Facilitating self-efficacy in university students: an interactive approach with Flipped Classroom

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ABSTRACT
The aim of this study is to investigate the perceived self-efficacy of university students after experiencing several Flipped Classroom sessions at different time points: prior to the outbreak of the COVID-19 pandemic (onsite instruction) and after confinement at home (online instruction). The study’s methodology followed a quantitative approach in which a total of 376 university students who had experienced the Flipped Learning sessions completed a general self-efficacy questionnaire. The results showed that the perceived self-efficacy is influenced by the academic year in which the students are enrolled, the modality in which the Flipped Classroom experience has been implemented (online or onsite) and the predisposition to innovation. In terms of practical implications, the Flipped Classroom applied in online formats could be a highly useful resource for designing active learning environments in which university students could improve their sense of self-efficacy. Consequently, their expectations and academic performance could also be improved.

KEYWORDS
Flipped classroom; self-efficacy; online; innovation

1. Introduction
In recent years, the positive effects of student-centered approaches to learning have been widely debated in the literature (Kong, 2015). It has been mentioned that this mode of learning has the potential to improve, among many other skills, the performance and perceived self-efficacy of students, as well as the social interactions that occur between students and teachers (Hwang & Lai, 2017). Student-centered learning environments require the application of active learning strategies that are completely different from traditional classroom instruction. Among these strategies, the need to involve the students’ own presentations, work on problem-solving skills, establish self-assessment techniques and peer evaluation and, finally, enhance discussions in group formats has been pointed out as particularly relevant (Mohanty & Parida, 2016).
Furthermore, in the context of Higher Education, the self-efficacy of students constitutes a key factor in the regulation of their learning behaviors (Van Dinther et al., 2011). Perceived self-efficacy is defined as ‘people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives’ (Bandura, 1994, p. 71). This perceived self-efficacy affects the way people feel, perceive, motivate and behave (this term will be discussed later in the article under the heading 'literature review'). In fact, the perception of self-efficacy mediates between various determinants of competence development (for example, skill, knowledge, ability, or former achievements) and their subsequent performances (Bandura, 2006). Considering this fact, the belief system that regulates people’s self-efficacy conditions the motivational, cognitive and affective responses that are linked to the performance of actions and behaviors.

2. Aim and rationale

As a result of this important role, it is essential to know and analyze the development of the students’ perception of self-efficacy when active learning processes based on a Flipped Classroom methodology are implemented in the university classroom. According to Albert Bandura’s social cognitive theory (Bandura, 1977), the study of these aspects would allow us to explore the relationship between the previous skills that university students have and their subsequent actions in flipped learning experiences. Flipped Learning is a pedagogical approach that causes changes in the spaces in which the learning process takes place (this term will be discussed later in the literature review section). Thus, the master class takes place outside the classroom and the classroom becomes a learning space in which the concepts learned are reflected on with the teacher’s guidance (Tourón & Santiago, 2015).

Also, more research is needed to know on what basis implementation of the Flipped Classroom explicitly benefits teaching and learning, in comparison to the traditional mode of teaching. At the same time, the possible relationship between perceived self-efficacy and the application of Flipped Classroom experiences should be explored, taking into account the effects that different variables exert on this self-efficacy. It is important to consider these variables that may be influencing students’ perceived self-efficacy because it is precisely this self-efficacy that can generate changes in behavior and actions towards learning (in this case, in an inverted learning model). More specifically, the study aims to answer the following research questions:

a. Do university students who have participated in the Flipped Classroom sessions (both in an onsite and online format) perceive a high general self-efficacy of their learning process?

b. Are there relationships between different contextual variables (such as the way in which the Flipped Classroom experience has been implemented, the course in which they are enrolled, the predisposition to educational innovation and previous experience with innovation) and students’ perception of self-efficacy?
3. Behavioral framework for perceived self-efficacy and Flipped Learning (literature review)

The pedagogical model known as Flipped Classroom, Flipped Learning or inverted classroom (among other names) allows the design and implementation of very diverse didactic modalities. Since its emergence, this methodology has been understood as a reversal of traditional classroom roles. In this way, the students take the main role in the learning process and the teacher acts as a guide and mediator (Bergmann & Sams, 2012). Under this approach, the contents are consulted on and studied by the students outside the classroom and, subsequently, the contact hours with the teacher are used to deepen and resolve possible doubts (Tourón & Santiago, 2015).

