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University students' preference for flexible teaching models that foster constructivist learning practices

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In recent years, universities have intensified their use of technologies and implemented various modes of flexible teaching. This study sought to demonstrate that students prefer flipped learning with combined forms of synchronous and asynchronous learning that foster constructivist learning practices. To this aim, two case studies ($N = 221$) for online teaching at two face-to-face universities during the 2020–2021 academic year are presented. Results show that students appreciate flipped models of learning that foster social constructivist practices, autonomous access and consultation of resources, self-regulation of time management and consciousness of learning needs. Such virtual self-paced learning results in more productive and interactive real-time classes. This combination of autonomous learning and synchronous instruction is preferred by students attending online and hybrid modes of teaching. Overall, this study demonstrates that the flipped classroom adapts well to online and hybrid modes of teaching with first-year undergraduate students. To effectively foster social constructivism through the flipped classroom in university contexts, course design should consider both synchronous and asynchronous learning spaces, amplifying opportunities to learn autonomously and to collaborate and get feedback in synchronous contexts.

Implications for practice or policy
- Student satisfaction with teaching may increase in online education if characteristics for flexibility are incorporated.
- Teachers can foster social constructivist practices through flipped classroom by designing synchronous and asynchronous instruction to be self-regulated, student-centred, collaborative and flexible.
- Institutional rules may limit teacher abilities to apply flexible modes of learning.

Keywords: flexible learning, social constructivism, flipped classroom, online learning, hybrid learning, student perspectives, case study

Introduction

Recent events have accelerated a shift towards technology-mediated education. A series of solutions have been deployed to deal with intermittent face-to-face (F2F) needs, including online, blended and hybrid modes of teaching. Experiences with these solutions have promoted reflection about teaching delivery modes and teaching methods and have provided greater opportunities to investigate innovative forms of teaching and learning. One such innovative model is the flipped classroom (FC), which has received much attention in recent years. For instance, the popularity of FC reached a milestone during the pandemic as shown by searches of the term *flipped classroom* in Google Trends (Google, n. d.) (Figure 1). Moreover, in Web of Science (n. d.) from 2019 to 2022, there are 2677 articles about the FC classroom in higher education. Among them, since 2020, 678 refer to online or distance education.
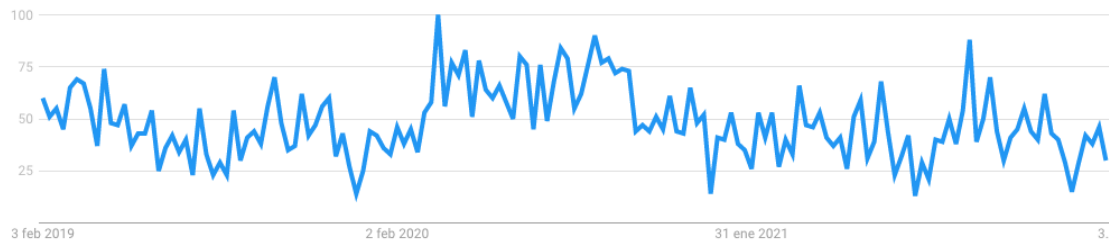
Figure 1. The popularity of the search term *flipped classroom* in Google Trends worldwide between February 2019 and February 2022. Data source: Google Trends (http://www.google.com/trends).

The traditional FC model devotes asynchronous time to the autonomous study of instructional resources (commonly video lectures) and synchronous time to practise and solve doubts (Alegre et al., 2019; Brown, 2012). While FC has been extensively tested in practice, the body of research is still in its early stages (Låg & Sæle 2019; Weiß & Friege, 2021). Akçayır and Akçayır (2018) reported six advantages of FC that frequently appear in research, namely learner outcomes, pedagogical contributions (e.g., flexible learning, self-efficacy, attendance), time efficiency, positive dispositions (e.g., perceptions, attitudes), frequent interaction and other (e.g., less anxiety or cost-effectiveness). However, in many cases, FC is implemented without the adequate adaptation of courses to this model and represents only a shift in the content delivery space (Bishop & Verleger, 2013).

This study sought to gather student views on flexible learning, specifically on FC as a model to make learning more flexible in online and hybrid education. In this research, we investigated and compared various applications of online FC that combine synchronous and asynchronous time in different ways to traditional approaches to organising time in online learning (i.e., fully synchronous and fully asynchronous). Therefore, when we describe synchronous and asynchronous time, we do so under the model of FC and considering all characteristics to prompt flipped learning (e.g., self-regulation strategies, active learning, constant feedback, collaborative learning). Synchronous and asynchronous learning are not equivalent to FC per se, even though, in this study, we always refer to synchronous and asynchronous time under a FC design. Three research questions drove this study:

(1) What FC model do students prefer in online education?
(2) Is there any difference in how students perceive flipped learning depending on their preference of the teaching delivery mode?
(3) How do reasons students give to describe a preference for flipped learning models relate to constructivist learning theories?

A multiple case study from two universities was used to reflect on student preferences for online learning. Results show that students attending online and hybrid forms of teaching prefer the FC as they perceive that it offers opportunities for flexible learning and self-regulation and meaningful interaction in synchronous instruction. Ultimately, these responses reflect student favouring of social constructivist approaches to learning.

Effectiveness of flipped classroom for flexible learning and teaching

A traditional definition of flexible learning states that the limitations of time, place and pace are overcome. Flexible learning refers to offering choices to learners to meet their needs; for instance, class times, course content, instructional approach, learning resources and location, technology use, completion dates and communication medium (Huang et al., 2020). From the teaching point of view, flexible teaching is defined as "an approach to course design and delivery that helps students learn and succeed in any mode: F2F, online, or hybrid" (Duke Learning Innovation, 2022). The FC is a type of blended learning that can support flexible teaching and learning.

