education sciences

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Preservice Teachers' Knowledge and Attitudes toward Digital-Game-Based Language Learning

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Abstract: There is a good body of literature about digital-game-based language learning (DGBL), but research has mainly focused on students as game players rather than as future educators. This paper reports on a research conducted among 154 teacher candidates at a higher-education institution in Spain regarding the adoption of digital games in education. It analyzes the participants' knowledge of and attitudes toward digital games in foreign language learning. Quantitative and qualitative data were gathered through a pre/post-test, digital game presentations, and student blog posts. The research comprised five stages associated with critical thinking skills (definition, selection, demonstration, discussion, and reflection), including a game learning module. In the first two stages, preservice teachers completed the module activities and selected different games aimed at teaching English to children in preschool and elementary education. In the last two, they illustrated, discussed, and evaluated the digital games in class following a rubric and reflected on their perception in blog posts. In this four-week research based on a mixed method and convenience sampling, quantitative and qualitative data were gathered through a pre- and post-test survey about student perceptions toward the use of video game in the classroom, class discussion, and blog posts. Statistical data analysis unveiled gender-based differences related to gameplay frequency and genre preferences. The Wilcoxon signed-rank test was used as a nonparametric statistical hypothesis test to compare the two sets of scores resulting from the same participants, and it showed a significant difference ($p \leq 0.05$) after the treatment in two of the five dimensions in the survey about teacher candidates' attitudes toward game usage in education, namely, usefulness (U) and preference for video games (PVG). Research findings revealed preservice teachers' positive attitudes but lack of practical knowledge about the use of digital games in foreign-language learning.

Keywords: digital games; language learning; teacher candidates; knowledge; attitudes

Citation: Belda-Medina, J.; Calvo-Ferrer, J.R. Preservice Teachers' Knowledge and Attitudes toward Digital-Game-Based Language Learning. *Educ. Sci.* **2022**, *12*, 182. https://doi.org/10.3390/educsci12030182

Academic Editor: Huei Tse Hou

Received: 26 January 2022
Accepted: 28 February 2022
Published: 6 March 2022

1. Introduction

The use of digital games in language learning has been the object of study in several publications over the last two decades [1–5]. Some works focused on the consequences of integrating such games in education and language learning, particularly as regards student motivation [6,7] and enjoyment [8,9], while others analyzed their impact on the development of certain language skills and components such as listening and speaking [10,11], reading and writing [12], grammar [13], and vocabulary [14–16]. Conversely, few articles examined the knowledge and attitudes of preservice teachers toward the integration of digital games in an English as a Foreign Language (EFL) classroom [17–19]. This is vital, as these students and prospective teachers will soon take a leading role in language instruction in 21st century education.

The increasing popularity of digital games and their use in the language classroom reinforced the need of proper training in teacher education programs. Therefore, several authors advocate for a better-quality preparation regarding knowledge on the principles and practices of digital games in language learning [18–20].

Two aspects seem to confirm the need for a better training of such students in their transition from digital native students, meaning individuals born after the widespread adoption of digital technology, to digital native teachers [20]. On the one hand, the proliferation of smartphones and the growing number of game-based apps elicit new pedagogical approaches in language learning, as attested by the increasing number of research papers about digital game-based language learning (DGBL) [21,22]. In this sense, various authors reported on the impact of integrating game-based apps in the foreign-language classroom, investigating its affordances such as student enjoyment and enhanced motivation, and its constraints such as limited functionality and lack of human interaction [23,24].

On the other hand, the application of game-design principles to education, particularly to second- and foreign-language learning, and the steady rise of new game formats and platforms (consoles, web-based, apps) strengthened this demand for more updated preparation [4,24–27]. In fact, this need has been more evident since the outbreak of the COVID-19 pandemic and its global impact on modern education due to online learning and social distancing [28].

This research has two objectives: first, to examine teacher candidates' knowledge on digital games in the foreign-language classroom; second, to measure their attitudes toward the use of such games in language learning. For this purpose, 154 education students grouped in teams completed a module about game-based language learning, selected a game, and illustrated it in the classroom. Then, the participants evaluated the different games and discussed the possible affordances and obstacles for their integration in language learning, and they reflected on different games and game-based learning on their blog posts.

2. Background

Digital games have outperformed other types of entertainment such as movies in terms of total number of users and economic power over the last two decades [29], particularly in the last two years, after the outbreak of the COVID-19 pandemic and its global impact [30–32]. In this paper, a digital game is defined as any kind of interactive program, either online or standalone, employed with different electronic devices such as a console, smartphone, or computer, which is primarily used for entertainment. There is a rich body of literature on the use of digital games in education from different perspectives, and foreign-language learning is no exception [33,34]. Studies on DGBL have multiplied in recent years, as evidenced by the appearance of new specialized journals. In these publications, several scholars evaluated the effectiveness of using such games in foreign-language education, particularly in relation to vocabulary development [3,35].