Authors such as AlJaser (2017) highlight that the Flipped Classroom strategy is designed to respond to the needs for self-efficacy and skills development within a completely integrated system. And students feel self-efficacious when they are actively involved in the construction and dissemination of their own knowledge (Abey & Dawson, 2015). According to AlJaser (2017), this self-efficacy is understood as the beliefs of oneself in their own personal abilities to be able to motivate themselves and put in place the cognitive resources and action programs necessary to handle a certain situation. Self-efficacy is what allows students to decide how much effort they are going to dedicate to a task, how long they will persist when they encounter obstacles, and how resistant they will be in difficult situations (Van Dinther et al., 2011). Therefore, the more robust the perception of self-efficacy, the greater the perseverance and effort that is put in (Bandura, 1997).

Perceived self-efficacy, which includes the belief that an individual has the ability to generate change through their own personal actions (Bandura, 2006), turns out to be a critical factor also in online learning modalities. In the Flipped Learning model, while students work at their own pace, an increase in self-confidence and self-esteem could occur which, at the same time, could lead to an improvement in the perception of self-efficacy (Kenna, 2014). In addition, it is worth mentioning that those people with a greater perception of self-efficacy have shown better levels of commitment to achieve certain goals (Bandura, 1997). Hommes and Van der Molen (2012) also identified that those students with consistent self-efficacy subsequently used and applied newly acquired learning. Self-efficacy is linked to expectations about one’s future performance. Therefore, in Flipped Classroom settings, students are expected to have a greater sense of self-efficacy as they are exposed to more opportunities to process learning content through videos and other electronic materials (Ajzen, 2015).

Although the existing studies have shown that the Flipped Classroom model is established as an emerging and promising tool within the field of education, few studies have been carried out that offer evidence about the benefits it has on the perceived self-efficacy of students in the university environment (Namaziandost & Çakmak, 2020). In some of them (İyitoğlu & Erişem, 2017), the authors found positive relationships between perceived self-efficacy and academic success. In fact, from an educational perspective, students may need to experience more self-efficacy situations so that academic success is guaranteed. In this way, students who reported a positive effect of Flipped Classroom on their learning also showed an increase in their self-efficacy (Ajzen, 2015).
Bandura’s social learning theory suggests that the elements of the environment could determine learning behaviors and also influence students’ self-efficacy beliefs (Van Dinther et al., 2011). Among the very diverse factors or elements that can shape perceived self-efficacy in learning with Flipped Classrooms, it has been highlighted that the modality in which these active learning experiences are applied is a clear determining factor. In this sense, some studies (Ibrahim & Callaway, 2014) have shown that Flipped Learning in fully virtual formats is an important incentive for the development of self-efficacy, self-directed learning and even self-esteem. Also, Hwang and Lai (2017) found that the interactive approach to learning based on online materials could stimulate students to have stronger beliefs in learning than in the traditional classroom.

On the other hand, the perceptual dimension of each individual as well as their previous experiences have been gaining importance as researchers and organizations have become aware of the impacts that both elements (perceptions and experiences) have on some expected results (Kumar & Uzkurt, 2010). Specifically, for the field of innovation in education, no research has been carried out in which the effects of predisposition or previous experience with innovation on the perception of self-efficacy in Flipped Classroom experiences have been analyzed. The main expressions with which students link innovation refer to ‘creativity’, ‘novelty’ and ‘processes to generate ideas’ (Edwards et al., October, 2009). Thus, when students have previously experienced the changes associated with any educational innovation project, their predisposition to learning and enthusiasm is expected to become more notable.

In addition to all this, it has also been found that the academic year in which university students are enrolled can shape their perception of self-efficacy when they are immersed in active learning situations. In this regard, Castedo et al. (2019) show that, during the first university years, the disparity of knowledge, predisposing attitudes and perception of self-efficacy are notably high. The literature on the relationships between the university course in which they are enrolled and the perception of self-efficacy with Flipped Classroom is scarce. Despite the lack of research in this area, in recent years some authors (Du Rocher, 2018) have stressed the importance of designing active learning practices throughout all university courses so that students’ perception of self-efficacy is increased.

In summary, previous and recent studies suggest that active learning approaches may lead to high self-efficacy perceived by university students. A few studies offer relevant findings about the effects that the format of the classes or the predisposition to innovation have on students’ perceived self-efficacy. Therefore, this study explores how Flipped Classroom sessions could be related to a high perception of self-efficacy in learning in university students. In addition, a set of variables is considered as possible factors that explain differences in these levels of self-efficacy.

