PRE-SERVICE TEACHERS' PERCEPTION OF ACTIVE LEARNING METHODOLOGIES IN SOCIAL SCIENCES: FLIPPED CLASSROOM AND GAMIFICATION IN AN E-LEARNING ENVIRONMENT

Abstract

The scientific literature reveals the impact of the application of game-based videos and gamification on undergraduates' learning. This work proposes, within an online context, the use of these educational strategies to make students the active protagonists of their learning. Therefore, it aims to analyze the students' perception of the effectiveness of the application of game-based videos (within a flipped classroom framework) and gamification in order to improve knowledge and competencies. The experience was carried out for four months by pre-service teachers (n =190) in an online Social Sciences course. In an ecological environment, a quasi and pre-experimental design was used, in which the students were provided with the lesson plan and filled in an *ad hoc* questionnaire. The results indicate a positive impact in all the assessed aspects after the implementation of the innovative experience. A different teaching style, with the student as the protagonist of the learning process plus the improvement of learning, shows significantly positive educational results. These preliminary findings enhance the development of pre-service teacher training and a student-centered teaching-learning process. Consequently, guidelines are provided to advance innovative educational experiences in online higher education.

Keywords

Gamification, Flipped Classroom, ICT, Game-based Videos, Higher Education, Pre-service Teachers, Active Learning Methodologies.

Introduction

Nowadays, teachers need to acquire the necessary knowledge and skills to be able to use technology as a resource within the teaching-learning process (Nikou & Aavakare, 2021; Kleimola & Leppisaari, 2022; Asratie et al., 2023). An innovative teacher transforms the resources and spaces in which education has been developed so far, and develops a more creative and interactive environment. Therefore, at the university level, training should be characterized by providing quality initial pre-service teacher training, preparing future teachers for the challenges of a changing society where the educational system plays a key role in adapting and responding to new emerging trends and demands. Thus, training should be focused on the contextualization of the learning process (Van Laar et al., 2020; Riivari et al., 2021).

Future research will demonstrate the great training improvement regarding technologies that teachers, at all educational levels, have been forced to acquire to face an imperative and urgent need, to connect with their students virtually due to the spread of the COVID-19 virus. This fact, which has brought a new challenge for the training of all teachers, has demanded educators and students to migrate from a traditional face-to-face system to a completely virtual one (Cheng, et al., 2019; Aprianto et al., 2020; Svetec & Divjak, 2021; Divjak et al., 2022). Similarly, due to the health measures taken during the Covid-19 outbreak, the lack of educational methods has become a major concern among education professionals, who have been using ICT (Information and Communication Technology) and active learning methodologies as motivational tools to help students with the different contents, and enrich their learning experiences in higher education, above all, when face-to-face learning was not possible, as it is our case (Sánchez et al., 2020; Areed et al., 2021; Ghai &Tandon, 2022; Kallunki et al., 2023).

The objective of educational innovation necessarily implies a shift of methodology in the classroom.

It entails, on the one hand, changing the teaching and learning style and, on the other hand, introducing ICT. In this line, this research focuses on two active methodologies: Flipped Classroom (hereafter, FC) and gamification, and two technological tools: game-based videos and gamified online resources in online tertiary education. Several reviews on FC applied in higher education demonstrated how active learning has increased through FC (Bergmann & Sams, 2014; Strelan et al., 2020) and improved knowledge, skills, and participation (Yıldız et al., 2022; Liu & Zhang, 2022). Strelan et al. (2020) also pinpointed that the use of game-based videos within the FC framework provided positive results in active student learning, performance, and motivation, and several studies showed how the integration of FC and gamification provided positive benefits in students' engagement in the classroom, motivation, higher academic performance, autonomy, and learning (Durrani, 2019; Ng & Lo, 2022; Carpena & Esteve, 2022). Therefore, FC has proved more effective than conventional teaching by increasing learning, changing the teaching style, and improving students' involvement and engagement (Mohamed & Lamia, 2020). In this sense, using FC could be one of the possible alternative and efficient models for the near future in the online teaching-learning process of Social Sciences. Thus, in this research, we intend to combine FC with game-based videos and gamification in a lesson plan in the online university context. There has not been similar research conducted in the initial training of pre-service teachers in higher education thus far. Thus, we respond to some educational needs and propose this novel research on the didactic implementation of FC with game-based videos and gamification in an online higher education context in the subject of Social Sciences considering the students' assessments. Accordingly, the following questions arise: (1) Do the students' assessments regarding the teaching style differ after the implementation of the lesson plan in which FC with game-based videos and gamified resources were used in the online university classroom of Social Sciences? (2) After the intervention, was there a difference concerning the students' assessments regarding the learning quality? (3) After the intervention, was there a difference in the students' assessments regarding motivation in the online university classroom of Social Sciences? The empirical findings of this research (students' assessments) suggest implications that provide a number of opportunities and challenges for teaching and learning and, above all, implications for professional training and educational development.

Literature review

The following sections present a brief review of the scientific literature on FC, game-based videos and gamification in education.