Regarding attitudes toward game-based learning, some works delved into the beliefs and determinants to adopt digital games among inservice teachers [36–38], stressing the benefits of integrating such games in the foreign-language classroom, such as increased motivation, shared enjoyment, and enhanced interaction in a student-centered model. However, a few voices were against the educational use of such games on the grounds of alleged ineffective learning structures, pedagogical inadequacies, and distracting factors [39–41]. According to Kaimara et al. [42], 'recent findings concluded that teachers were unwilling to adopt digital educational games because they were not really convinced that games are very useful for enhancing their job' (p. 827). However, there is ample evidence that digital games can be effectively used to reinforce certain cognitive skills such as problem solving, risk taking, and reasoning [43,44].

However, the majority of published studies have focused on current language learners as game players rather than as future educators. There is a little research on knowledge and attitudes toward the integration of digital games among teacher candidates in foreign-language education. Previous works in this area generally showed that prospective teachers hold positive attitudes toward the use of games, particularly after a gaming intervention [18,45]. However, some authors also expressed reservations about the teacher

candidates' practical knowledge and ability to integrate meaningfully digital games in foreign-language education, partly due to a lack of proper training [46].

In this sense, Demirbilek et al. [47] explored the relationship among four categories (current situation, usage, game features, and efficacy for lesson) and second-language instructors' perspectives. The authors concluded that 'the way how computer games are employed during the instruction, the features of the game, hardware and software infrastructure of the classroom affect the perception and attitudes of instructors and students towards the computer games' (p. 720). Likewise, Alyaz and Genc [19] investigated teacher candidates' beliefs about digital games to learn German as a foreign language, and claimed that participants found games beneficial as both teachers and learners, stressing the need to integrate DGBL into the foreign language education curriculum.

Similarly, Sardone and Devlin-Scherer [48] studied teacher-candidate perceptions and reactions to 33 digital games as a learning technique, concluding that game usage enabled participants to understand the teacher's role as a facilitator of instruction, and that it is necessary to consider 'major curricular changes requiring the incorporation of gaming pedagogy in K-12, higher education, and teacher preparation settings' (p. 65). The same authors in a subsequent study recommended the integration of a digital game module in teacher education courses as a way to foster creativity, innovation, and motivation through alternative forms of educational technology [49].

In her study on preservice EFL teachers' behaviors and perceptions about digital games, Blume [17] found significant correlation between game playing and positive beliefs on the one hand, and between game playing frequency and perceived usage of language learning strategies on the other. According to this author, having no previous learning experience in digital games can actually be better than having a negative one, and she highlighted the relative receptivity of preservice teachers toward DGBL despite this lack of experience. As a result, Blume emphasized the need of better teacher training to strengthen strategic language learning.

More recently, Kaimara et al. [42] examined the preservice teachers' perception of the potential barriers to the implementation of digital-game-based learning in the classroom, identifying as the major obstacles 'the lack of financial resources, the preference for traditional teaching methods and stereotypes about the value of digital games, the lack of ICT training, the lack of infrastructure and the lack of educational policy' (p. 838). In general, three main factors seem to shape learners' beliefs about the use of digital games in language learning, namely, previous playing experience, the perception of other significant individuals such as teachers and parents, and perceived self-efficacy [50,51].

Concerning pedagogical approaches to computer games, Munkundan et al. [52] examined the potential of incorporating such games in foreign language curricula from different learning theories and game design principles. The first generation of games were based on programed instructions, and focused on repetition and reinforcement techniques following the principles of behaviorism. However, these drill-and-practice games were criticized for promoting rote learning and lower levels of knowledge [53,54]. Therefore, the second generation of computer games were more learner-centered and aimed at developing students' creativity and cognitive skills through authentic and situated learning tasks, thus following a constructivist approach [55,56]. The third generation of electronic games were designed from a sociocultural perspective to explore other factors such as context, culture, interaction and learners' identity, where teachers become facilitators of the learning process [57,58].

On the whole, previous works illustrated that there is a positive attitude toward the use of digital games in education and language learning among teacher candidates. However, there is also a lack of educational experience and insufficient professional development, and a necessity to incorporate such games in teacher training programs [59,60]. This article aims to bridge the research gap between preservice teachers' knowledge and attitudes toward digital games in language learning as future educators.

3. Objectives and Method

3.1. Objectives

This research had two objectives: first, to examine the teacher candidates' knowledge on digital games in the foreign language classroom; second, to measure their attitudes toward the use of such games in language learning. The two research questions were as follows: (1) What knowledge do teacher candidates have about game-based language learning? (2) What are their perceptions toward game usage after selecting, illustrating and discussing different games in the classroom? In this study all forms of digital games were considered without distinguishing between serious or educational games, commercial off-the-shelf games (COTs), web-based games, and game-based apps.

3.2. Context and Sampling

Participants in this research were 154 students enrolled in undergraduate course Integrating Skills in English addressed to preschool and elementary education teacher candidates at the University of Alicante (Spain). This course ran daily for two consecutive months, and students were expected to learn how to integrate different ICTs through a collaborative learning approach. In this course, the teacher candidates had to develop two digital projects aimed at teaching English: the first was related with game-based language learning (4 weeks), while the second was associated with the integration of augmented reality (AR) in the English as a Foreign Language (EFL) classroom. This research presents the results of the first project. Bearing in mind the exploratory nature of the research, participants were selected following a convenience sampling approach based on data collection from population members who were available [61]: 154 student of the 167 officially enrolled who had completed all the tasks. As regards age and gender, 83% were female students, and 93% of them were aged 20 to 30.