FC is effective in higher education as it improves academic performance (e.g., Chang et al., 2020; Chyr et al., 2017; Kurt, 2017), motivation and self-regulation (Galindo-Domínguez, 2021). Students prefer FC over

traditional approaches because it provides flexible paced learning (Alghasab, 2020; Butt, 2014; Gilboy et al., 2015). However, literature on online FC reports both positive and negative results (Özüdoğru, 2021). Positive results include self-directed learning (Domínguez-Torres et al., 2021), maintenance of students perceptions and performance in comparison to F2F (Gopalan et al., 2022), increase in average grades obtained in hybrid FC (Fidalgo-Blanco et al., 2020) and increase in student engagement (Swart et al., 2021). On the contrary, the application of online FC in a study by Tang et al. (2020) resulted in dissatisfied students even if their learning, attention and evaluation improved. Lin et al. (2019) emphasised the need for efficient use of technologies in online flipped learning.

Interestingly, recent results from the use of FC to emergency-online learning demonstrated that FC adapts fairly well to online mode, increasing student engagement and performance (Campillo-Ferrer & Miralles-Martínez, 2021; Gopalan et al., 2022; Jia et al., 2022; Latorre-Cosculluela et al., 2021). As for the target groups of our study, in engineering degrees, results show a positive impact on learning processes and student acceptance in online FC (Polanco & Moré, 2020) even if further research on effective FC in distance education is needed (Nahar & Chowdhury, 2019). In education degrees, the flipped model has proven to be effective in online education for student learning, performance and motivation and in relation to the quality and variety of didactic resources provided (Collado-Valero et al., 2021; Romero-García et al., 2021).

The opportunity of the flipped classroom to foster social constructivism

The social constructivist approach to learning states that learners construct knowledge in a process of integration, interrelation of ideas and construction of knowledge based on prior knowledge – accomplished through interaction with others and tools. In social constructivist theories, learning starts by participating in authentic experiences and the social context has a great impact on learning. The FC model has attracted attention as it supports the social constructivist approach and prompts three important priorities in education: self-regulation, student-centred learning and flexibility.

FC is capable of reinforcing co- and self-regulated learning, incorporating more flexibility into learners' and teachers' work and enabling learners to profit from the digital and physical world (Hartyányi et al., 2018). An effective FC scenario will prompt student self-regulatory skills by scaffolding them during the three self-regulation phases (forethought, performance and self-reflection) (Zimmerman, 2000). Furthermore, it might facilitate flexible learning by adapting to student choice of when and where to study, offering uninterrupted access to learning materials and adapting to special educational needs, prior knowledge and interests. Lastly, it may prompt student-centred learning by engaging learners and promoting learning ownership through the design of learning activities and the shared responsibility for learning between the teacher and the students.

The main contribution of our research is to present the reasons why first-year students prefer flexible teaching models that foster social constructivist learning practices. To that aim, we provide a method to analyse FC preferences from a social constructivist perspective.

Methodology

Participants and sample

This paper reports a multiple case study focusing on first-year university student perspectives on modes of teaching (online and hybrid) under the FC model (combining synchronous and asynchronous time) and more traditional approaches to online learning (fully synchronous and fully asynchronous). These modes were available to students during the academic course (2020–2021) in response to the pandemic. Case studies from two universities of two disciplines in Spain are presented. The first case presents a double example of the application of a unique course design under the FC model, where students were able to select the teaching mode (online or hybrid). The second case shows a set of combinations of synchronous and asynchronous learning and discusses the preference among students towards those who were driven by the flipped learning model. Table 1 summarises the cases.

Australasian Journal of Educational Technology, 2022, 38(4).

Table 1
Case descriptions

Case	Date	University	Faculty	Groups & students	Mode of teaching	Description
1	Apr–Jun 2020	U1	Education (Early Childhood Education Degree) 1st-year course in communication in education	GA: 27	Fully online	• 5 classes of 5 hours, half synchronous and half asynchronous every 2 weeks. • Flipped model: (1) resources uploaded in advance that had to be reviewed, (2) 2.15 hours of synchronous learning to perform activities and solve doubts, (3) 2.15 hours of asynchronous and self-paced guided work.
			Education (Primary Education Degree) 1st-year course in communication in education in English	GB: 30	Hybrid: students F2F & teacher online	• 9 F2F sessions of 2.15 hours every week with remote synchronous guidance from the teacher • Flipped model: (1) resources uploaded in advance that had to be reviewed, (2) 2.15 hours of synchronous learning to perform activities and solve doubts, (3) self-paced learning.
2	Sep–Nov 2020	U2	Engineering 1st-year course: Introduction to Information and Communication Technologies (IICT)	164 English: 65; Spanish: 99	Online	• 25 sessions of 50 hours (14 large-, 4 medium-, 7 small-group sessions). • Across 2 group classes of the course (English, Spanish), there were 14 instructors who were able to choose the online learning model to apply. Students experienced multiple models (traditional online lecture, active learning lecture, flipped model).

The first case (C1) involved two group classes (English, Catalan) within two education degree courses (Communication in Education) for a total of 57 first-year students. Students had the opportunity to decide whether to follow the course online or hybrid. In both cases, the teaching method was the FC. Students had to consult the materials before each class and had individual and group work to perform. Synchronous time was devoted to practising and solving questions. The learning activities and materials were the same. In the online model (GA), the asynchronous time was structured and guided by the teacher, while in the hybrid model (GB), students self-paced their learning.