Flipped Classroom

FC is considered a different way of learning, in which students obtain new knowledge not only in the classroom but in other spaces such as at home employing videos, educational audio files, images, and learning virtual platforms or LMS (Learning Management Systems), which provide the necessary framework that handles all aspects of the learning process: learning spaces management, synchronous and asynchronous communication, content and group management and assessment (Fernández-Pampillón, 2009) which are easily accessible to students (Akçayır & Akçayır, 2018). It is a pedagogical approach to the teaching-learning process, through which direct instruction takes place outside the classroom and face-to-face time is employed to develop meaningful and personalized learning activities. As its name entails, FC is about teaching in an inverted way. The work usually performed in the classroom is now executed at home and vice versa. The teacher guides each student through strategies and active practices on basic concepts previously worked on (Santos & Serpa, 2020). Thus, the classroom becomes a dynamic and interactive learning scenario (Brewer & Movahedazarhouligh, 2018; Bredow et al., 2021) in which they do their assignments, interact and perform more engaging activities: analysis of ideas, debates, problem-solving tasks or group work. (Basal, 2015).

According to Hamdan et al. (2013), FC is composed of four primary pillars, F-L-I-P: flexible

environment (regarding students' learning times and assessment), learning culture (classroom time is devoted to exploring topics deeply), intentional content (development of conceptual comprehension) and professional educators (teachers provide their students with the most relevant feedback and practice). The teacher acts as a guide (Cukurova et al., 2020; Gedera & Zalipour, 2021) and ICT tools, which foster more personalized teaching adapted to the individual students' needs and rhythms (Wang & Zhu, 2019). The classroom becomes a dynamic and interactive learning scenario in which the appropriate use of time is crucial (Doğan et al., 2021). FC constitutes a magnificent teaching opportunity for innovation and teaching change in line with the new demands and requirements raised in the new socio-educational context. In general terms, it implies three dimensions of learning: i) the social dimension, which allows a greater possibility of working and interacting with other colleagues during the dynamics of the teaching-learning process; ii) The emotional-affective dimension, which fosters motivation and satisfaction of all the educational agents involved (Chou et al., 2021), students work at their own pace, make their own decisions, and teachers consider their students' interests and strengths to promote more active and experiential learning; And iii) the cognitive dimension, which promotes critical thinking work in the classroom, better access to the learning content and provides feedback for continuous improvement and enhancement of lifelong learning (Cueva & Inga, 2022; González-Zamar & Abad-Segura, 2022; Cheng et al., 2022).

Videos in the University Classroom

Along with this proposal, the benefits of using videos in the classroom and an educational environment are numerous. Educational videos are defined as the ones that fulfill a previously formulated objective (Bravo, 1996) and are a pedagogical tool to achieve different goals and capabilities in students in any educational context (Shoufan, 2019; Santos et al., 2020). The convenience and versatility of videos make them relevant resources with technical potentialities and didactic purposes to be used by students, teachers, and educational institutions, whether at primary or secondary education or higher levels (Al-Samarraiel, 2019; Sahin, 2020). These videos are different from teachers talking videos, video lectures, or learning pills, which are teachers' lectures in a digital format and do not usually provide indexing, captioning, and search capability. They are generally videos that expose lesson plans oriented to the transfer of a basic concept or concise data framed within technology, which improves the teaching-learning process of students within the theoretical framework of the European Higher Education Area (Noetel et al., 2021). Likewise, a high percentage of undergraduate students state that traditional lectures are too theoretical and long. Therefore, learning pills help to decrease this issue. However, they are understood to be a source of additional support to traditional notional learning and not as a solution to a much more complex teaching-learning process (Arruabarrena et al., 2021).

Besides, Game-based learning (GBL) is a teaching method that uses games as a resource and strategy to support learning, assimilation, or evaluation of knowledge and support learning outcomes (Velaora & Kakarountas, 2021). It is an innovative methodology that offers students and teachers a different and practical educational experience that can be applied to one subject or topic or integrate several subject areas. If educational games and ICT tools are used together, as in our case when using game-based videos for learning art and history content, GBL is a complete approach that also works on digital literacy and facilitates the understanding of the contents of the subject of Social Sciences (Carrión et al., 2022). In this scenario, game-based videos have evolved from being simply an element of distraction to becoming valuable tools, even demonstrating that they can play a leading role in educational processes and as support for teaching tasks. In this sense, multiple authors justify the relevance of using game-based videos in the educational context (Chang et al., 2022; Gordillo et al., 2022; Yu & Gao, 2022; Turner et al., 2022). They highlight that they motivate students since game-based videos capture their attention, entertain, and provide them with an environment they like. They also promote active learning because these videos offer the possibility of exercising knowledge practically by learning by doing, experimenting, practicing trial and error, establishing

relationships between previous and new knowledge, and making decisions to improve. They also enable students to control their learning because they receive instant feedback on their understanding of a given topic or subject, which allows them to be aware of their degree of acquisition of what they have learned. Likewise, social skills develop since game-based videos are perfect for collaborative work in class.

With this practice, students interact and work on emotional education, communication, and dialogue, which entails a better classroom atmosphere, cohesion among its members, and acquisition of values. For all these reasons, FC and videos as digital didactic resources have created a great interest in education as they develop a learner-centered approach that promotes active and meaningful learning. Students are engaged in their learning experience and develop their scientific and technological knowledge and skills (Santiago & Bergmann, 2018). FC has proven to be more effective than conventional teaching methods since it is a comprehensive approach that combines instruction within a constructivist framework (Mohamed & Lamia, 2020). Although it does not represent a unique learning model, it may be one of the possible alternative and efficient models for the near future in the teaching-learning of Social Sciences.