3.3. Procedure

This four-week research was based on a mixed method. Quantitative and qualitative data were gathered through the use of a pre/post-test survey, game demonstrations, class discussion, and students' reflections in the form of blog posts. The project covered five stages corresponding to different critical thinking skills included in education studies [62]: defining, selecting, demonstrating, discussing, and reflecting, as shown in Figure 1. Each thinking skill was associated with several academic abilities: stating the problem and becoming familiar with the current situation in DGBL (defining); carefully choosing the most suitable game among different choices on the basis of certain criteria (selecting); explaining and illustrating the games selected through practical examples (demonstrating); debating and evaluating the affordances and limitations of each game with peers (discussing); and considering the learning gains from a critical perspective and expressing the ideas in blog posts (reflecting). For this purpose, students were randomly arranged in teams of 4–5 members in order to find, play, analyze, and select digital games that could be used to teach English to children. The project took place in 8 two-hour class sessions during four weeks.

First, a game-based learning module was created in Moodle with information about gamification and the use of digital games in language learning in the form of readings, websites and practical examples. Then, the different teams were requested to find and select digital games aimed at teaching English as a foreign language, and to think about the target students, context, and learning goals. Next, the participants illustrated the use of the selected games in class. In this project, particular relevance was given to inclusive digital games that could be addressed to different types of learners, such as those with special needs (SEN).

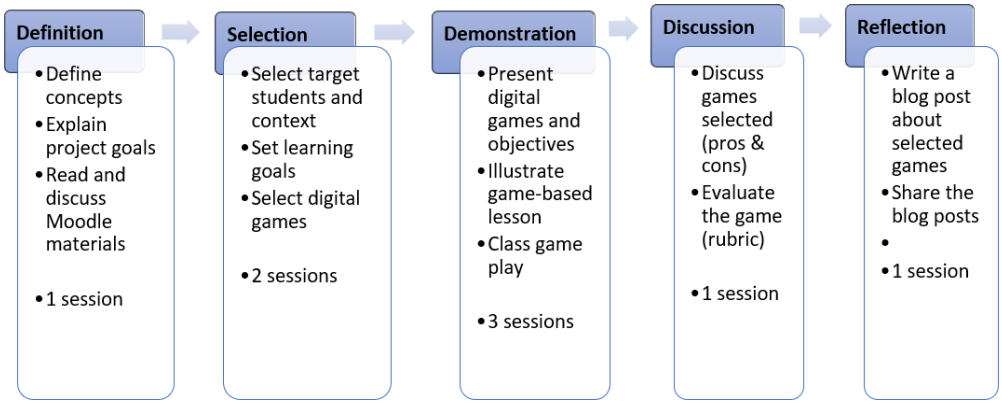

Figure 1. Stages of game-based language learning project (1 session = 2 h).

In the fourth stage, teacher candidates discussed the potential affordances and limitations in class, and they evaluated the games following an assessment rubric which covered aspects such as game design (interface, visual elements, instructions, mechanics, and rewards) and educational use (target learners, language level, learning goals, corrective feedback). In the last stage, the teams had to post some comments and game images in their blogs as multiple reflections based on class presentations and discussion.

3.4. Instruments

An online pre/post-test was administered on the first and last weeks of class. The pretest contained 35 questions divided into three sections: the first section included 5 items associated with sociodemographic data; the second section comprised 6 questions related to technology ownership and usage; the third section was formed by 23 specifically related items to the use of video games in education. This scale was based on previous research by Bourgonjon et al. [63] about students' perception of using video games in the classroom, it surveyed the different factors determining the students' preference for using video games grouped into five dimensions: personal experience (EXP), usefulness (U), ease of use (EOU), learning opportunities (LO), and preference for video games (PVG). The items included in this scale are displayed in Tablet 7 with the results.

The post-test replicated the third section so as to compare the results at the beginning and the end of the treatment, and included questions aimed at measuring students' satisfaction with the games they had selected and discussed in class. Qualitative data were obtained through class discussion and blog posts.

3.5. Method

Quantitative data were analyzed using SPSS 22.0 statistical software. The Wilcoxon signed-ranked test was employed to analyze the medians of the two measurements about students' perceptions toward video games before and after the experiment with the significance level set at 0.05. This nonparametric test was used to compare the difference between the two paired sets of ordinal data as suggested in previous research [64]. In order to identify any existing relations between the participants' gender and the different dimensions, correlational analyses were performed with the simultaneous inclusion of all measured variables. Qualitative data obtained from the students' reflection in the form of blog posts were analyzed and coded by the two researchers according to different patterns of data in the main themes.