4. Research context and method

Students and professors from the education area of a Spanish university participated in this Flipped Classroom experience. Specifically, it was carried out in various subjects taught in Higher Education. A group of university teachers who had experimented in previous years with this methodology decided to launch this research. This Flipped Classroom project originated with the intention of providing better learning environments in which university students could develop their commitment and responsibility to tasks, as
well as a more active type of learning. From the university institution where this flipped learning experience was carried out, it was considered that it would provide notable benefits in terms of teacher training in active methodologies, the use of technology to achieve more significant learning in students and the involvement in processes of teaching innovation.

The subjects were selected to participate in the experience based on a series of logistical aspects that allowed the Flipped Classroom sessions to be successful: having sufficient technological resources, presenting a suitable learning content to be taught through the internet and having the allocation of internal resources required for the Flipped Classroom design to be viable. The professors responsible for each of these subjects were previously informed of a series of minimum homogeneity criteria that should be respected to ensure the validity of the data collected. The criteria presented were the following: first, it was requested that the theoretical contents be reserved for autonomous learning outside of class sessions. These class sessions could be carried out either as an onsite instruction in the university classroom (if the classes were held prior to the COVID pandemic) or as an online instruction (if the classes were held in a virtual format due to suspension of classroom attendance). In both cases, the main purpose of the class sessions (both online and in the classroom) was that students could reflect in depth on the material they had previously studied autonomously and, in this way, consolidate everything they had learned (Roach, 2014).

The Flipped Classroom experience in each of the subjects lasted for three weeks. During this time, the teachers had to have planned the appropriate audio-visual material so that the students could receive the learning lessons from home. From the coordination of the project, they were recommended to rely on figures, diagrams, graphics and images as long as the content of the subject was adequate for it. In this first phase of the experience, the teaching methodology was based on the expository ‘video classes’ of each subject. Through the visualization and autonomous study of the ‘video classes’, the theoretical knowledge related to the contents of the subjects was transmitted to the students. These ‘video classes’ should motivate students to reflect and facilitate the discovery of relationships between different concepts. All this, in order to allow students to self-regulate, plan and adapt their own learning. The video classes should also contain interactive elements (for example, some activity posed as a short-open question, some multiple-choice questions and some activity to relate concepts). The content of these ‘video classes’ corresponded to a specific topic of each subject in which the experience was carried out:

- Topic of the subject 1: The teaching-learning planning process.
- Topic of subject 2: Early attention to learning needs.
- Topic of the subject 3: Attention to diversity.
- Topic of the subject 4: Specific didactics in the natural environment.
- Topic of the subject 5: Theoretical bases of the psychology of the education.
- Topic of the subject 6: Transversal competences of the twenty-first century.

In addition, it should be noted that the university students received the appropriate explanations about the Flipped Classroom methodology prior to the start of the experience. Given that it was a novel situation for all of them, the teachers repeatedly insisted
on the need to access and view the audio-visual material that was offered to them from the corresponding virtual platforms. They were also informed of the need to complete some activities in online format that the teacher had designed. These activities were intended to review the content presented in the audio-visual material prior to the class session with the teacher. More specifically, each teacher created a self-assessment test on the subject’s virtual platform. Before each class session, the students had to answer 10 multiple-choice questions and a short-open question on the topic learned in the ‘video classes’. This strategy allowed each teacher to get an idea of those subjects that the students mastered better or worse in order to place greater emphasis on them during class sessions. All this, with a weekly periodicity and prior to the onsite or online session (depending on when the experience was carried out).

For the class sessions with the teacher, the coordination of the project offered different models of activities to the participating teachers that they could apply with their students: quizz-type questions, elaboration of mind maps or design of questions to exchange with other classmates. In addition to those specific activities that each teacher designed, the class sessions included a reflection debate among the students moderated by the teacher. These initial discussions were intended to resolve possible doubts that arose during the viewing of the ‘video classes’ and discuss the topics learned. The discussions were also used to establish relationships between previously learned concepts. For example, before starting the topic of subject 1 (The teaching-learning planning process), the students watched a short video in the class session showing a traditional classroom and a current classroom. Subsequently, they reflected as a group how the teaching-learning process was planned in each of the two situations.