Currently, many educational institutions, particularly universities, are choosing to create their videos not only for the classroom and coursework but also to enrich the teaching material of the different subjects (Mojtahedi et al., 2020), employing the use of videos with digital tools such as ***EdPuzzle, Camtasia, PlayPosit, OBS Studio, Panopto*** or ***Kaltura***, among others. In this sense, FC is flipping over traditional classes by bringing the lessons to students at any time and place to promote student-centeredness (Strelan et al., 2020). Recent research, similar to our work, allows us to explore the prevalence degree of the FC model as a learning experience in higher education and its impact on knowledge, skills, and participation: Murillo et al. (2019), Yıldız et al. (2022) or Liu & Zhang (2022).

Gamification as an Innovative Experience in Higher Education

In the context of higher education, it is increasingly common to demand new forms and methodologies of learning. It is valuable to carry out teaching experiences that may become successful practices and allow the transfer of information and knowledge. The current student lives in a technological society, surrounded by stimuli and new realities. Thus, gamification emerges as a current increasing educational trend (Briffa et al., 2020; Huang et al., 2020).

Its educational use contributes to greater motivation, participation, collaboration, and fun in the learning process through positive feedback. The natural predisposition of human beings toward competition and games contribute to make tasks less cumbersome or bothersome, performed dynamically and effectively. Gamification is defined as "the use of game design elements in non-game contexts" (Deterding et al., 2011, p. 10) or "the use of mechanisms, dynamics, and frameworks to promote desired behaviors" (Lee & Hammer, 2011. p. 1). More recently, Bai et al. (2022), Dahalan et al. (2023), and Kaya & Ercag (2023), consider gamification as the use of the game method in subjects and applications that do not have a gameful component, with the principal objective of increasing students' participation, concentration, commitment and loyalty, among other values.

With gamification, the educational experience becomes a constant task of discovery in which students are the protagonists of their own learning experiences. Due to the frequent feedback provided, the teacher and the students immediately know the progress achieved. Authors such as Kyewski and Krämer (2018) and Mustafa and Karimi (2021) considered it an effective strategy to optimize the learning objectives and improve performance in a given area. Furthermore, Battle (2016), Martín-Macho (2016), and Pérez (2018) stated that gamification significantly improved undergraduates' motivation. Moreover, Bai et al. (2020), Huang et al. (2020), Sánchez et al. (2020), and Murillo et al. (2021) argued that the use of gamification improved performance, motivation, and a positive attitude toward learning.

The methodological strategy of this work focuses on the integrated use of FC and gamification, a pedagogical approach that is becoming increasingly popular in higher education. Both methodologies allow greater student participation in classroom dynamics. Thus, for this reason, we

justify the importance of combining FC with gamification with undergraduates since they involve positive effects regarding motivation, academic performance, and autonomy. In this line, some works have shown that they can improve students' participation and satisfaction, reduce the complexity of the subject, allow a clear orientation of the task, and improve the efficiency of the session (Durrani, 2019; Ng & Lo, 2022; Carpena & Esteve, 2022).

In this framework, following the relevant literature, gamification is a relatively new trend that is increasingly attracting the attention of educational researchers since the use of gamification in education leads to greater participation, collaboration, and fun in the learning process through positive feedback, and aims to make students more motivated and interested in the lessons.

For all these reasons, this research aims to propose a novel educational experience by implementing gamification at the University level through the use of resources and didactic tools based on gamification principles, *Quizizz* and *Socrative* together with game-based videos under the FC framework. They may constitute effective and motivating educational strategies for learning Social Sciences by emphasizing collaborative, argumentative, and discovery-based learning in the classroom and the students' development of social skills by interacting, exchanging information, and broadening their knowledge. The participants of this study demonstrated that the integrated use of FC and gamification eased teaching, learning, and motivation.

In the review of the scientific literature carried out so far, there is a lack of research on the combined use of FC with game-based videos and gamification in higher education in an online environment. For this reason, this proposal aims to develop a motivating teaching-learning process based on FC with game-based videos and gamification that complements, and enhances the learning of Social Sciences. During this educational proposal, university students used game-based videos and gamified activities and demonstrated that this integrated methodology facilitated teaching, learning and motivation. This research could contribute to the scientific literature on the didactic implementation of FC with game-based videos and gamification in the initial training of Social Sciences of pre-service teachers in online higher education.

Methodology

Objectives

The goal of this research is to know if the use of FC with game-based videos and gamification improves students' assessments of learning (in terms of teaching, learning, and motivation) in the subject of Social Sciences in an online university context. Current studies at university in different subjects (Putz et al., 2020; Behl et al., 2022) evidence the improvement of learning, performance, and motivation, among other aspects, in students who received gamified classes. Therefore, according to recent research and the indicated objectives, the following hypothesis is proposed:

H1: The use of game-based videos (within the FC framework) and gamification improves students' perception (regarding teaching, learning, and motivation) of their learning in the subject of Social Sciences in an e-learning environment.

Method

The present study follows a quantitative methodological approach to collect data on the following questions:

RQ1. Do the students' assessments of the teaching style differ after using FC with game-based videos and gamified resources in the Social Sciences online university classroom?

RQ2. After the intervention, do students' perceptions differ regarding the learning quality in the Social Sciences online university classroom?

