; *t*-statistic = 2.811; $p < 0.01$). In particular, when the ability to work in groups and to listen to others' opinions and their self-learning ability are improved, among others, the students' level of general satisfaction is also improved. This finding connects to previous studies that pointed out that there is a positive relationship between students' skills and their satisfaction (Eom & Ashill, 2016; Kuo et al., 2013; Liaw, 2008; Lin et al., 2008).

Finally, Hypothesis H9 is confirmed, relating to the effect of students' engagement on students' satisfaction (standardized coefficient = 0.276; *t*-statistic = 2.358; $p < 0.05$). In particular, using a teaching methodology that engages students more actively in the module and that makes it easier for them to follow (the module), students' general level of satisfaction is enhanced. This result coincides with the well-documented literature about the existence of a positive relationship between these two variables (Chen et al., 2008; Eom et al., 2006; Kahu, 2013).

5. Discussion and limitations

Higher education lecturing has traditionally followed a teacher-centered approach, with lecturers giving master classes in the classroom and students performing out-of-class activities. Under this traditional approach, the main actor in the teaching-learning process is the lecturer, and students play a passive role (Freeman et al., 2014; Meltzer & Thornton, 2012). It has been shown that when students acquire such a passive role in their learning process, they find it more difficult to reach their full potential in terms of final grades and the use of course knowledge (He et al., 2016; Peterson, 2016).

In this context, the flipped classroom has been conceived as a student-centered pedagogical approach attempting to improve students' performance. The literature has acknowledged the potential of the flipped classroom over traditional teaching and learning procedures (Akçayir & Akçayir, 2018; Bishop & Verleger, 2013; Strayer, 2012). In most cases, this alternative approach has simply consisted of a reordering of the processes to be conducted inside and outside the classroom by the students (Roach, 2014; Love et al., 2014; Hung, 2015, O'Flaherty & Phillips, 2015). This narrow focus has been questioned by academics and practitioners (Bishop & Verleger, 2013; Chen et al., 2014), noting that the flipped classroom as aforementioned could be improved and could become more useful by adding a series of complementary tasks to be performed by both lecturers and students, as well as both inside and outside the classroom.

Considering this methodological criticism and in terms of the benefits that this research provides to the current stream of flipped classroom literature, this paper presents a successful flipped classroom proposal to better understand its influence in terms of knowledge, skills, and engagement. To date, no study has formally stated and tested these three dimensions together in the analysis of the effectiveness of the flipped classroom in a 21st century higher education classroom with Generation Z. In doing so, we first develop a measurement scale (4D_FLIPPED) to explore the degree of flipped classroom presence in our higher education learning experience. Then, we present an SEM to analyze the causal relationships of knowledge, skills, and engagement with students' satisfaction.

Following this approach and to attain a fruitful flipped classroom, our results cause us to consider the following essentials: first, the need for two-way feedback (instructor to students, and *vice versa*) as an effective link between the out-of-class and in-class activities; and second, the use of technology in terms of moving the lecture to outside the classroom and conducting more active learning inside the classroom. Our research offers strong evidence supporting the proposed conceptualization of the 4D_FLIPPED classroom consisting of four dimensions: out-of-class activities, feedback, in-class activities and the use of technology. This study is the first time that such a theoretical framework has been tested in higher education by means of a PLS approach for SEM, which allowed us to identify new and key managerial and theoretical implications.

This study also confirms the view that our proposal for the flipped classroom has a positive and direct effect on students' knowledge and skills. Regarding the effect of this proposal on students' engagement, we identify a set of mediating effects: first, simple mediation – students' knowledge mediates the influence of the flipped classroom on students' engagement, and students' skills mediate the influence of the flipped classroom on students' engagement; and second, double mediation – students' knowledge and skills mediate the influence of the flipped classroom on students' engagement. All of these considerations lead us to consider the critical role that students' knowledge and skills play as full mediators in the relationship between the flipped classroom and students' engagement.

The research conducted in this study provides useful recommendations and insights for academia. Our 4D_FLIPPED classroom measurement scale consisting of four dimensions (out-of-class activities, feedback, in-class activities and the use of technology) shows that it is possible to attain greater student engagement with the teaching-learning process. Additionally, that students can be in contact with course content as often as they need and where and how they want to allows for greater flexibility for the knowledge adoption process. In this context, students also seem to be delighted to see how their teachers are involved in monitoring their progress and difficulties through the feedback process (Skovholt, 2018; Zhang & Hyland, 2018). In fact, students enjoy the direct application in their daily academic lives of the information and communication technologies with which they are so familiar in their private spheres, providing them with better learning experiences and greater learning efficiency (Yip, Wong, Yick, Chan, & Wong, 2019).

From the teachers' point of view, it seems reasonable to think that they might be more motivated by facing a group of students who are more predisposed and better prepared to follow their learning guidelines. This approach renders tangible the work and effort developed by teachers, both in terms of students' academic results and in terms of their satisfaction with teachers, which ultimately have direct impacts on teachers' reputations within the workplace. A virtuous circle occurs. In terms of workplace dynamics, the theoretical framework tested in this study favors its reputation as an innovative agent in the sector, which facilitates recruitment of new students, the generation of collaborative synergies and a good working atmosphere and the visibility of the educational process.