4.1. Participants and survey

Our sample is composed of 376 students during the first and second semesters of the 2019–2020 academic year. 75% of the sample was enrolled in the initial university courses and the remaining 25% of the sample was enrolled in the last courses (third and fourth year of university). Regarding the way they did the experience with Flipped Classroom, 68% experienced it through an onsite instruction and 32% through an online instruction. The percentage of students with a predisposition to educational innovation was balanced: approximately 52% had an interest in innovation compared to almost 48% who did not. Finally, 36.70% of the sample had no previous experience with innovation while 63.30% did have some prior contact with this methodology.

The General Self-Efficacy Scale (Baessler & Schwarcer, 1996) was used in order to analyse perceived self-efficacy of university students after being involved in various Flipped Classroom experiences. Using this scale, the feeling of personal competence is evaluated to effectively handle a wide variety of learning situations that can be challenging. Instead of adopting its original response format, a 10-point Likert-type scale was used that had already been previously validated by Sanjuán et al. (2000). The instrument consists of a total of 10 indicators that assess the perception of personal competence to effectively handle a wide variety of stressful situations. Students were asked to rate the ten indicators of self-efficacy after experiencing the Flipped Classroom sessions. In this way, they had to record their degree of agreement regarding the contribution of this active methodology to increase their general perceived self-efficacy and self-efficacy in learning.
4.2. Data analysis

Table 1 shows descriptive statistics for the self-efficacy scales (dependent variables), from strongly disagree (0) to strongly agree (10). In particular, the table shows the means, standard deviation, item total correlation (correlation coefficient between the score on the individual item and the sum of the scores on the remaining items) and the Cronbach’s alpha coefficient if the individual item is deleted from the scale. There is a high agreement among all the indicators on the scale. Almost all of them exceed the average score of 7, except for EF6 item, which refers to ‘Develop the necessary skills to handle challenging learning situations’. This item has been the one in which low agreement is observed within the whole scale. The respondents agreed most with the EF2 item (‘Solve problems if I put in enough effort’; mean 7.98), followed by EF8 item (‘Solve most tasks if I try my best’; mean 7.86). On the contrary (in addition to EF6 item), those questions in which less agreement is observed among students refer to EF7 item (‘Handle any type of challenge that may occur’; mean 7.05) and EF9 item (‘Find solutions or alternatives to challenging situations’; mean 7.22). Even so, it should be noted that the average score obtained in the degree of agreement of these indicators was considerably high.

The internal consistency of the concepts measured by Cronbach’s alpha for the self-efficacy scale were reliable, ranging from 0.869 for ‘Handle any type of challenge that may occur’ to 0.883 for ‘Finding a way to get what I want without someone opposing me’; and Cronbach’s alpha for the overall scale was 0.886. Similar results (0.87) were obtained by Sanjuán et al. (2000) with Spanish university students. On the other hand, the correlation coefficients of the score of each item with respect to the sum of all the scores of the rest of the items also presented a similar trend.

Table 2 summarizes the sociodemographic factors and how they affected self-efficacy. These factors will be used as explanatory variables in the analysis. The choice of these variables has been based on the literature review on those factors that affect the perceived effectiveness of active methodologies in the university

| Perception about self-efficacy (Cronbach’s alpha = 0.886) | Mean | S.D. | Item total correlation | Cronbach’s alpha |
|------------------------------------------------------------|------|------|------------------------|------------------|
| EF1. Finding a way to get what I want without someone opposing me. | 7.288 | 1.756 | 0.456 | 0.883 |
| EF2. Solve problems if I put in enough effort. | 7.984 | 1.478 | 0.449 | 0.880 |
| EF3. Persist in the proposed tasks until reaching the desired goal. | 7.421 | 1.705 | 0.455 | 0.882 |
| EF4. Have confidence in myself to handle different situations effectively. | 7.252 | 1.588 | 0.427 | 0.870 |
| EF5. Overcome unforeseen situations thanks to my resources and qualities. | 7.537 | 1.456 | 0.425 | 0.870 |
| EF6. Develop the necessary skills to handle challenging learning situations. | 6.738 | 1.974 | 0.455 | 0.882 |
| EF7. Handle any type of challenge that may occur. | 7.052 | 1.674 | 0.425 | 0.869 |
| EF8. Solve most tasks if I try my best. | 7.861 | 1.422 | 0.434 | 0.873 |
| EF9. Find solutions or alternatives to challenging situations. | 7.223 | 1.572 | 0.425 | 0.870 |
| EF10. Find different alternatives for solving the same problem. | 7.249 | 1.732 | 0.426 | 0.870 |
environment. Specifically, it includes the course in which the students are enrolled, the way in which the Flipped experience has been carried out, the predisposition or interest in educational innovation and, finally, previous experience with activities or experiences of innovation. Regarding the academic year, it was decided to capture two subgroups that divided the variable into ‘first university levels’, including 1st and 2nd year students, and ‘upper years of university’ that may also include Master’s level students. On the other hand, and considering that this Flipped Classroom experience was developed throughout the 2019–20 academic year (and, therefore, the second semester coincided with the outbreak of the COVID-19 pandemic), a second variable was proposed related to the way in which the logistical aspects had enabled the activities to be carried out. Within this variable, two categories were established: onsite instruction (if the experience was carried out in the first semester and, therefore, in the university classroom) and online instruction (if the experience started in the second semester after declaring the state of alarm). Finally, in the explanatory variables related to the predisposition to educational innovation and to previous experience with innovation activities, two categories were included: yes / no.