RQ3. After implementing the lesson plan, do students' perceptions differ concerning their motivation in the Social Sciences online university classroom?

A quasi and single pre-experimental design has been used with pre and post-test measurements (Maciejewski, 2018). This study consists of the design and implementation of a lesson plan based on the development of contents to innovate the educational practice in the online subject of Social Sciences in the Bachelor of Elementary Education during the 2021-2022 academic year. In October 2021, before implementing the lesson plan, a questionnaire was administered to the sample of the study. The lesson plan was applied for October, November, December and January. In January 2022, once the online Social Sciences classes finished, the same questionnaire was administered again to know to what extent there were differences in the students' assessments (regarding the teaching style, learning, and motivation) of the use of FC with game-based videos and gamification used in class.

Participants

The selection of participants involved a non-probabilistic intentional sampling, selecting all the pre-service teachers who studied the subject of Social Sciences in the third year of the Bachelor of Elementary Education at a private Spanish university. The study sample mainly identified as female (73% female, 26% male) with ages between 20-30 years old (39.5%), 30-40 years old (40.5%), 40-50 years old (19.5%) and over 50 years old (0.5%). There was a small percentage of students over 40 years old (20%) who had redesigned their professional careers and did not have teaching experience. The average age of students was 30 years old. Most of them were students who had already studied for a former university degree and intended to enrich their curriculum and training. All these participants (n =190) received the online classes on the same day. In most cases, the students had no experience with game-based videos and had rarely used game-based videos in the educational context for didactic and pedagogical purposes. They were also adequately informed about the goal of the research before starting the work, following the criteria indicated in the Declaration of Helsinki.

Implementation of the Lesson Plan

The lesson plan implemented in the classroom in the subject of Social Sciences focused on four workshops or online pedagogical practices in which students visualized game-based videos and gamified resources created by the teacher. The teacher used the video editor OBS Studio (Open Broadcaster Software), added a narration/explanation, and elaborated the videos based on the video game Assassin's Creed Origins/ Odyssey and Discovery Tour (Ubisoft, 2021). We used this video game because various authors pinpointed its ecological validity and positive benefits for college students (Arbuckle, 2021; Rollinger, 2020). These game-based videos were available on the teacher's YouTube channel so that students could freely access them everywhere as far as they had an Internet connection. As regards the gamified resources (*Socrative* and *Quizizz*), the teacher created the questions on the websites of the indicated resources and worked on them collaboratively in class. The working methodology of the lesson plan was as follows:

Workshops 1 and 2.

1) Presentation and explanation of the task: during the first minutes, the teacher explained to the students that they would watch a video with theoretical contents about Ancient Egypt based on the video game Discovery Tour Assassin's Creed: Origins, - "Meet the Great Library of Alexandria." The students watched the video at home before the class. During the lesson, the teacher helped the students to solve the questions raised in the video, and then she asked them to write a summary of the content of the video.

[INSERT FIGURE 1]

Figure 1. Video 1. Meet the Great Library of Alexandria with Assassin's Creed Origins. [screenshot].

Source: Own creation. https://www.youtube.com/watch?v=96NWkcgCqJ4

2) Development of the gamified resource *Quizizz*. It is a multiplayer contest. It comprised ten multiple-choice quiz questions on the origin, historical context, and cultural legacy of the Library of Alexandria. Students played the contest individually with their cell phones, and afterward, the teacher shared and commented on the results of the *Quizizz* contest with the class. Students received immediate feedback on what they had learned with the game-based video.

[INSERT FIGURE 2]

Figure 2. *Quizizz*: The Great Library of Alexandria with Assassins Creed Origins. [screenshot]. Source: Own creation. https://b.socrative.com/teacher/#edit-quiz/60391195

Workshops 3 and 4:

1) Presentation and explanation of the task: during the first minutes, the teacher explained to the students that they should watch the video "Meet the Acropolis with Discovery Tour Assassin's Creed: Odyssey" based on the video game Assassin's Creed: Odyssey, to work contents of Ancient Greece. Students watched the video at home without taking notes before the class. During the lesson, the teacher helped them to solve the questions about the contents presented in the game-based videos and then asked the students to write a summary of the most relevant contents of the video.

[INSERT FIGURE 3]

Figure 3. Video 2 Visit to the Acropolis of Athens. Discovery Tour in Assassin's Creed Odissey. [screenshot]. Source: Own creation. https://www.youtube.com/watch?v=t_z3gzcH5v8

2) Development of the gamified resource *Socrative*. It is a multiplayer quiz that comprised ten questions (multiple-choice, open, and true-false questions) on what Athena Nike means, which monument gave access to the Acropolis, why the Parthenon was built, and curiosities about the treasure of the Parthenon. To play, the teacher provided students with a PIN to log on to the webpage and played the *Socrative* quiz collaboratively in class. Finally, the teacher explained and showed the students' answers to the *Socrative* to the students, so that they could understand which knowledge they had learned.