This course was previously designed following the flipped model and it was adapted to the online mode during the academic year 2020–2021. The course design aimed to foster collaborative knowledge building under a social constructivist approach (Figure 2). Both in the online and hybrid modes, the course integrated the following key characteristics to prompt collaborative knowledge building: meaningful learning scenarios, active learning (high order skills), collaborative learning, self-regulation opportunities, student-centred learning and flexible learning. The use of the Moodle platform and the Google suite facilitated out-of-class learning.
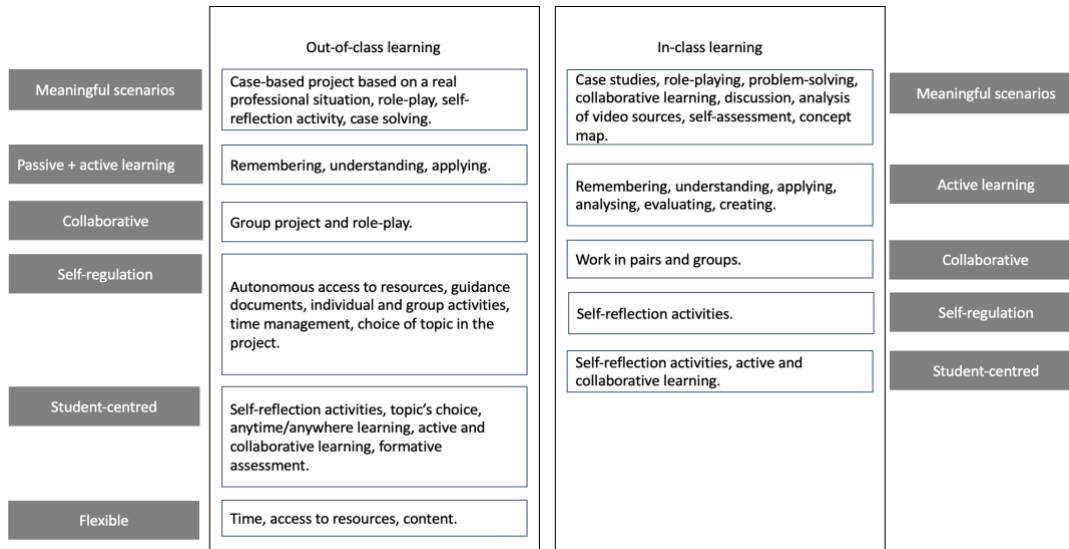
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Figure 2. C1 course design follows a social constructivist approach to learning

The second case (C2) involved two group classes (English, Spanish) within an engineering degree course (IICT – Group A; IICT – Group B) for a total of 164 first-year students. The compulsory course, Introduction to ICT (IICT), serves as an introduction to university studies in the engineering school. The course comprises 14 large-group sessions (average size of 53 students), 4 medium-group sessions (average size of 26 students) and 7 small-group sessions (average size of 13 students) sessions of 2 hours each. One small-group session was F2F; all subsequent sessions were online. The 2020–2021 IICT course involved numerous instructors (14), all of whom were given permission to select the model of online teaching for their classes – be it flipped, fully synchronous or fully asynchronous. The institution recommended reducing the online synchronous sessions to 90 minutes. This resulted in students experiencing different models such as traditional online lectures and flipped learning models. For example, a FC was used for a medium-group session on evidence-based learning strategies. Students were given 1 week to asynchronously consult video resources (five videos: introduction, types of practice, scheduling practice, structuring practice, conclusion) and complete no-stakes reflection questions following each video. The resources and question tasks were hosted in a learning management system. An optional synchronous session was offered to solve any doubts students had regarding the video content.

This session was previously designed following a spaced learning method in which content is rapidly presented and then repeated two more times. The repetition of content is separated by two 10-minute distractor activities. This method is thought to facilitate rapid long-term memory formation (Kelley & Whatson, 2013), and student views of the particular session in the past had been very positive (Beardsley et al., 2021). The flipped model was selected to carry out this session online as there was uncertainty surrounding how to best adapt the spaced learning method for online learning. Another medium-group session on data privacy maintained its format as a traditional synchronous class. It was taught as an online lecture with interspersed activities recreated using a digital technology (Mentimeter).

Research instruments

In both cases (C1 and C2), students were invited to respond to a survey that collected their views on preferred teaching methods for online learning. In C1, a questionnaire with 29 Likert-scale items (labelled from 1 – *strongly disagree* to 5 *strongly agree*) grouped in 5 dimensions (design, benefit, participation, motivation, academic performance) was administered to students at the end of the course (Appendix A). The validity of the questionnaire relies on literature and previous surveys used for its creation (Aljaraideh, 2019; Barua et al., 2014; Del Arco et al., 2019; Sánchez-Rivas et al. 2019). As for the reliability, all alpha coefficients are greater than 0.70 (over 0.8 in four subscales) and can be considered acceptable for exploratory research (Charter, 2003). A total of 20 students from GA (90% female, 80% aged 18–20 years old, 20% aged 21–23 years old) and 16 students from GB consented to participate in the survey (87.5% female, 75% aged 18–20 years old, 12.5% aged 21–23 years old, 12.5% older than 24 years old). The response rate was 74% for the GA and 53% for the GB.