4. Results and Discussion

Concerning technology ownership, the pretest results indicated that every student had a smartphone, 93% of them owned a laptop and/or a tablet, and 85% had access to a desktop personal computer. As regards frequency of computer usage and game play, some gender-based differences were observed, as shown in Table 1. Female students spend more

time on average on the computers, while males dedicate more time to game playing. In fact, nearly 43.3% of female participants stated they never play games, as opposed to 7.4% of males. Results are in line with previous research findings indicating higher gaming time of males over females [65], and contrary to other reports stating that game play, meaning the amount of time dedicated to playing games, is gender-neutral [48]. However, these results may be limited by the context and different number of participants based on gender, as most teacher candidates were women.

Table 1. Computer usage and game play frequency (N = 154).

	Computer Usage Frequency (Daily)			**Game Play Frequency (Weekly)**	
	Males (n = 27)	Females (n = 127)		Males (n = 27)	Females (n = 127)
Never	0%	0%	Never	7.4%	43.3%
<1 h.	18.4%	4.7%	<1 h.	28.2%	37.1%
1–2 h.	24.9%	19.8%	1–3 h.	41.3%	14.8%
2–3 h.	25.2%	27.5%	3–5 h.	14.6%	3.1%
3–4 h.	17.3%	22.8%	5 h. +	8.5%	1.6%
4 h. +	14.2%	25.2%			

Concerning reasons for computer usage and based on a multiple-choice questions with multiselect answers, the top three options were academic purposes, web searching for information, and entertainment (excluding games) such as watching movies or videos, as shown in Table 2. Playing games yielded the lowest score among participants. As regards smartphone usage, communication purposes (instant messaging, video call) ranked first, followed by web searching, entertainment, online shopping and social networking, while playing games also provided the lowest score.

Table 2. Main reasons for computer and smartphone or tablet usage.

	Main Reasons to Use	**Personal Computer**	**Smartphone Tablet**
1	Web searching (general information retrieval)	82.5%	91.7%
2	Academic purposes	86.4%	74.6%
3	Communication (instant messaging, video calls, e-mail, etc.)	68.9%	99.3%
4	Entertainment (excluding games) such as watching movies or series	74.7%	81.3%
5	Social networking	52.7%	79.5%
6	Online shopping	51.4%	67.2%
7	Game playing	14.6%	31.6%

As for game platform, participants who spend more time playing games (3+ h per week), opted for home video game consoles, particularly PlayStation (PS), whereas those who played occasionally (<1 h per week) preferred their smartphones, as illustrated in Table 3. Regarding genres, the data confirmed previous academic and commercial reports on genre/gender game differences [66–68]. Among participants who had indicated that they did play games, male students (n = 25 out of 27) predominantly chose two categories, fighting and sports, whereas females' preferences (n = 72 out of 127) were much more diverse, with puzzle/card, role playing, simulation, strategy, and action and adventure games providing similar results. The data also confirmed previous findings that action and adventure games are popular among both genders, and that women tend to play more RPG and strategy games, while men are more into sports and fighting [67].

Table 3. Preferred game consoles and game genres among teacher candidates.

Game Console or Device Based on Gameplay Time *			**Game Genres Based on Gender ***		
	Frequent Gamers *(3+ week)*	Occasional Gamers *(<1 h week)*		Males *(n = 25)*	Females *(n = 72)*
			Action and adventure	25.2%	22.6%
Smartphone/tablet	19.3%	24.8%	Fighting (shooter)	39.5%	18.2%
Computer	23.1%	13.7%	Sports and racing	36.3%	14.5%
PlayStation	37.3%	22.6%	Simulation	18.6%	26.4%
XBOX	21.8%	11.5%	Strategy	27.8%	23.2%
Nintendo	25.4%	18.2%	Role playing	16.1%	27.4%
			Puzzle/card	12.7%	31.3%

** Excluding participants who indicated that they never play games (7.4% males and 43.3% females).

In this course, students needed to work collaboratively. The main goal was to train them in the meaningful integration of such games in foreign-language education. First, a game-based learning module was created in Moodle containing different readings, websites, and examples of digital game practices, which the participants had to consult. In the second stage, each team had to find, play, and select a digital game aimed at teaching English to children in preschool and elementary education following the rubric provided in the materials and shown in Figure 2. This was the same rubric that the students later used to evaluate all games after the presentations.

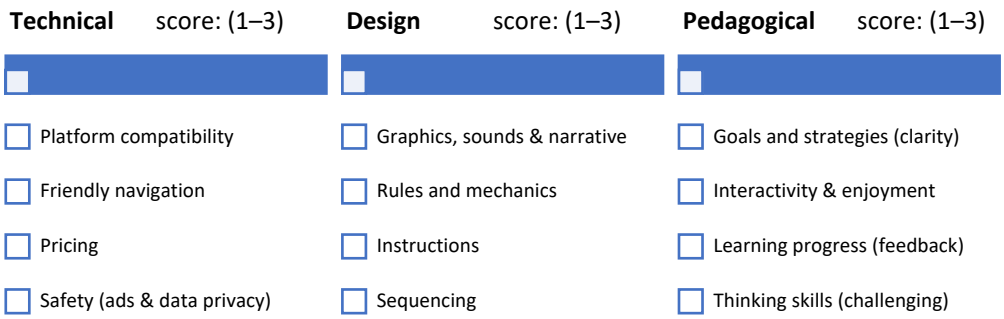

Figure 2. Rubric used for assessment of digital games (1 = basic, 2 = medium, 3 = high).