[INSERT FIGURE 4]

Figure 4. *Socrative*: "Playing to learn the art." [screenshot]. Source: Own elaboration. https://b.socrative.com/teacher/#edit-quiz/40351872

3) Conclusions and evaluation of the workshops: At the end of the workshops, the teacher asked the students in class an open question about their assessment that needed to be answered through the chat room. Thus, all the students' answers were shared. The teacher synthesized the students' participation in these workshops and administered the questionnaire to the students. Finally, the teacher, with the students' answers, reflected on the use effectiveness of the workshops: the use of FC with game-based videos and gamified resources positively complemented the teaching of some historical content (Ancient Egypt and Classical Greece) established by the syllabus. They helped to increase the students' motivation who actively learned with the teacher's guidance. This is reflected in the greater number of questions asked during the class, inquiring more about the subject, proposing arguments for and against the art and history contents, providing opinions on the subject in the chat room before starting the class, working with enthusiasm the different gamified resources, the number of visualizations in the YouTube channel where the videos were uploaded, and completing the tasks without being reminded by the teacher.

Evaluation Instruments

In order to assess the participants' perceptions, a pre-planned online questionnaire was designed and administered before and after the intervention. This questionnaire aimed to analyze the students' appraisals (regarding the teaching style, learning, and motivation) of using FC with game-based videos and gamification in the online learning of Social Sciences in higher education. This questionnaire was created with questions from the review of scientific literature (Liu & Zhang, 2022; Murillo et al., 2019; Santiago & Bergmann, 2018; Yıldız et al., 2022; Carrión & Roblizo, 2022) that justified the advantages of implementing FC and ICT by considering them valuable tools to optimize students' learning, performance and motivation in higher education. A version of Carrion and Roblizo's (2022) questionnaire, applied to Social Sciences, was used in this research. The questionnaire consisted of ten questions that employed a Likert-type scale from 1 to 5 (1: strongly disagree; 2: disagree; 3: neither agree nor disagree; 4: agree and 5: strongly agree). It consisted of questions related to the teaching style, active learning role, learning quality, achievement of goals, students' learning, classroom participation, teamwork, autonomous work tools, the most positive and meaningful classroom work, and recommended approaches for other subjects. These ten questions were grouped into three categories: teaching style, learning quality, and motivation. Three judges, university professors of education specialized in the subject and selected by convenience, analyzed the content validity. These judges scored whether they agreed or disagreed with the explicitness and importance of the items. The Kappa coefficient was calculated to find the level of agreement among the judges, being adequate (value of 0.87). The same questionnaire was used both before and after applying the lesson plan. Reliability was estimated for this research and this sample, obtaining a good level both before ($\alpha = 0.958$; $\Omega = 0.968$) and after the intervention ($\alpha = 0.941$; $\Omega = 0.953$).

Procedure

First, participants gave their informed consent in the first online class session by asking whether they agreed or not on their participation in this research in a ***Google Forms*** form. Secondly, the pre-questionnaire was administered in the online class through a link to (age and sex) were also collected. Thirdly, after implementing the lesson plan based on FC game-based videos and gamification, in January 2022, the post-questionnaire was administered in the last online class with a link to ***Google Forms*** to be filled in and sent. The response and the effective rate of the questionnaire were 100%.

Data analysis

First, to establish the reliability of the questionnaire made up entirely of Likert-scale questions, Alpha was calculated with the polychoric correlations and omega with the factor weights of a confirmatory factor test both in the pre and post-tests. In both cases, the level of reliability was good for the ten questions. Content validity was also adequate, and expert feedback was incorporated into the final version of the questionnaire. Secondly, to assess the normal distribution of the ten questions of the questionnaire, Kolmogorov-Smirnov (with Lilliefors correction), Shapiro-Wilk, and Anderson-Darling tests (Yap & Sim, 2011) were employed, which produced a p-value < 0.005 in all cases; therefore, non-normality was assumed, that is, the distribution of scores on each question of the questionnaire was not symmetrical. Thirdly, for the assessment of the pre and post-intervention changes in participants' perceptions of the online Social Sciences class, the non-parametric Wilcoxon rank sum test was applied to the ten questions of the questionnaire (teaching style, the role of active learning, learning quality, achievement of goals, students' learning, classroom participation, teamwork, autonomous work tools, the most positive and meaningful classroom work, and the recommended approach to other subjects). The Wilcoxon rank sum test does not require normal distribution in the ordinal dependent variable studied. It allows us to compare the rank of means of two related samples to analyze whether there were differences. In this study, we found the same sample before and after implementing the lesson plan who answered the same ten asymmetric

ordinal questions. This test employed the rank of the data from the lowest to the highest order that the data held within the total data set. In fact, as the value by itself was not enough (Fritz et al., 2012), we used the effect size with biserial rank (95% confidence interval). This way, the results indicated that the difference between before and after the application of the technological tools was taken for granted and significant. To complement this analysis, the differences in the ten questions according to gender and age were also compared in pre and post-test scores. In this study, both gender and age were intervening variables and have been controlled so that they could not threaten the results of the research (Navarro et al., 2017). Differences by gender were tested with the non-parametric Mann-Whitney U test because there were two independent samples (men/women) in pre and post-intervention in ten asymmetric questions. Differences regarding age were analyzed with the non-parametric Kruskal-Wallis H test because they were four independent groups (20-30 years old, 30-40 years old, 40-50 years old, and over 50 years old) in pre and post-intervention in ten asymmetric questions. SPSS Statistics version 27 (IBM, 2016) was used for all statistical analyses of the data. R version 4.1 (R Core Team, 2021) was used to calculate normality and effect size.