### 4.3. Multivariate ordered probit model for self-efficacy estimates

Assessment of the determinants of perceived improvement in their perception of self-efficacy can be achieved using several approaches. One commonly used approach is to estimate a single equation such as ordered probit for each self-efficacy indicator, but it ignores simultaneous behavior. In the case of the indicators used in this study, it is worth noting that this simultaneous behavior should not be ignored because they are all part of the same dimension called perceived ‘self-efficacy’. Therefore, and with the aim of overcoming the shortfalls of using other techniques, we estimated multivariate ordered probit models (Greene & Hensher, 2010).

The econometric model that summarizes the behavioral framework presented so far includes as dependent variables \(Y_{ik}\) the self-efficacy indicator for students, where \(i = 1, \ldots, N\) are students and \(k = 1, \ldots, K\) are different self-efficacy indicators. This model was selected from the intuition that students are more likely to perceive self-efficacy for a variety of reasons than a single one. We consider a set of exogenous explanatory variables to evaluate the reasons – socio-demographic effects – which are common to

| Variables      | Definition                                                        | Units                        | Mean  | Std Dev |
|----------------|-------------------------------------------------------------------|------------------------------|-------|---------|
| First courses  | Dummy variable for students in the first and second years.        | 1 = 1st and 2nd year         | 0.706 | 0.457   |
|                |                                                                  | 0 = Other year               |       |         |
| Online experience | Dummy variable for type of experience with Flipped Classroom    | 1 = Online                   | 0.379 | 0.486   |
| Innovative    | dummy variable for students’ willingness to innovate             | 1 = Yes                      | 0.456 | 0.499   |
| Experience     | dummy variable for students’ previous experience with innovative experience | 1 = Yes                      | 0.621 | 0.486   |
|                |                                                                  | 0 = No                       |       |         |
all the alternatives \((X)\). The model is specified as follows:

\[
Y_{i1}^* = b_1'X_i + \varepsilon_{i1}, \quad \text{where } Y_{i1} = j_1 \text{ if and only if } \mu_{j-1,1} < Y_{i1}^* < \mu_{j,1} \\
Y_{i2}^* = b_2'X_i + \varepsilon_{i2}, \quad \text{where } Y_{i2} = j_2 \text{ if and only if } \mu_{j-1,2} < Y_{i2}^* < \mu_{j,2} \\
\ldots \\
Y_{ik}^* = b_k'X_i + \varepsilon_{ik}, \quad \text{where } Y_{ik} = j_k \text{ if and only if } \mu_{j-1,k} < Y_{ik}^* < \mu_{j,k} 
\]

where \(\beta_k\) are parameters to be estimated, \(\mu_{j,k}\) is the upper bound threshold for count level \(j\) of objective \(k\) \((\mu_{0,k} < \mu_{1,k} < \ldots < \mu_{J,k})\), \(\mu_{0,k} = -\infty, \mu_{J,k} = +\infty\) for each objective \(k\). The threshold bounds define a range of the underlying latent continuous variables corresponding to each observed discrete outcome. The \(\varepsilon_{ik}\) a standard normal error term with:

\[
\begin{pmatrix}
\varepsilon_{i1} \\
\varepsilon_{i2} \\
\vdots \\
\varepsilon_{ik}
\end{pmatrix} \sim N
\begin{pmatrix}
0 \\
0 \\
\vdots \\
0
\end{pmatrix},
\begin{pmatrix}
1 & \rho_{12} & \ldots & \rho_{1k} \\
\rho_{21} & 1 & \ldots & \rho_{2k} \\
\vdots & \vdots & \ddots & \vdots \\
\rho_{k1} & \rho_{k2} & \ldots & 1
\end{pmatrix}
\] or \(N[0, \Sigma]\)