In C2, a questionnaire with one rank order question regarding student preference for online teaching modes (see responses in Figure 3) and an expansion open question were administered to students in the middle of the course. We designed the initial rank order question to reflect the experiences of students in the IICT course. For example, in a message sent to students, they were explained that one of their classes was "asynchronous – this means that you will do the tasks at your own pace" with all tasks due by a specific deadline. The same message posted in the learning management system stated that an online synchronous class was offered as "a short tutoring session" in which attendance was optional. As each instructor in the course was able to select the teaching mode but the institution recommended reducing the online synchronous sessions to 90 minutes, the hypothetical scenarios in the rank order question were generated with the intention of capturing the possible experiences of students in IICT while using terminology they were familiar with. A total of 164 students responded to the questionnaire: 65 English students from IICT-A (81.25%) and 99 Spanish students from IICT-B (84.61%). The validity of the analysis of data from this questionnaire, and the entire study, relies on the process of triangulation (investigator triangulation, data source triangulation and theory triangulation) (Patton, 1999). We authors, who belong to different knowledge areas and institutions, took part in the data analysis and interpretation of results. The data sources are the students (from two university institutions and different disciplines) and scientific literature. We analysed the data from the perspective of online flexible learning theory and from the social constructivist approach to learning. Furthermore, to be consistent, we used the same categories to analyse the data from both questionnaires. We discussed divergences among us in regard to data analysis and solved by reviewing the data, categories and interpretations repeatedly, which increased the reliability of the study.

Data analysis, collection and ethics

We analysed the quantitative data using IBM SPSS Statistics version 28.0. To analyse the qualitative data, we used Excel, and the coding scheme followed the broad categories of the C1 questionnaire (Appendix A). We used two groups of categories to analyse and relate the quantitative and qualitative data gathered through the two surveys in relation to satisfaction (design, benefit, participation, motivation and performance) and social constructivist characteristics (meaningful learning, active learning, self-regulated learning, student-centred learning and flexible learning). Although the response rate for all cases is high, the number of students and number of courses is small, and results are not representative nor sufficient to be able to generalise. Findings presented below seek to describe cases that are representative of solutions given to online learning in the first academic year of undergraduate studies following the onset of the pandemic in two different disciplines in terms of teaching modes. Results might offer some insights into student preferences over a range of technology-mediated teaching delivery modes.

We followed the institutional ethical considerations with study participants. Students were informed about the research and specific goal for data gathering through the survey. We gave information about data exploitation, confidentiality and anonymity of data. Students participated voluntarily and agreed to share their data for research purposes.

Results

C1: Comparison of student perceptions of online and hybrid flipped models

This section presents C1, a survey comparison of student perceptions of online and hybrid flipped models in the context of a first-year undergraduate course. Students in GA and GB had the choice to select their preferred mode of teaching: online or hybrid. GA selected the online mode, and GB the hybrid one. GA representatives argued that the online mode was more comfortable and permitted greater time management. GB representatives defended their group's selection of the hybrid mode as they prioritised direct social contact with classmates. Results of the Likert scale items are presented in Figure 3 and show that the GB (hybrid) flipped model obtained slightly higher ratings than the GA (fully online) model on almost all items. Note that both models received high ranks (above 3 out of 5) in all survey items.
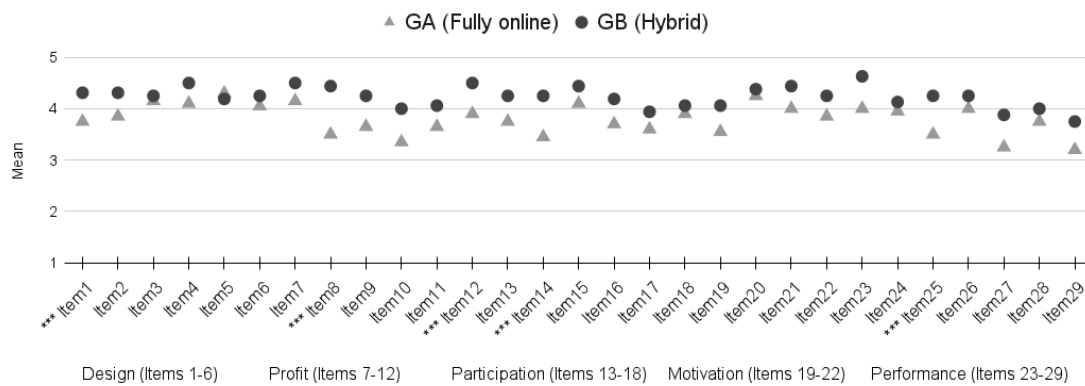
Figure 3. Survey items results (5-point Likert scales) shown based on the flipped model experienced by students. Asterisks indicate statistically significant differences (Mann–Whitney U test).

Statistically significant differences were found in 5 of 29 survey items (Table 2; asterisks in Figure 3). Students who experienced GB gave significantly higher ratings when compared to GA on valuing the contribution that the flipped model brought to (1) giving access to a variety of resource formats, (2) offering students the ability to reflect and organise ideas for evidence and work, (3) supporting the development of critical thinking skills and creativity, (4) providing the opportunity to express arguments in discussions and (5) ensuring that learning was proportional to effort.

Table 2
Survey items that present statistically significant differences (Mann–Whitney U test) when comparing hybrid and online flipped models

Survey items		GA M (SD)	GB M (SD)	Signif. test
1	The flipped classroom model has contributed to increasing the variety of resource formats. (Design)	3.75 (0.716)	4.31 (0.704)	U = 95.0 $p = 0.027$
8	The flipped classroom model has contributed to the ability to reflect and organise ideas for evidence and learning products. (Benefit)	3.50 (1.147)	4.44 (0.892)	U = 85.0 $p = 0.012$
12	The flipped classroom model has contributed to encouraging the practice of critical and creative thinking. (Benefit)	3.90 (0.852)	4.50 (0.632)	U = 96.0 $p = 0.028$
14	The flipped classroom model has contributed to the feeling that I have the opportunity to express my arguments in the discussions. (Participation)	3.45 (1.146)	4.25 (1.065)	U = 91.0 $p = 0.021$
25	The flipped classroom model has contributed to the fact that the learning carried out is proportional to my effort. (Performance)	3.50 (1.000)	4.25 (0.856)	U = 88.5 $p = 0.017$

Survey items were originally grouped in categories related to design, motivation, benefit, performance and participation. *T* tests were performed to compare whether there were statistically significant differences between the groups. Only the category of benefit presented statistically significant differences (GA: *M* = 3.7, *SD* = 0.945; GB: *M* = 4.3, *SD* = 0.57; $t(34)=-2.193$, p=0.035).