Results

In this section, the previous analyses according to the research design and related to the question addressed in this study are presented.

Preliminary analyses

The type of design employed entails the non-randomization of the sample. Thus, age and gender were studied to check if these variables threatened the research results. In the group, 73% were female and 26% male in both the pretest and post-test. The age was asked in gender-age brackets showing that 39.5% were between 20-30 years old, 40.5% were between 30-40 years old, 19.5% were between 40-50 years old, and 0.5% were older than 50 years old.

For the statistical analysis regarding gender, the non-parametric Mann-Whitney U test was used to assess the differences in mean ranks before and after the application, taking 0.05 as a reference point. Both before ($n = 190$, $U = 3435{,}500$, $p = 0.846$) and after ($n = 190$, $U = 3367$, $p = 0.689$), the p values obtained were greater than 0.05, which show that the differences were not significant. It implies that both groups had similar performance both before and after the implementation of the ten questions of the questionnaire (teaching style, role of active learning, learning quality, achievement of goals, student learning, classroom participation, teamwork, tools for autonomous work, the most positive and meaningful classroom work, and recommended approach for other subjects). Regarding age, the non-parametric Kruskal-Wallis H test was used to evaluate the differences in mean ranks before and after the application, taking 0.05 as a reference point. Both before ($n = 190$, $H = 3.565$, $p = 0.312$) and after ($n = 190$, $H = 1.349$, $p = 0.718$), the p values obtained were higher than 0.05, which showed non-significance. It implies that all four age groups had similar performance both before and after the implementation of the ten questions of the questionnaire (teaching style, role of active learning, learning quality, achievement of goals, student learning, classroom participation, teamwork, tools for autonomous work, the most positive and meaningful classroom work, and recommended approach to other subjects). Therefore, comparisons by gender and age before and after the lesson plan were not significantly different. It indicates that they were not a source of relevant differences in students' outcomes, two intervening variables that were controlled and did not threaten the research results.

[INSERT TABLE 1]

Regarding the question "RQ1. Do students' assessments regarding the teaching style differ after implementing game-based videos and gamified resources in the Social Sciences online university

classroom?" Table 1 shows the average rank and the rank sum for each item used in the questionnaire. Since these are ordinal data that do not assume normality, the necessary ranks were used for the subsequent non-parametric Wilcoxon rank sum test. Specifically, average rank and the rank sum with higher values were observed after the intervention (W+=46.60, W-=38.52), which indicated that students responded that, with the application of FC with game-based videos and gamification, the teaching style was better than traditional lecturing. In order to compare the changes before and after the application (independent variable) in the participants' assessments of the teaching style question (ordinal dependent variable), we used the non-parametric Wilcoxon rank sum test because the distribution was asymmetric (Kolmogorov-Smirnov tests with Lilliefors, Shapiro-Wilk, and Anderson-Darling correction). In addition, to indicate whether the difference was significant, the p-value was used, and the biserial rank orrelation was employed as effect size with a 95% confidence interval to add the magnitude of the difference.

Table 2 shows the values of the Wilcoxon rank sum test, the significance, and the effect size taking 0.05 as a reference point. Pre-service teachers clearly and significantly valued the difference regarding the teaching style when game-based videos and gamified tasks were used in the online classes (W=1271, p=0.005, effect size=-0.321). The effect size was small (Coolican, 2009). This question enabled us to contrast traditional lecturing with the innovation developed in this lesson plan and the relevance of teacher training in digital competence to promote the acquisition of autonomous learning tools among students.

Regarding the question "RQ2. Is there a difference in the students' assessments regarding the learning quality before and after the intervention?". Table 1 shows the mean rank and the rank sum. Since these are ordinal data that do not assume normality, the necessary ranks were used for the subsequent non-parametric Wilcoxon rank sum test. Specifically, mean ranks and the rank sum with higher values were observed after the intervention in all the questions of this category of analysis, which indicated that students appreciated the use of FC with game-based videos and gamification since the quality of their learning in Social Sciences improved. Specifically, as regards the active learning role (W+=64.97.60, W-=61.27), students responded that they were more active learners after the implementation; as far as the learning quality is concerned (W+=72.47, W-=44.16), students answered that they learned better after the intervention; as regards the achievement of goals (W+=63.00, W-=58. 52) students indicated that with the application of FC with game-based videos and gamification they were able to achieve some goals. They felt that, without these tools, they would not accomplish them; regarding students' learning (W+=57.12, W-=48.30), students replied that they learned more than in a traditional way; and, on autonomous work tools (W+=65.17, W-=60.65), students indicated that after the implementation, their learning was more self-directed. To compare the changes before and after the implementation (independent variable) in the participants' assessments of the active learning role, learning quality, achievement of goals, students' learning, and autonomous work tools (ordinal dependent variables), the non-parametric Wilcoxon rank sum test was used because the distribution was asymmetric (Kolmogorov-Smirnov tests with Lilliefors, Shapiro-Wilk, and Anderson-Darling correction); In addition, to indicate whether the difference was significant, the p-value was used, but in order to add the magnitude of the difference, the biserial rank correlation was employed as the effect size with a 95% confidence interval. Table 2 shows the Wilcoxon rank sum test values, significance, and effect size, taking 0.05 as a reference point. It shows that there were significant differences in two questions, whereas there were no significant differences in other three items. Specifically, students felt significantly more active, participative, and responsible for their learning (W=3064, p=0.015, effect size=-0.234) when using ICT tools in the classroom (game-based videos, and gamification resources such as *Socrative* and *Quizizz*). It implies a positive preconception towards the control of their learning with this type of methodology. In the question about the contribution to the quality and improvement of learning (W=1678, p=0.000, effect size=-0.587), students significantly valued that they learned better with ICT-based didactic tools after the implementation of this lesson plan in the Social Sciences classes. In fact, for the students, the presence in the classrooms of teachers with training and experience in ICT and gamification guaranteed satisfaction in learning improvement (W=2367, p=0.159, effect size=-0.150) though the difference was not significant. These questions provided a contrast between methodologies: on the one hand, traditional lecturing based on passivity and reproduction of