The off-diagonal terms of \(\Sigma\) capture the error covariance across the underlying latent continuous variables of the different objectives; that is, they capture the effect of common unobserved factors influencing the perceived improvement in their sense of self-efficacy. Then, if \(\rho_{12}\) is positive, it implies that students with a higher than average propensity in their peer group to self-efficacy in the first indicator are also likely to have a higher than average propensity to self-efficacy in the second indicator. As is well known, if all the correlation parameters are zero, the model system in Equations (1) should be estimated as independent ordered response probit models for each indicator providing consistent and asymptotically efficient estimators for all model parameters.

5. Results and discussion

Tables 3 and 4 present results of the multivariate ordered probit model where determinants of self-efficacy scales are modeled jointly. Table 3 presents estimation results for the socio-demographic variables and Table 4 reports the correlation coefficients of the random components of each self-efficacy indicator. Following Greene and Hensher (2010), the multivariate ordered probit model provides more efficient results if and only if those correlations are jointly different from zero. At the end of Table 3 results of the statistical test for that condition are reported. Test results suggests that different statements are effectively correlated by unobserved factors and therefore this model improve the efficiency of the estimation, also Table 4 that all self-efficacy indicators are positively and significantly correlated, which means that are complementary, and consequently, students do not agree upon a single self-efficacy scale; instead, the probability of agreeing an item is conditional on whether other items have already been agreed.

The magnitude of the estimated coefficients in Table 3 do not have a direct interpretation, but we can say that an increase in a variable with a positive coefficient increases the probability of the dependent variable being in the highest category (high self-efficacy), yet
Table 3. Estimation results for the self-efficacy indicators.

|                | EF1 Coef (Std Err) | EF2 Coef (Std Err) | EF3 Coef (Std Err) | EF4 Coef (Std Err) | EF5 Coef (Std Err) | EF6 Coef (Std Err) | EF7 Coef (Std Err) | EF8 Coef (Std Err) | EF9 Coef (Std Err) | EF10 Coef (Std Err) |
|----------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| **First courses** |                    |                     |                     |                     |                     |                     |                     |                     |                     |                     |
| First courses   | −0.150 (0.138)     | −0.236* (0.139)     | −0.406*** (0.139)   | −0.084 (0.136)      | −0.004 (0.136)      | −0.178 (0.136)      | −0.177 (0.136)      | −0.463*** (0.140)  | −0.238* (0.137)    | −0.167 (0.136)       |
| Online exp.     | −0.110 (0.129)     | −0.067 (0.129)      | 0.163 (0.129)       | 0.058 (0.129)       | −0.015 (0.128)      | −0.004 (0.129)      | 0.045 (0.129)       | 0.233* (0.129)     | 0.210 (0.129)      | 0.305** (0.129)     |
| Innovative      | 0.257** (0.121)    | 0.492*** (0.123)    | 0.435*** (0.121)    | 0.194* (0.120)      | 0.292*** (0.119)    | −0.031 (0.121)      | 0.221* (0.120)      | 0.509*** (0.123)   | 0.269** (0.121)    | 0.223* (0.120)      |
| Experience      | −0.201* (0.123)    | 0.022 (0.123)       | −0.101 (0.122)      | 0.165 (0.122)       | 0.190 (0.121)       | 0.138 (0.121)       | 0.033 (0.122)       | −0.090 (0.123)     | 0.055 (0.122)      | 0.164 (0.122)       |
| Equation test χ²(4) | 11.17*** (0.123)  | 23.45*** (0.123)    | 23.62*** (0.122)    | 5.28 (0.122)        | 9.32* (0.121)       | 2.94 (0.121)        | 5.81 (0.122)        | 30.47*** (0.123)  | 9.41* (0.122)      | 10.27** (0.122)     |
| Global test χ²(40) | 93.47***          |                     |                     |                     |                     |                     |                     |                     |                     |                     |
| All rho = 0 χ²(45) | 882.25***         |                     |                     |                     |                     |                     |                     |                     |                     |                     |
| Num. obs.       | 309                |                     |                     |                     |                     |                     |                     |                     |                     |                     |