Survey items can also be grouped based on characteristics of a social constructivist approach to learning design as follows: meaningful learning (items 21, 20); self-regulated and flexible learning (items 2, 8, 10, 11); collaborative learning (items 6, 13, 16); student-centred learning (items 7, 17, 18); and active learning (items 12, 23, 26). No statistically significant differences were found when comparing items grouped by constructivist categories between GA and GB. However, item 8 "The flipped classroom model has contributed to the ability to reflect and organise ideas for evidence and learning products." related to self-regulated and flexible learning, and item 12 "The flipped classroom model has contributed to encouraging the practice of critical and creative thinking." related to active learning present statistically significant differences when comparing both groups (as reported in Table 3), with the GB (hybrid FC) group placing greater value on these two constructivist design characteristics in the context of FC.

C2: Online teaching-learning models preferred by students

Figure 4 presents the online teaching-learning models preferred by students (first choice and rank) resulting from the C2 survey. The graph shows results considering all students of the IICT subject and by language cohort (Spanish vs. English groups). Quantitative results show that most students (71.2%) prefer the flipped learning model with different combinations of synchronous and asynchronous online teaching-learning time (B, C and D) over a real-time synchronous online class (20.1%, E) or an at-own-pace asynchronous class (8.5%, A) of 90 minutes. Among the possible combinations of FC, students are roughly evenly split between those who prefer to have a 60-minute asynchronous at-your-own-pace work first followed by a 30-minute synchronous tutoring class (B and C, 37.1%) and those who prefer a 45-minute synchronous class followed by 45 minutes of autonomous work (D, 34.1%).

Interestingly, 28% out of the 37.1% of students who prefer to have a tutoring session after an asynchronous autonomous work time stated that they would prefer the tutoring session to be optional (B) whereas the remaining 9.1% would prefer to have it mandatory (C). Moreover, if we consider that models B and C could correspond to an online version of the traditional flipped-classroom model (where out-of-class learning precedes in-class learning), the results indicate that this is the preferred online teaching-learning model by students (37.1%).

When comparing language cohorts, the FC model (B, C and D models together) is still the preferred option in both cases. However, a much higher percentage of students in the Spanish cohort prefer a synchronous class of 90 minutes (26.3% Spanish group versus 10.8% English group). On the contrary, a higher percentage of students in the English cohort prefer an at-your-own-pace class of 90 minutes (12.3% English group versus 6.1% Spanish group). Moreover, when comparing the models individually, the top ranked option from the Spanish group is model D (34.3%), whereas in the English group, it is model B (35.4%).
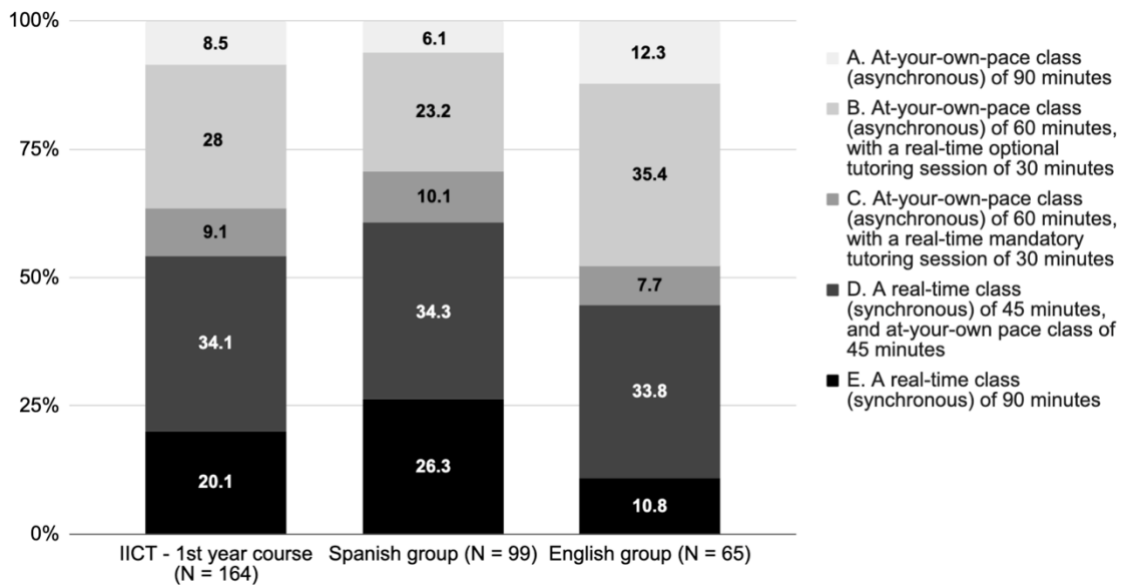

Figure 4. Student 1st-choice ranks of online teaching-learning models: all students, Spanish cohort, English cohort