knowledge, and, on the other hand, innovative methods of lesson plans focused on activity and creation. Students positively estimated without significant difference (W=3160, p=0.157, effect size=-0.144) the possibilities of ICT and gamification, which favored the achievement of objectives that would be difficult to reach with other methodologies in the classroom, and more autonomous learning without significant difference (W=3639, p=0.438, effect size=-0.076). These resources made it easier for them to face more ecological situations and real problems in order to propose similar solutions in their professional practice. Effect sizes were small for all questions except for the learning quality, which was moderate (Coolican, 2009).

Regarding the question, "RQ3. after the implementation of FC with game-based videos and gamification, is there a difference in the students' assessments in terms of motivation in the Social Sciences online university classroom before and after the implementation of the lesson plan?", Table 1 shows the mean rank and the rank sum since these are ordinal data that do not assume normality. The necessary ranks were used for the subsequent non-parametric Wilcoxon rank sum test. Specifically, mean ranks and the rank sum with higher values were observed after the intervention in all the questions of this category of analysis, which shows that students appreciated that with FC with game-based videos and gamification, their interest and motivation towards learning Social Sciences improved. Specifically, in classroom participation (W+=51.39, W-=48.64), students responded that after the implementation, they participated more in class; in teamwork (W+=58.08, W-=57.91), students valued that after the lesson plan, group work improved; in more meaningful work (W+=63.29, W-=61. 57), students indicated that after the application, their work was more meaningful for them; in recommended for others (W+=44.10, W-=45.73), students responded that after the implementation of FC with game-based videos and gamification they would recommend to use it them in other subjects. To compare the changes before and after implementing the lesson plan (independent variable) in the participants' assessments when being asked about class participation, teamwork, more meaningful work, and recommendation to other subjects (ordinal dependent variables), we used the non-parametric Wilcoxon rank sum test because the distribution was asymmetric (Kolmogorov-Smirnov tests with Lilliefors, Shapiro-Wilk, and Anderson-Darling correction). In addition, to indicate whether the difference was significant, the p-value was used, but in order to add the magnitude of the difference, the biserial rank correlation was employed as the effect size with a 95% confidence interval. Table 2 shows the Wilcoxon rank sum test values, significance, and effect size, taking 0.05 as a reference point, which demonstrates that in the four questions in this category of analysis, there were no significant differences. Specifically, Table 2 shows that students valued that class participation improved (W=2432, p=0.874, effect size=-0.017) with no significant differences, teamwork (W=3185, p=0.659, effect size=-0. 045) responded that it was positive for learning with no significant difference, the lesson plan was valued as more meaningful work (W=3510, p=0.333, effect size=-0.094), with no significant difference and they recommended it to other higher education courses (W=1764, p=0.298, effect size=-0.119) with no significant difference. Effect sizes were small for all questions (Coolican, 2009). It is possible that they had greater initial predisposition and expectations towards the motivation of what these technological tools would be than what they experienced when using them in class; this may have influenced the opinions collected in this question. Thus, there were no significant differences in any question concerning motivation.

[INSERT TABLE 2]

Discussion

In this research, the students' perceptions of the teaching style, learning, and motivation of an integrated methodology (FC and gamification) supported by the use of ICT tools in an online university Social Sciences classroom of pre-service teachers are studied. The results show positive assessments after implementing these innovative active learning methodologies, as reflected in the Wilconson rank sum test and the corresponding effect size.

The study hypothesis is verified, and the use of game-based videos (within the FC framework) and gamification in online university teaching improves the students' assessments regarding the teaching style, learning, and motivation of their learning in the subject of Social Sciences. The data demonstrate an improvement after the application of the lesson plan in all the aspects evaluated, as well as statistically significant differences found in the participants' assessments regarding the teaching style when using FC and gamification, the students' active role in their learning process and the improvement of the learning quality. These findings are consistent with other studies (Shavab et al., 2021; Oliveira et al., 2022), which have shown better students' performance and perception of their learning after applying gamification in the classroom. All the participants perceived that with this new methodology, they could achieve learning objectives in a fast and enjoyable gameful way, participated actively all the time in the classroom, learned from teamwork, and the digital tools allowed them to be autonomous in their work. They also perceived a more positive atmosphere in the lessons and would recommend this teaching methodology for other subjects. Along the same line, in a systematic review examining different educational stages, Hamari et al. (2014) found that the use of active learning methodologies such as gamification optimized the learning process of all students, and Fritz et al. (2012) argued that active learning methodologies also increased students' commitment towards the proposed tasks and the contents regardless of socio-demographic variables such as gender and age. The findings of this research are contrary to the ones provided by some authors (Almeida et al., 2021; Nyström, 2021; Andrade et al., 2016) who highlighted the adverse effects of gamification, such as the lack of understanding, irrelevance, or worsened performance.