Next, the teams had to explain and illustrate the use of the games they selected, specifying the context (educational level and target students) and goals (language skills and components) to their peers, who had in turn a limited time to play some of these games in the classroom. For this purpose, each team had to prepare a visual presentation which was later shared in the learning module (Moodle) containing relevant information about the game, some images explaining the details included in the rubric and a link to the website so that the classmates could check out, and play whenever possible, the games in and after class. Two examples of presentations are shown in Figure 3.

Most of the recommended games were first- and second-language learning websites and apps specifically oriented to children, a relatively unexplored area for the participants. Some examples mentioned were *Pili Pop*, a game-based language app designed to improve the listening and speaking skills among children aged 5–10; *My Word Coach*, a video game aimed at improving children's vocabulary; and *Monkey puzzles*, developed by the University of Cambridge to help children read in English.

With this app, "ClassCraft", students play "Warriors, Wizards and Healers". They choose the role they want to take on in the classes. As they level up, they acquire new powers, which gain through participation, the delivery of tasks, the realization of work, etc. As they do things, they win points, coins, level up and unlock things, they can earn an extra day to deliver some homework or even win 5 minutes to look at their notes to solve a doubt in a quiz. With this app, cooperation is worked, it promotes sociability and it motivates students, but to get all the benefits offered by the app, you need to get a Premium account.

Astrokids

It is an application designed for the little ones to start learning English in an easy and fun way: thanks to different mini-games created by specialists in early education. Can use to learn new vocabulary and pronunciation of words. It is a free application that can be downloaded on any device. I think you can use it in class and play the different games with the whole class.

Figure 3. Digital game presentations for language learning.

A few games were mentioned by several teams such *Reader Rabbit*, an edutainment software used to teach children how to read and write in English, and *Sesame Street Games*, a website dedicated to children which contains several minigames devised to promote reading, spelling, and problem-solving skills. Some game-based apps were conceived for multilingual education, such as *Naraba World*, an app available in English, Spanish, French, and German, aimed at developing cognitive skills such as space, visual memory, and coordination in several languages.

Some games were not specifically oriented toward language learning, but the participants clarified how to use them with such purpose. Simulation games came up as the favorite genre, for example *World of Zoo*, a game that can be used to teach children about animals in English. As the teacher candidates illustrated, this game includes several rewards in the form of hearts and tokens that can be exchanged for food and tools, and an 'animal creature' feature to foster learners' creativity and interactivity, a trait of third-generation games as they had previously learned. Another example was *SimCity Edu*, a simulation game with online multiplayer elements that can be used to teach children English together with certain social skills such as friendship and respect.

Role-playing games (RPGs) were frequently mentioned, such as *Miitopia*, an RPG based on Mii characters to teach children about intercharacter relationships; *Pepi Bath Lite*, an RPG addressed to children aged 0–5 about body hygiene in English; and *Layton's Mystery Journey*, a game for children aged 10+ where players take the role of Katrielle, a young woman who opens a detective agency in London and needs to solve some mysterious cases, thus promoting learners' analytical skills.

As mentioned earlier, particular relevance was given to inclusive digital games that could be used among children with special needs (SEN). According to previous research [69,70], there are several benefits in using computer games with different types of learners, such as children with hearing or visual impairment [71–73], attention-deficit hyperactivity disorder (ADHD) [74], and autism spectrum disorder (ASD) [75,76]. However, the impact of digital gaming on special education (SEN) and its use in language learning is a relatively unexplored area, so most teacher candidates were unaware about the potential of such games.

One of the most cited inclusive games was *Otsimo*, a highly awarded app that focuses on helping autistic children in learning basic concepts through different games and develop their speaking, reading, and writing skills. Two more mentioned examples were *GraphoGame*, a Finnish game for children with dyslexia available in several languages; and *Visual Reading app*, an application created by a parent with an autistic child that is particularly addressed to children with autism or dyslexia. In this game, children can place images or videos above each word to help them make a connection. A special example was *Autcraft*, announced as the first *Minecraft* server for children with autism and their families.

This platform was created by an autistic father of an autistic child, and provides a safe and respectful environment including different games.

On a more commercial side, some teams referenced popular video games such as *Minecraft* and the *Legend of Zelda* series. In fact, these options were mainly recommended by participants with a higher playtime score (over 3 h per week). The use of such commercial off-the-shelf games or COTS for language learning had been investigated. *Minecraft* is a massive multiplayer online (MMO) game with an offline version available, which is globally very popular among children. As the teacher candidates explained, in this game, young learners can choose an avatar to build things, learn words (castle, volcano, bridge, etc.), and chat with other users. In line with the research carried out in previous works [77,78], participants focused on the use of *Minecraft* for vocabulary building.