Results of the qualitative analysis of responses to the open question "Explain your ranking for the type of online classes you prefer" follow. When comparing student reasons for choosing their preferred online teaching-learning model, we see differences dependent on whether students marked their first choice as a fully asynchronous online autonomous work (A), a fully synchronous online class (E) or a FC model (B, C, D) (Figure 5).
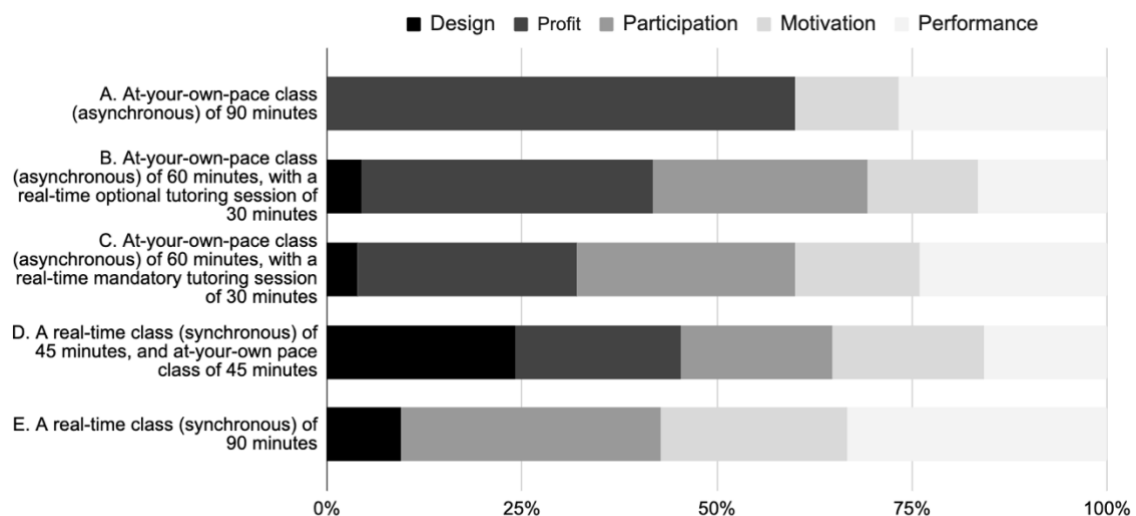
Figure 5. Summary of categorisations of student reasons for their 1st-choice ranks related to teaching-learning models (*N* = 141 students provided at least a reason in the open question; students could provide more than one reason at the same time)

Following are the reasons given by students for choosing each model:

- Model A (asynchronous class of 90 minutes): Reasons were mainly related with benefit (60%) – e.g., time self-management, sense of improving, performance (26.7%) and motivation (13.3%).
- Model B (FC model with optional synchronous tutoring session): Reasons were mainly related with benefit (37.4%) and participation (27.5%). These were followed by performance (16.5%), motivation (14.3%) and design (4.4%). Students highlighted the opportunity to organise work at their own-pace and detect learning gaps before optionally attending the synchronous tutoring session for solving doubts.
- Model C (FC with mandatory tutoring): Reasons were similar to the B model regarding participation, design and motivation. However, a difference is that student reasons shift from benefit (37.4% in the optional tutoring mode vs. 28% in the mandatory tutoring mode) to performance (16.5% in the optional vs. 24% in the mandatory). Students preferring the mandatory tutoring session feel that being forced to attend the synchronous class is beneficial for them for interacting with the teacher and classmates to solve doubts and engage in discussions.
- Model D (FC combining 45-minute synchronous class followed by 45 minutes of asynchronous autonomous learning): Reasons were fairly evenly distributed across categorisations. The order was design (24.1%) – e.g., to take advantage of the best of both synchronous and asynchronous classes; benefit (21.3%); participation (19.4%); motivation (19.4%); and performance (15.7%).
- Model E (real-time class of 90 minutes): Reasons were mainly related with participation (33.3%) – e.g., doubts solving and synchronous interaction with the teacher, performance (33.3%) and motivation (23.8%) – e.g., having a sense of being more focussed and having compulsory time to work on the content. Only 9.5% of reasons given were related to design (e.g., similarity of the model to a face-to-face class, video watching is not required, unique learning model and balanced workload).

Appendix B exemplifies, through excerpts, students' reasons for preferring Models A–E.

Open responses from students who selected options Models B and C have been analysed with regard to characteristics of the flipped learning model that link to the constructivist approach to learning. Table 3 summarises the number of responses related to key aspects of social constructivism for flipped learning stated in literature (meaningful learning, active learning, self-regulated learning, student-centred learning and flexible learning). Most highlighted characteristics are student-centred learning, mainly referred to as doubt-solving (32) and self-regulated learning, mostly linked to self-paced learning and time-management. Flexible (3), active (2) and meaningful learning are anecdotally cited.

Table 3
Student reasons classified according to social constructivist characteristics

Constructivist characteristics	Related concepts	Number of responses	Excerpts
Meaningful learning	To learn more and better	1	(C) "It could use the 3x2 technique and thus be able to learn more and better."
Active learning	Practice Interactive	1 1	(B) "To me it will be better to learn then practice then learn then practice again."
Self-regulated learning	Self-paced learning Reduce dependency on the teacher Time management	29	(B) "It's better at your own-pace-class since you can do them whenever you want, which is really beneficial as you can take the lessons when you feel more motivated and concentrated and you can stop when you are not. It is good to have some time for tutoring as well in order to solve doubts in case something is not clear at all."
Student-centred learning	Doubt-solving Individual needs	32	(B) "What I personally go better is having a tutorial class that can help the student to better understand classes"
Flexible learning	Time-management	3	(B) "I prefer working at my own pace, as it gives me the flexibility to manage my own time."