The lesson plan implemented offers a meaningful learning context for higher education students who study online since it provides them with a wide range of academic competencies and skills. It evidences that it is possible, in an online scenario, to use a methodology that is positively accepted by students and may be generalized to other subjects. Current studies on online environments (Mohamed & Lamia, 2020) highlight this research line of active learning methodologies within a transforming process of traditional classrooms (Márquez, 2022). This current pedagogical growth meets the gradual implementation of the sustainable development goals of the 2030 Agenda to achieve quality education.

FC using game-based videos and gamification offer pedagogical tools with great potential to promote a kind of learning in which the students are the protagonists of their own learning (Jang et al., 2015). Using technological tools in online Social Sciences classes generates a challenge that enriches the pedagogical practice. Gamification and technology become relevant complements to the teaching activity (Nela & Supriatna, 2021; Rakasiwi et al., 2021). However, the success of technological tools applied to education requires teacher training in these gamification resources (Almusharraf, 2021; Guerrero-Puerta, 2021). The teacher's involvement in this kind of pedagogical innovation implies a different teaching style with a higher commitment in terms of time and effort (Zawilinski et al., 2020) which presupposes more training in technological resources, teaching preparation, organization, and student counseling, among others. (Mojtahedi et al., 2020). Pre-service teachers should receive university training based on active pedagogies, such as the ones presented in this work, which enable them to apply them in their future classrooms and adapt them to their circumstances (Cukurova et al., 2020).

This research provides preliminary evidence of the advantages of implementing a didactic methodology based on technological and gamified resources in an online university context, which encourages us to continue working on further research in order to improve pre-service teachers' educational quality and professional performance. This work proposes a lesson plan easily replicable by other researchers with open gamification resources which can be applied to any academic content.

Limitations and Future Research

This research has had some limitations that are identified and may modulate the interpretation of the results. On the one hand, regarding the research methodology, the assignment of students was done by convenience and not randomly. In order to mitigate it, a preliminary analysis was performed to verify that there were no differences in socio-demographic variables such as gender and age that

could influence the results obtained in the research. On the other hand, regarding the study design, it was a pre-experimental study of a single group with pre and post-test measures. This choice was considered so that all undergraduates could have the same teacher and all received the innovative proposal in the classroom context. Finally, the work focuses on university students enrolled in a teacher education program, pre-service teachers, who work the contents of Social Sciences with some game-based videos, *Socrative* and *Quizizz*. Scientific literature (Rodrigues et al., 2019) suggests that different designs should be adopted depending on the learning task. However, in this work, we used the same procedure and resources (game-based videos + *Socrative* and *Quizizz*) in the workshops, so it was estimated that the effect observed in the participants' perception was due to the innovative proposal itself.

Future research could increase the sample size and apply it in other disciplines, universities, and international contexts, and hence, test the proposal on different types of students. Future work could extend the analysis to other variables that provide objective data, such as academic performance or a validated motivation test. In addition, the use of other types of qualitative and/or quantitative methodologies (depending on the variables used and their operationalization) could be introduced to enrich the results obtained.

Conclusions

This study consists of the design and implementation of a lesson plan based on the development of contents to innovate the educational practice in the subject of Social Sciences in the degree of Elementary Education during the academic year 2021-2022. This study has followed a quantitative methodological approach with a quasi-experimental design. Therefore, survey-type research has been chosen through the design and implementation of a pretest and post-test, as this technique is the most appropriate when the objective is to know the assessments of the protagonists of the educational processes (López-Roldán & Fachelli, 2015).

The post-pandemic social context, which forced teachers to use technological tools in the classroom, and the current results on active methodologies constitute the scenario on which the current research was developed in an online classroom. The lesson plan used was outlined as a possibility of an effective educational strategy to turn students into active protagonists of their learning. The results of this research show positive assessments after the implementation in all the aspects assessed, and in some cases, statistically significant differences in the students' perceptions after implementing the technological and gamified resources. This methodology, used by pre-service teachers, leads to meaningful learning of the Social Sciences content by developing a deeper understanding based on learning by doing. The use of technology in the classroom facilitates the acquisition of not only curricular competencies (Social Sciences contents) but also transversal competencies such as digital competence (European Framework for Educators' Digital Competence), being a convenient resource for educational innovation in the learning of contents and allowing the transfer to other subjects.

The pedagogical implications aim at the teaching-learning process in online higher education. First, there is empirical evidence that using FC game-based videos plus gamification positively affects undergraduates' assessments. It confirms that active methodologies benefit the quality of students' learning. Secondly, the implemented proposal lasted for four months, which is estimated to be a substantial period for the results to be reliable. The literature on gamification pinpoints that studies of less than twelve weeks are insufficient to faithfully observe the impact on learning due to the novelty and familiarization effects. Therefore, four months would have positive benefits and could help authors estimate the duration of their innovative proposals before applying them. Thirdly, the research could be extended to online university contexts. This work focuses on pre-service teachers studying Social Sciences but it could be applied to other online university subjects and courses.

Declarations

Data availability statements:

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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