On the other hand, *Legend of Zelda* is a series of fantasy action-adventure video games based on a medieval-inspired journey where players must travel through dungeons and labyrinths to learn the origin of the Triforce and save the princess Zelda. Some teams proposed this game to be autonomously used for incidental vocabulary learning (signs, holes, fireballs, dungeons, leaf pile, stairs, etc.) alongside other educational values such as risk taking and memorization, although previous research works indicated that teacher intervention in the classroom might be necessary to strengthen the pedagogical value of this game [79].

In the fourth stage, the teacher candidates discussed the different games explained in class, and reflected on the benefits and limitations of integrating them in language learning among preschool and elementary education children. Class presentations and discussion were analyzed as qualitative data in this research. Consistent with previous studies [2,75,80], participants highlighted three potential benefits: enjoyment, enhanced motivation, and autonomous learning. However, they also predicted some challenges such as lack of or limited digital access and technological differences among children in and outside the classroom, inappropriate choice of the games depending on different factors (safety, students' educational needs), and distrust and lack of interest among current educational practitioners and supervisors. These conclusions confirmed results from previous works [5,17].

The prevailing view among future educators in the class discussion was that digital games are still conceived by a good number of professionals and parents as distracting and marginal to more formal education, and there is a widespread belief that these games may negatively impact children, such as through lack of attention and social interaction [81]. Therefore, participants highlighted the necessity to enhance the educational value and benefits of some digital games through practical examples, and to better prepare both in- and preservice teachers in foreign-language education.

In the last research stage, the teacher candidates had to post their thoughts about digital games in the team blogs as illustrated in Table 4 (transcribed game reviews) and Figure 4 (blog posts).

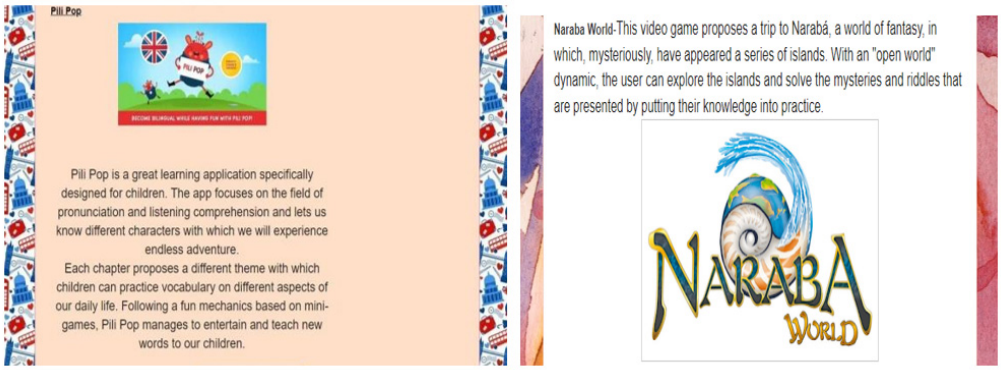

Figure 4. Screenshots of two students' blog posts about digital games.

Table 4. Blog post reflections about the use of digital games in language learning.

Subject	Game	Platform	Blog Post Reflection
32 (F)	Funland	Wii, PC/MAC, Smartphone	Funland is an application developed by Cambridge. It is set in a fair where each attraction is an opportunity to learn playing, and has four mini games. It is designed for children aged 7–12 who already have a basic knowledge of English. The idea is very good and interesting because children can read in English and use the vocabulary they already know in a sentence.
67 (F)	Land of Fantasy	App (Android, iOS)	Land of fantasy is oriented to learn the basic vocabulary and phonetics of the language, in this case English. It has two levels. When you choose the level, you find different games such as searching for objects, finding the image, making equal pairs, putting the missing letter, memorizing objects, arranging the letters, placing everything in its place, and choosing the correct words. Within each activity there are different levels.
137 (F)	Miitopia	Nintendo	We chose Miitopia because it is an RPG that allows for children to create their own characters (warrior, mage, thief, chef, etc.) and team, so it can boosts students' imagination and creativity. In addition, it promotes friendship because children are immersed in an adventure with characters that they created and the battles are not violent. However, they need to have a basic English level to play it. The problem is the cost and platform compatibility.

Concerning students perception about the use of video games in the classroom, the pre/post-test results based on Bourjongon et al. [63] revealed a small increase in all five dimensions (experience, usefulness, ease of use, learning opportunities, and preference for video games) as shown in Table 5. Results of learning opportunities (LO) were higher compared to the other dimensions, thus confirming participants' positive attitudes toward video games, but gaming experience (EXP) yielded low scores, and results about the ease of use (EOU) only improved to a small degree.

The Wilcoxon signed-rank test was employed to analyze the difference in the means of the two related samples before and after the treatment, revealing statistically significant differences in only two of the five dimensions, namely, usefulness (U) and preference for video games (PVG), as illustrated in Table 6. In light of these data, teacher candidates seemed to be more confident about the positive impact of using video games on learning performance ($p = 0.011$), effectiveness ($p = 0.014$) and achievement ($p = 0.045$). Similarly, they expressed a stronger interest ($p = 0.026$) and enthusiasm ($p = 0.014$) about the adoption of video games in foreign-language education after the treatment.