*p-value < 0.1; **p < 0.05; ***p < 0.01.
decreases the probability of it being in the lowest category. Then, regarding the results of the estimation of Table 3, firstly, the influence of the explanatory variable of the academic year on some of the indicators of the self-efficacy scale is observed. Those students enrolled in the first university courses are less likely to position themselves according to certain indicators of self-efficacy after experiencing the Flipped Classroom sessions. Specifically, there is a positive impact of taking the first degree courses on the perception of considering that Flipped Classroom helps ‘Persist in the proposed tasks until reaching the desired goal (EF3)’ and ‘Solve most tasks with the necessary effort (EF8)’. Although with a lower degree of significance, the students of the first years of the university are also less likely to agree on the improvement of the EF2 ‘Personal ability to solve problems’ and EF9 ‘Find solutions or alternatives to challenging situations’ with the Flipped Learning methodology. The trend found here is similar to the results offered by Elias et al. (2010). In their study, those students from higher university courses presented a greater adjustment (understood in terms of greater perceived self-efficacy and achievement motivation) compared to other younger students.

On the other hand, the way in which the Flipped Classroom sessions were carried out has practically had no impact on the self-efficacy declarations of university students. Even with this, it is appreciated that the students who took the classes in an online format are more likely to agree on the improvement that Flipped Classroom offers to their ability to ‘Solve most tasks with the necessary effort (EF8)’ and for ‘Find different alternatives for solving the same problem (EF10)’. For all other statements, there is no positive impact on the way in which the experience was shaped. These results are located in a similar line to that found in previous studies (Chu & Tsai, 2009) in which it is indicated that the acceptability of learning experiences in online formats can be determined by study preference in these online supports, among other factors. In addition, fully online learning formats can facilitate students’ cognitive engagement and provide guidance to efficiently interact with the learning content (Ibrahim & Callaway, 2014). Consequently, the chances that the self-efficacy of university students will be improved are greater in those online

| Table 4. Correlation coefficients of the random components of each self-efficacy indicator. |
|-----------------------------------------------|
| EF1   | EF2       | EF3       | EF4       | EF5       | EF6       | EF7       | EF8       | EF9       |
|-------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| EF2   | 0.670***  | 0.524***  | 0.311***  | 0.484***  | 0.449***  | 0.421***  | 0.481***  | 0.523***  |
|       | (0.036)   | (0.046)   | (0.045)   | (0.048)   | (0.052)   | (0.046)   | (0.048)   | (0.052)   |
| EF3   | 0.438***  | 0.484***  | 0.314***  | 0.404***  | 0.398***  | 0.361***  | 0.433***  | 0.477***  |
|       | (0.050)   | (0.048)   | (0.045)   | (0.052)   | (0.053)   | (0.057)   | (0.057)   | (0.057)   |
| EF4   | 0.450***  | 0.484***  | 0.531***  | 0.517***  | 0.484***  | 0.457***  | 0.521***  | 0.560***  |
|       | (0.050)   | (0.048)   | (0.045)   | (0.052)   | (0.048)   | (0.047)   | (0.047)   | (0.047)   |
| EF5   | 0.464***  | 0.489***  | 0.414***  | 0.531***  | 0.484***  | 0.451***  | 0.521***  | 0.494***  |
|       | (0.049)   | (0.048)   | (0.052)   | (0.046)   | (0.053)   | (0.047)   | (0.047)   | (0.053)   |
| EF6   | 0.260***  | 0.223***  | 0.277***  | 0.506***  | 0.564***  | 0.564***  | 0.564***  | 0.564***  |
|       | (0.057)   | (0.060)   | (0.057)   | (0.046)   | (0.042)   | (0.042)   | (0.042)   | (0.042)   |
| EF7   | 0.362***  | 0.332***  | 0.433***  | 0.588***  | 0.617***  | 0.707***  | 0.707***  | 0.707***  |
|       | (0.056)   | (0.050)   | (0.041)   | (0.038)   | (0.031)   | (0.031)   | (0.031)   | (0.031)   |
| EF8   | 0.474***  | 0.643***  | 0.402***  | 0.494***  | 0.577***  | 0.397***  | 0.532***  | 0.532***  |
|       | (0.049)   | (0.038)   | (0.053)   | (0.047)   | (0.042)   | (0.042)   | (0.042)   | (0.042)   |
| EF9   | 0.422***  | 0.444***  | 0.456***  | 0.536***  | 0.589***  | 0.587***  | 0.645***  | 0.554***  |
|       | (0.051)   | (0.051)   | (0.049)   | (0.044)   | (0.041)   | (0.040)   | (0.036)   | (0.044)   |
| EF10  | 0.419***  | 0.410***  | 0.434***  | 0.521***  | 0.615***  | 0.611***  | 0.676***  | 0.585***  |
|       | (0.051)   | (0.053)   | (0.051)   | (0.045)   | (0.039)   | (0.039)   | (0.034)   | (0.042)   |

*p -value < 0.1; **p < 0.05; ***p < 0.01.
Flipped Learning course formats. In these online learning environments, students must access the courses completely independently and plan their learning times, pace and strategies by themselves. This fact implies a totally self-directed learning (Lai, 2015).