Discussion

Results of this study are in line with previous research that has found students prefer FC over traditional approaches because it provides flexible paced learning (Alghasab, 2020; Butt, 2014; Collado-Valero et al., 2021; Gilboy et al., 2015; Romero-García et al., 2021). Reasons given for preferring the online traditional FC are comfort, self-paced learning and time management. However, the hybrid model is still desired for maintaining synchronous and in-person contact with classmates. In addition, as demonstrated in the literature (Campillo-Ferrer & Miralles-Martínez, 2021; Gopalan et al., 2022; Jia et al., 2022; Latorre-Cosculluela et al., 2021), C1 shows that the flipped model adapts well to both online and hybrid instruction as high satisfaction rates were obtained from students. Moreover, study results highlight students' perceptions of flipped learning benefits while considering the teaching delivery mode. Benefits comprise (1) having access to a variety of resource formats, (2) consulting resources at their own pace, (3) having the ability to reflect and organise ideas for evidence and work, (4) being able to self-regulate their learning, (5) working in advance to identify their learning needs, (6) developing critical thinking skills and creativity, (7) gaining opportunity to express ideas and arguments in class discussions and (8) better receiving learning that is proportional to effort invested. In line with Sousa et al. (2021), students perceive that flipped learning makes their time more productive and provides more opportunities for practice. In C1, one reason for the greater perceived learning experience of the group that selected the hybrid model could be that it implied attending almost twice the number of sessions. According to Låg and Sæle (2019), interacting more with the teacher and classmates and repeating the flipped sequence throughout the degree could lead to a greater degree of satisfaction. In C2, apart from the learning benefit, reasons for selecting the flipped model are also related to participation and performance aspects.

Students who prefer FC seem to advocate for constructivist and social constructivist approaches to learning. They perceive that FC better contributes to active learning, meaningful learning and collaborative learning (C1) and to self-regulated and student-centred learning (C2).These results align with previous studies (Hussain et al., 2020; Xu & Shi, 2018), which found that the flipped model supports constructivist learning as it facilitates putting the student at the centre of learning. It allows students to actively construct knowledge building upon their prior knowledge, as their learning needs are scaffolded by the teacher and

classmates. Furthermore, as previously reported (Eryilmaz & Cigdemoglu, 2019; Gökçe, 2020; Hayashi et al., 2015; Kanjug et al., 2018), this study confirms that cooperative learning is suitable for FC as demonstrated in C1; students in C1 constructed knowledge actively and autonomously by means of digital resources and activities and, in class, benefited from interactions with teachers and peers to perform meaningful, active and collaborative activities in the zone of proximal development – the difference between what a learner can do without help and what the learner can do with the support from a skilled partner or teacher (Vygotsky, 1978).

To effectively foster social constructivism through FC in university contexts, we recommend considering both synchronous and asynchronous learning spaces in course design, no matter if these contexts are mediated by technologies or not. This can amplify opportunities to learn autonomously and asynchronously, and to collaborate and get feedback in synchronous contexts. We also recommend course design to include opportunities for student-centred learning, active learning, flexible learning and self-regulated learning, through meaningful and collaborative activities, to prompt social constructivist practices. The inclusion of a variety of resource formats, reflection activities and discussion-based activities is also encouraged.

At the university level, course design is often performed individually and is dependent on the pedagogical knowledge or experience of the individual (often a professor) leading the course (Seonghee & Boryung, 2008; Toohey, 1999). Based on results presented in this paper, we suggest supporting course designers with guidance and scaffolds regarding flexible modes of learning, and more specifically FC, to better satisfy student learning needs and desires. As McDonald and Mayes (2007) wrote, one approach could include having an instructional design team support professors in making informed-design decisions. Another approach could be advocating the use of lesson planning tools (learning design tools) that scaffold the implementation of flexible learning modes such as FC. Tools such as edCrumble make use of learning design data and provide specific guidance for blended learning design (Albó & Hernández-Leo, 2020). This innovative approach offers a data-driven way in which courses can be designed and shared with others.

While the potential of FC surpasses the mere instrumental use of technologies, technologies can facilitate the effective application of constructivism or social constructivism with an emphasis on student-centred learning, active learning and self-regulated learning. Thus, we recommend using digital technologies to amplify time spent outside the classroom as there are more opportunities to share content, interact with students, communicate and provide and receive feedback. Online resources and social media offer new opportunities to learn in a social and interactive way (Brown, 2012).

The main contribution of this study is to show that first-year university students engage with flexible forms of teaching that support social constructivist learning practices. We have demonstrated that first-year university students prefer a FC model that combines self-paced learning followed by synchronous interaction no matter the discipline and mode of teaching (online or hybrid). The main lesson learned is that learning theories, such as social constructivism, offer us reasoning and a basis to develop effective practices. Moreover, the flipped model supports social constructivist characteristics such as student-centred, self-regulated learning, active-learning and flexible learning. The flipped model has the potential to represent a shift towards blended and flexible modes of teaching and learning. To implement it effectively, further research on flexible and flipped learning design is needed.

Conclusion and future work

Results of the study help demonstrate the need to rethink face-to-face universities to adapt to new generations of students who advocate for flexible forms of constructivist approaches to learning. Flipped modes of teaching presumably adapt well to the current need for flexible teaching and learning. They facilitate self-paced learning through digital resources and active and social learning in real-time class. They permit F2F, online, blended and hybrid modes of teaching and a range of active and student-centred practices.

The future of universities is hybrid, in which the design of courses considers synchronous and asynchronous spaces no matter if these contexts are mediated by technologies or not. Efforts should be made to move beyond the traditional distinction between F2F and virtual education and start to generate scenarios for flexible teaching and learning practices adaptable to any circumstance, need and learner. Technologies matched with effective teaching approaches can facilitate contexts to learn continuously with minimal

disruptions. Emergency remote teaching experiences have brought forth this need for flexibility and also demonstrated that many traditional F2F courses have been able to function online – albeit with much room for improvement.