However, no significant difference was observed in the results of the three other dimensions of experience (EXP), ease of use (EOU), and learning opportunities (LO). The result of EOU was particularly surprising, given the fact that teacher candidates had illustrated the use of digital games in the classroom, but according to their own comments, this just helped them in realizing the complexity of technological and pedagogical factors involved for the effective integration of digital games in language learning and their lack of preparation.

Table 5. Students' perception about the use of video games in the classroom based on five-point Likert scale (1 = strongly disagree to 5 = strongly agree).

	N = 154 Cronbach's Alpha: 0.922	Pre		Post	
		M	**SD**	**M**	**SD**
EXP1	I like video games in general	2.71	1.261	2.84	1.081
EXP2	I like playing video games	2.62	1.324	2.76	1.054
EXP3	I often play video games	2.37	1.482	2.41	1.118
EXP4	Compared to people of my age, I play a lot of video games	2.14	1.582	2.36	1.385
EXP5	I would describe myself as a gamer	2.18	1.709	2.36	1.636
EXP6	I play different types of video games	2.42	1.499	2.60	1.306
U1	Video games in the classroom would improve my performance	2.55	1.438	2.92	0.946
U2	Using video games in the classroom would increase my learning productivity	2.66	1.330	3.01	0.918
U3	Using video games in the classroom would enhance my effectiveness	2.75	1.315	3.00	0.936
U4	Using video games in the classroom would help me to achieve better grades	2.58	1.422	2.86	0.946
EOU1	I would know how to handle video games in the classroom	2.75	1.276	2.83	0.995
EOU2	It would be easy to for me to use video games in the classroom	2.72	1.245	2.94	0.975
EOU3	My interaction with video games in the classroom would be clear and understandable	2.86	1.223	2.94	1.046
LO1	Video games offer opportunities to experiment with knowledge	3.11	1.202	3.31	1.202
LO2	Video games offer opportunities to take control over the learning process	2.97	1.123	3.13	0.853
LO3	Video games offer opportunities to experience things you learn about	3.23	1.136	3.34	1.212
LO4	Video games offer opportunities to stimulate transfer between various subjects	3.20	1.134	3.36	1.171
LO5	Video games offer opportunities to interact with other students	3.34	1.184	3.47	1.206
LO6	Video games offer opportunities to think critically	3.01	1.085	3.23	0.891
LO7	Video games offer opportunities to motivate students	3.42	1.302	3.61	1.457
PVG1	If I had the choice, I would choose to follow courses in which video games are used	2.94	1.197	3.13	1.136
PVG2	If I had to vote, I would vote in favor of using video games in the classroom	2.93	1.194	3.22	1.127
PVG3	I am enthusiastic about using video games in the class	2.55	1.242	2.86	1.004

Table 6. Wilcoxon signed-rank test of students' perception about the use of video games.

Item	**Wilcoxon Test Z**	***p*-Value**	**Item**	**Wilcoxon Test Z**	***p*-Value**
EXP1	−0.891	0.373	LO1	−1.378	0.168
EXP2	−0.973	0.331	LO2	−1.205	0.228
EXP3	−0.311	0.756	LO3	−0.814	0.416
EXP4	−1.384	0.166	LO4	−1.266	0.205
EXP5	−0.895	0.371	LO5	−0.972	0.331
EXP6	−0.960	0.337	LO6	−1.822	0.068
U1	−2.543	0.011	LO7	−1.193	0.233
U2	−2.465	0.014	PVG1	−1.504	0.132
U3	−1.899	0.058	PVG2	−2.234	0.026
U4	−2.007	0.045	PVG3	−2.445	0.014
EOU1	−0.737	0.461			
EOU2	−1.653	0.098			
EOU3	−0.566	0.571			

Reported values are two-tailed.

Correlational analyses were also performed to identify any existing relations between the participants' gender and any of the aforementioned dimensions. As it turned out, no significant data were found to identify the *gender* variable as related to experience, usefulness, ease of use, learning opportunities or preferences in either the pretest or the post-test. However, there seemed to be positive correlation between the gender of the participants and the time they stated they spend on their tablets and computers per week; specifically, males claimed to devote more time ($r = 0.400$) than females did on such devices ($p = 0.000$). This supports the notion that perceived usefulness directly and positively influences teachers' intention, while gender and age do not impact teachers' attitudes as explained in previous works [82].

Qualitative data obtained from the blog posts were analyzed and coded according to different patterns in three main themes. The first theme was related with the technical description and reasons to select each game. The three most repeated arguments were visual design, clear instructions, and pricing, which were part of the rubric, and they had been analyzed in previous research as predictors of game preference [83]. However, teacher candidates did not consider safety (data protection, ads, etc.) as a key element, despite the fact that they were selecting games addressed to children.