Willingness to innovate had a positive impact on the self-efficacy scale, except for EF6, ‘Develop the necessary skills to handle challenging learning situations’ with a non-significant result, suggesting that students are more likely to agree with the fact that the Flipped Classroom experience has the potential to enhance your sense of perceived self-efficacy. In most of the indicators of the scale, the significance of the impact of the students’ predisposition towards innovation was high. The only two exceptions are found in EF7 ‘Handle any type of challenge that may occur’ and in EF10 ‘Find different alternatives for solving the same problem’.

Regarding the explanatory variable related to the previous experience of university students with educational innovation, it is not observed that it has a significant impact on most of the self-efficacy indicators of the scale. Only in the EF1 statement ‘Finding a way to get what I want without someone opposing me’ is appreciated that students with previous experience were less likely to consider that the Flipped Classroom methodology improved this indicator. Some studies on university professors (Ghaith & Yaghi, 1997) found relationships between experience and predisposition to innovation, the implementation of active learning practices and perceived self-efficacy. In other studies carried out on a sample of professionals from Turkey (Kumar & Uzkurt, 2010), a positive relationship was also found between readiness for innovation and perceived self-efficacy.

Regarding the correlation coefficients in Table 4, highly significant correlations were observed between all variables. This sense of ‘unity’ of the scale reveals a significant fact, and it is that in the same way that a high perception of self-efficacy is perceived in a certain indicator after experiencing the Flipped Classroom sessions, it will also occur in another indicator of self-efficacy. In all the indicators of the questionnaire, the correlations were very high. Consequently, it was concluded that the scale was robust.

6. Conclusions

The results of this study suggest that the high self-efficacy perceived by university students could be due, in part, to the application of this Flipped Classroom approach, regardless of the online or onsite virtual format (in no case can a causal relationship be established between both). This methodology in online format is a good possibility for this next course marked by the uncertainty of the evolution of the COVID-19. Currently, the beginning of the course is mostly onsite but online teaching can become mandatory at any time. The educational field is one of the many affected by this pandemic in many countries (Almarzooq et al., 2020; Telles, 2020; Wyse et al., 2020) and therefore alternative solutions must be considered in this situation. Thus, these online Flipped Learning environments also allow the student to be the protagonist of their own learning and the reduction of that social distance when there is no presence, thanks to the dynamic sessions and online participation of students with teachers (Telles, 2020). These tasks are presented in electronic format at the end of the viewing of the material provided and prior to the online discussion session. This
whole process makes the students constantly active during the elaboration of their own knowledge with greater autonomy, always counting on the teacher as a guide in their process and with the supervision of the students’ progress on their part (Schwarzenberg et al., 2020).

The use of Flipped Classroom as a teaching resource is an important advance within an educational system that prioritizes innovation and the development of a wide range of skills. Precisely in these moments of pandemic, the digitalization of education and a greater use of new technologies is being imposed (Telles, 2020). The case of COVID-19 has accelerated the need for innovative solutions to optimize education efforts (Almarzooq et al., 2020) and could be considered as a provider of educational technology (Wyse et al., 2020). This has meant an imposition of new strategies and formats that must be incorporated in an emergent way into the teaching-learning process and that pose challenges to teachers, students and families (Wyse et al., 2020). The online Flipped Learning is an innovative, effective methodology that positively impacts higher education students by enhancing their learning (Dooly & Sadler, 2020). Its application in the classroom would be the beginning of the updating of society and a move towards an innovative education of the twenty-first century by making frequent and/or permanent use of online teaching (Telles, 2020).

6.1. Further research

Finally, this study could be complemented with an analysis of teachers’ views as professionals involved in this teaching-learning process. Future research could investigate what factors lead these professionals to decide to apply or not the Flipped Classroom in their classrooms and, at the same time, explore their perspectives on the influence of this methodology in the self-efficacy of the students. Future research could also validate our findings in other educational stages to obtain a more global vision of online or in-situ teaching with the Flipped Classroom method and its impact throughout the different formative stages.

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