With reference to limitations, we should consider the following. First, the study employs perceptual measurement scales, which is a common practice in the literature, and common method variance was not a problem in this research. However, a longitudinal study would provide further evidence that would have strengthened the results. Second, the theoretical framework was tested using a sample of 112 students, and we understand that future research should confirm our results with larger samples and different settings, especially within internationalized environments characterized by the presence of heterogeneous and culturally diverse student groups. Third, flipping the classroom implies increases in both students' and instructors' workloads (He et al., 2016), which might complicate its implementation.

6. Conclusion

The aim of this research is to present a successful flipped classroom proposal in higher education to better understand its influence in terms of knowledge, skills and engagement. The reason why we focus on these three dimensions is due to their core roles in the international skills-oriented learning conceptual frameworks developed to enhance the employability of Generation Z students in the digital society of the twenty-first century. In doing so, first, we develop a flipped classroom measurement scale (4D_FLIPPED) to explore the degree of flipped classroom presence in our higher education learning experience. Second, we present a quantitative analysis by means of PLS-SEM to analyze the causal relationships of knowledge, skills, and engagement with students' satisfaction. To the best of our knowledge, this study is the first time that the two above contributions are accomplished in the literature. The empirical results point out that there are four fundamental dimensions that should be present in the flipped classroom to be successful in the 21st century with Generation Z. This study also confirms that the flipped classroom has positive effects on students' knowledge, skills, and engagement.

In terms of additional benefits not only to the literature but also to day-to-day practice, our research provides useful recommendations and insights for academia. Following the 4D_FLIPPED measurement scale tested in this investigation, course coordinators can consider how the flipped classroom can be incorporated into a learning design for their own courses in higher education. The purpose of this study is that our learning experience setup can be generalizable to other university contexts that might be interested in developing active and student-centered learning environments, as well as engagement and satisfaction generators, with the potential to acquire the knowledge and skills necessary to be successful in the workplace.

Finally, it is also worth mentioning that flipping the classroom implies increases in the workloads of both students and instructors. Complementary pedagogical approaches aimed at enhancing the engagement of students and instructors, such as gamification, crowdsourcing, digital transformation, and creativity, can help to render this workload more bearable. In this sense, future research could include the treatment of more complex frameworks by combining our flipped classroom proposal with these complementary pedagogical approaches in higher education. Additionally, the inclusion of variables such as time, gender, and language as different settings could provide further insights with reference to the model proposed in the present study.

Declarations of interests

Non.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgements

Our warm thanks to Prof. Dr. Subramaniam Ramanathan, Prof. Dr. Núria Hernández Nanclares, Prof. Dr. Carmelo Petraglia and Prof. Dr. Manuel Montanero for the feedback provided on earlier versions of this manuscript. We also thank the comments and suggestions from four anonymous referees. All remaining errors are our own. We would like to acknowledge the funding of the European Regional Development Fund [GR15044], the Government of Extremadura (Junta de Extremadura) [SEJ016].

Appendix. Evaluation questionnaire (Likert-type survey)

Block of questions	Item	Definition
In your opinion, in the Macroeconomics module … (1: Completely disagree – 7: Completely agree)		
Block 1: Out-of-class activities dimension (OOC)	OOC1	Video-tutorials have been made available to students to understand in advance the module's content.
	OOC2	Online questionnaires (flipped classroom questionnaires) have been made available to students to analyze their comprehension before they begin the class.
Block 2: Feedback dimension (FB-K)	FBK1	The results of the online questionnaires (flipped classroom questionnaires) answered by students have been commented on in class by the lecturer.
	FBK2	The information obtained from the online questionnaires (flipped classroom questionnaires) has been used to identify the more difficult-to-understand elements of the module's content.
	FBK3	The information obtained from the online questionnaires (flipped classroom questionnaires) was used to devote more time to aspects that the students indicated were the most difficult to understand.
Block 3: In-class activities dimension (ICL)	ICL1	Activities that enhance students' self-learning have been conducted in class by the students.
	ICL2	In-class activities have been conducted that enable the students to develop a series of competencies.
Block 4: Use of technology dimension (TCH)	TCH1	The teaching and learning process has been enhanced by allowing students to use mobile devices in the class (laptops, mobiles, tablets).
	TCH2	The teaching and learning process has been enhanced by the use of cloud services (Blendspace, Google Drive, Dropbox, Virtual Learning Environment, YouTube).
	TCH3	The teaching and learning process has been enhanced by means of the use of social networks (Google+).
In your opinion, the teaching methodology used in the module has helped you to … (1: Completely disagree – 7: Completely agree)		
Block 5: Knowledge (KNO)	KNO1	Better understand the module contents.
	KNO2	Better prepare for the final exam.
Block 6: Skills (SKI)	SKI1	Improve the ability to work in groups.
	SKI2	Improve the ability to listen to others' opinions.
	SKI3	Improve self-learning ability.
	SKI4	Improve the ability to apply knowledge in practice.
	SKI5	Improve the ability to analyze (ability to distinguish and separate the parts of a whole).
	SKI5	Improve the ability to synthesize (ability to form a whole from its elements).
Block 7: Engagement (ENG)	ENG1	Engage more actively in the module.
	ENG2	Follow the module more easily.
Indicate your level of general satisfaction … (1: Completely dissatisfied – 7: Completely satisfied)		
Block 8: Satisfaction (SAT)	I21	With the lecturer.
	I22	With the module.
	I23	With the assertion that the teaching method used leads to greater learning than would traditional methods consisting of expository master classes.

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