The second theme was related with the expected affordances or impact on language-learning progress. In line with previous findings [84], participants mostly focused on vocabulary development as the most relevant benefit over other areas and skills. Other anticipated effects mentioned in the blog posts were enhanced motivation and enjoyment. The last theme was about the potential obstacles and limitations for the adoption of the selected games, and the most cited problems were three: lack of or poor digital resources, no accessibility of some selected games for different types of learners, and fear of no academic support for such innovative practices among current educators and school authorities due to lack of knowledge and mistrust about the benefits of using digital games in language learning.

5. Conclusions and Implications

The use of digital games in education is on the rise, and current technological advances are reshaping traditional methodologies in foreign-language learning. Research has mainly focused on students as game players rather than as future educators. However, new generations are already transitioning from digital native students to digital native teachers. This paper aimed to analyze teacher candidates' knowledge and attitudes toward the use of digital games in foreign-language education. For this purpose, 154 education students participated in this four-week research comprising five stages related with critical thinking skills (analyzing, selecting, demonstrating, discussing, and reflecting).

As the pretest results revealed, computer usage among participants was primarily dedicated to web searching for information retrieval and academic purposes, whereas tablet and smartphone usage was mainly linked with instant communication and entertainment such as watching videos and movies. Gameplay scored low compared to all the other options. Contrary to previous research findings, some gender-based differences were observed, such as a longer gameplay time and a more limited choice regarding genres, basically fighting and sports among males, as opposed to female students whose preferences were more diverse (simulation and RPG, action and adventure, puzzle and card games). The first implication is that better preparation is necessary to familiarize all future educators with different game principles, practices, and genres, and bring out their potential in education, since the integration of digital games seems to be closely related with their previous personal experiences as gamers [17].

Although participants' previous knowledge on the use of digital games for language learning was scarce, they managed to describe a wide range of games through class presentations. Some teams chose digital games specifically designed for language learning such as *Pili Pop* or *Lingokids*, while others preferred more commercial games such as *Minecraft*. Simulation games such as *World of Zoo* and *SimCity* emerged as the preferred

genre among future educators. However, participants lamented being unfamiliar with inclusive digital games that could be used for children with special needs. As future educators, they valued the knowledge shared among peers about certain games such as *Otsimo* and *GraphoGame*. A second implication is that more technical and pedagogical efforts are necessary about game accessibility and students' needs in teacher training programs to prepare preservice teachers for an inclusive and diverse education in which digital games can play a positive role in the case of students with special needs [69,70].

Concerning participants' perception about the use of video games in the classroom, pre/post-test results and data analysis revealed significant differences in only two of the five dimensions, namely, usefulness (U) and preference for video games (PVG). The teacher candidates endorsed the educational value of video games and believed in their positive impact on learning productivity, performance, and achievement. They were also keen on learning more about digital games. In line with previous works [85], results showed that teacher candidates hold positive views toward video games, as evidenced by the scores of learning opportunities (LO).

However, no relevant changes were observed concerning ease of use (EOU) after the treatment. This may have been due to the insufficient time dedicated to the use of digital games in language learning and the wide range of available options, the complexity of technological and pedagogical factors involved, and their inexperience in integrating them in the classroom. As highlighted by Kaimara and Fokides [51], 'even if the motivation is a good starting point for games to be integrated into education, games should be aligned with the principles of pedagogy and educational methodology, as well' (p. 8217). As a third implication, digital games are a fast-growing sector requiring constant training and updated knowledge about emerging technologies (AR, VR) and new applications, so this may require more systemic integration in the curriculum and not only a game-based learning module.

Qualitative data based on class discussion and blog post reflections evidenced the benefits of including a digital game module, as indicated in previous works [49]. Future educators became more familiar with game-related principles and practices in language learning, and aware of the necessity to include digital games in the curriculum. However, and consistent with previous research findings [86,87], they also expressed their concern on the academic distrust about video games among some inservice teachers and parents because of the alleged negative effects such as the distraction factor and social isolation. The last implication is that preservice teachers may be reluctant to integrate digital games in their future career if they perceive there is no professional support for such innovative practices in the classroom. For this reason, special programs should be designed to highlight affordances, and discuss the risks of such integration to be specifically addressed to education stakeholders.

Lastly, these results may be limited to the specific context and participants in this research, particularly regarding gameplay experience and previous formal training, since the adoption of game-based language learning courses in the curriculum may vary depending on each setting. Further research is needed about the adoption of digital games in teacher training programs, particularly regarding confidence development and practical experience in early education, through game-based learning modules, and in the students' preparedness to include digital games for language learning from an inclusive perspective.

Author Contributions: Conceptualization, J.B.-M.; methodology, J.B.-M., J.R.C.-F.; validation, J.B.-M., J.R.C.-F.; formal analysis, J.B.-M.; investigation, J.R.C.-F.; resources, J.B.-M.; data curation, J.R.C.-F.; writing—original draft preparation, J.B.-M., J.R.C.-F.; writing—review and editing, J.B.-M., J.R.C.-F.; visualization, J.B.-M.; supervision, J.R.C.-F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data supporting the research findings are available from the authors upon request.

Conflicts of Interest: The authors declare no conflict of interest.

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