Future work is needed to investigate characteristics of the effective application of flipped learning for social constructivism in a range of disciplines and in a broader number of courses. This work should include exploring ways to deepen the regulatory skills of first-year students in the context of hybrid and online flipped learning scenarios grounded on social constructivist approaches to learning. Further research is also needed to determine the features of technologies to support effective flexible and flipped learning scenarios.

Acknowledgements

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Appendix A

Questionnaire used in C1

Category	Items	Cronbach's alpha
Design (6 items)	The flipped classroom model has contributed to ... 1. increasing the variety of resource formats 2. the availability of resources before the synchronous session 3. increasing the relevance of resources consulted asynchronously for synchronous sessions 4. increasing my understanding of the key concepts through the activities during synchronous sessions 5. the effective integration of technologies in teaching 6. facilitating collaborative learning using digital technologies	0.745
Benefit (6 items)	7. ensuring time for doubts solving 8. the ability to reflect and organise ideas for evidence and learning products 9. facilitating the development of evidence and learning products 10. developing the ability to self-pace my learning 11. reducing the dependency on the teacher 12. encouraging to practise critical and creative thinking	0.911
Participation (6 items)	13. effective workgroup and working with pairs 14. the feeling that I have the opportunity to express my arguments in the discussions 15. greater opportunities to interact with the teacher 16. greater opportunities to communicate with other students 17. teaching guidance and progress monitoring 18. greater opportunities to ask more questions during synchronous sessions	0.861
Motivation (4 items)	19. better disposition to learning in synchronous sessions 20. greater perception of the utility of learning for my future career 21. interesting teaching and learning process 22. an enjoyable teaching and learning process	0.834
Performance (7 items)	23. facilitating opportunities to apply theory in practical activities 24. understanding concepts and procedures 25. the fact that the learning carried out is proportional to my effort 26. developing my professional competence 27. improving my academic achievement 28. the feeling that I am prepared to complete learning activities and the project after consulting the resources autonomously 29. feeling that I am more prepared for my exam	0.929

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Appendix B

Codes and student excerpts of the open responses to "Explain your ranking for the type of online classes you prefer."

Code	Excerpts (teaching-learning model code in brackets)
Design	(E) "I prefer that the whole class is in the same format and not having to be making changes." (E) "doing the most similar to a face-to-face class it's for me the best way to teach a lesson, moreover if assistance is mandatory." (B) "I think it is really useful to have the option of asynchronous lessons, as you can stop them, repeat the lesson if necessary, etc." (lesson materials point of view) (D) "I prefer balanced work, not only one kind of learning." (D) "I think the best is to have some content to do on my own but at the same time I think it is profitable to attend class and participate. I think it's the perfect balance."
Benefit	(A) "I'd rather work at my pace and if the session is asynchronous I can organise myself better for the calendar." (B) "I prefer at-your-own-pace classes because I feel they are more individual and each student can focus on their weaknesses and spend more time on them and less time on the things they are better at." (C) "I like to have at-my-own pace classes. I think that they are one of the few good things that the pandemic has brought. When studying concepts on my own, it is easier for me to become conscious of what I understand and what I don't understand. Furthermore, it gives me the opportunity to dedicate more time to think about the concepts that I didn't comprehend, which is practically impossible with a synchronous class." (D) "I think that a mix of both real class and at your own pace makes the class more productive, as if it is only real time it can get too much, and if you do the whole thing at your own pace it can also become a little bit tiring."
Participation	(E) "I value the interaction between students and teachers. When possible, classes should be face-to-face." (C) "I also think it is important to have a tutorial session to be able to ask questions and clarify ideas. Personally, I prefer this class to be mandatory because it is quite likely that if it were not, I would not attend." (B) "It's good to have the chance to attend an optional tutoring session to have feedback. This tutoring is better to be optional but I wouldn't mind it being mandatory." (C) "I also choose a mandatory tutoring session over the optional one, because otherwise people probably would prioritise other mandatory work than the class and I really think the contact is important. For that reason for sure I wouldn't like doing it all by myself because it would be less appealing." (D) "I think it is important that there are the two components in the online class (synchronous and asynchronous) but that there must be a strong preference for the synchronous class as the figure of the professor is very relevant."
Motivation	(E) "I found it much easier to concentrate and I get much more motivated if I am in a synchronous class with someone actually talking to me in real time rather than an at-your-own-pace class." (A) "Sometimes if there is a very long real time class I get bored and disconnect, while if I am alone I can do things the way I like ..." (B) "I feel like the classes we enjoy more are the ones that we can work on our own and then ask questions or whatever we want to the teacher because, on the other hand, the online classes that only the teacher talks are a lot less interactive and they are kind of boring." (C) "The fact of having a time to have a tutorial or class with the teacher directly, once the class has been had, allows you to present doubts and make comments that make it more enjoyable and more useful." (D) "I think that a class of 45 minutes of each is the best since it is the most varied, and therefore, it is not so heavy the fact of being for a long time doing the same."

Performance	(E) "My main preference is to make a synchronous class because I think the concepts are better understood." (A) "For me it is better to do the classes at your own peace, since if you are productive you can distribute them in a better schedule and you can focus on the topics you don't dominate instead of having to see the explanation of all of them." (B) "I prefer an online class at my own pace because I can pause the video or rewind it if I have not been able to listen or understand something and then an optional synchronous class to solve doubts or aspects that have not been clear." (C) "I think doing at-my-own-pace class and then tutoring would be so efficient and fun, because I could revise the previous material whenever I want and as many times as I need to process it. Then, having the tutorial would help with doubts or merely to discuss the issue and exchange ideas." (D) "It seems to me that the synchronous class of 45 minutes with one at your own pace is beneficial to practise in the other 45 minutes, what we studied in the previous 45 minutes."