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ORIGINAL ARTICLE

# The use of massive online games in game-based learning activities

*El uso de juegos masivos en línea en actividades de aprendizaje basadas en juegos*

O uso de jogos online massivos em atividades de aprendizagem baseadas em jogos

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KEYWORDS

COVID-19, learning, videogames, virtual reality, virtual world.

**ABSTRACT.** The popularity of massively multiplayer online games such as Minecraft and Roblox has aroused the attention of teachers and educational researchers in the past decade. The purpose of this paper is to provide preliminary classroom experience using Roblox in game-based learning activities through action research. Convenience and quota sampling were used, intervening in four groups from different educational levels: 1 secondary, 1 high school, and 2 colleges. The learning activities with Roblox were conducted during the 2020-2021 academic year during the COVID-19 pandemic that forced Mexican schools to go digital. Roblox was used to learn content (like dinosaurs, contagious diseases, system definition) and interpersonal skills (negotiation, cooperation). The participants' learning perception was explored through quantitative and qualitative data. Findings suggest that students enjoyed the Roblox learning activity as it allowed social interaction between classmates. The students evaluated the learning through the Roblox activity class on different scales (3,08; 3,18; 4,07 and 4,21 on the Likert scale). The results indicate that there are generational differences between groups. Finally, the paper offers concrete suggestions for the use of Roblox in the educational context.

PALABRAS CLAVE

**RESUMEN.** La popularidad de los juegos en línea multijugador masivos como Minecraft y Roblox ha llamado la atención de profesores e investigadores educativos en la última década. El propósito de este documento es proporcionar una experiencia preliminar en el aula utilizando Roblox en actividades de aprendizaje basadas en juegos a través de la investigación-acción. Se utilizó

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COVID-19, aprendizaje, videojuegos, realidad virtual, mundo virtual.

muestreo por conveniencia y cuotas, interviniendo en cuatro grupos de diferentes niveles educativos: 1 secundaria, 1 bachillerato y 2 facultades. Las actividades de aprendizaje con Roblox se realizaron durante el año académico 2020-2021 durante la pandemia de COVID-19 que obligó a las escuelas mexicanas a digitalizarse. Roblox se utilizó para aprender contenido (como dinosaurios, enfermedades contagiosas, definición de sistemas) y habilidades interpersonales (negociación, cooperación). La percepción de aprendizaje de los participantes fue explorada a través de datos cuantitativos y cualitativos. Los hallazgos sugieren que los estudiantes disfrutaron de la actividad de aprendizaje de Roblox, ya que permitió la interacción social entre compañeros de clase. Los estudiantes evaluaron el aprendizaje a través de la clase de actividad de Roblox en diferentes escalas (3,08; 3,18; 4,07 y 4,21 en la escala de Likert). Los resultados indican que existen diferencias generacionales entre los grupos. Finalmente, el artículo ofrece sugerencias concretas para el uso de Roblox en el contexto educativo.

PALAVRAS-CHAVE

COVID-19, aprendizado, videogames, realidade virtual, mundo virtual.

**RESUMO.** A popularidade de jogos online multiplayer massivos, como Minecraft e Roblox, despertou a atenção de professores e pesquisadores educacionais na última década. O objetivo deste artigo é fornecer uma experiência preliminar em sala de aula usando o Roblox em atividades de aprendizado baseadas em jogos por meio de pesquisa-ação. Utilizou-se amostragem por conveniência e por cotas, intervindo em quatro grupos de diferentes níveis de escolaridade: 1 secundário, 1 médio e 2 universitários. As atividades de aprendizado com Roblox foram realizadas durante o ano letivo de 2020-2021 durante a pandemia de COVID-19 que forçou as escolas mexicanas a se tornarem digitais. Roblox foi usado para aprender conteúdo (como dinossauros, doenças contagiosas, definição de sistemas) e habilidades interpessoais (negociação, cooperação). A percepção de aprendizagem dos participantes foi explorada por meio de dados quantitativos e qualitativos. Os resultados sugerem que os alunos gostaram da atividade de aprendizagem Roblox, pois permitiu a interação social entre os colegas. Os alunos avaliaram a aprendizagem por meio da aula de atividade Roblox em diferentes escalas (3,08; 3,18; 4,07 e 4,21 na escala Likert). Os resultados indicam que existem diferenças geracionais entre os grupos. Por fim, o artigo oferece sugestões concretas para o uso do Roblox no contexto educacional.

## 1. INTRODUCTION

There has been a growing interest for several decades of educational researchers studying the uses of video games for educational purposes (Horizon Report, 2010; Nebel et al., 2016). This wide-spread practice has been valued positively by many researchers (Delwiche, 2006; Foreman, 2004; Gee, 2003; Greenfield, 1994; Gros, 2007; Hung et al., 2020; Ke, s. f.; McClurg & Chaillé, 1987; Nebel et al., 2016; Orosy & Allan, 1989; Squire, 2005; Squire & Barab, 2004).

Gee (2003) argued that schools could use games and gaming technology to enhance learning. In Gee´s words, "designers face and largely solve an intriguing educational dilemma, one also faced by schools and workplaces: how to get people, often young people, to learn and master something that is long and challenging and enjoy it, to boot" (p. 1). He considers that since good videogames are supported by cognitive science research, schools could benefit from their use to boost learning.

Roblox, *Minecraft*, *Fortnite*, *Everquest*, and *Second Life*, among others, are defined as multi-user virtual environments (MUVEs) or massively multiplayer online games (MMOs or MMOGs). MMOs "bring many players together in activities that are sometimes collaborative and sometimes competitive, generally goal-oriented, and often tied to a storyline or theme" (Horizon Report, 2010, p. 25). In these virtual worlds, participants create highly personalized characters called avatars and, since they have a highly addictive quality, some users often "spend

more waking time with friends in the digital world than with human beings in their physical environment" (Delwiche, 2006, p. 160). In 2007 when Horizon Report wrote about this trend, MMOs were relatively rare because of the cost and the difficulty of producing them. That report argued that the adoption of MMOs in educational environments would take an additional four to five years. MMO´s potential application in schools was announced in the earlies 2000s because they offered a situated learning experience in a virtual environment (Delwiche, 2006; Foreman, 2004). In other words, they "offer immersive, engaging experiences in a variety of disciplines" (Horizon Report, 2010, p. 26). They were further named as massively multiplayer online role-playing games (MMORPGs). These kinds of games "are not just online extensions of console or personal computer role-playing games; instead, they offer vivid online worlds through which players share aspects of their daily lives while engaging in-game activities" (Lin & Sun, 2015, p. 1).

Since the early 2000s, MMOGs became one of the most popular "forms of entertainment and a major mechanism of socialization for young and old alike" (Steinkuehler, 2004, p. 521). At present, they are "an ongoing trend for this generation" (Long, 2020, p. 24). This trend undoubtedly has grown during the COVID-19 crisis that forced people to stay at home for many months, searching for digital mechanisms to interact socially. For example, Minecraft grew from 112 million monthly users during September 2019 to more than 131 million monthly users during October 2020 (Wales, 2019).

On the other hand, *Roblox* had 100 million monthly active users during August 2019 and expanded to 150 million monthly users by July 2020 (Roblox Corporation, 2020; Wales, 2019). *Fortnite* had 250 million players in March 2019, and grew to 350 million registered accounts by 2020 (Kay, 2020). But obviously, the expansion of the MMORPG users was not the only phenomenon that happened during the COVID-19 pandemic crisis.

During the COVID-19 crisis, many countries decided to bring schools from face-to-face activities to online learning (Díaz & Loyola, 2021; Gómez & Quijada, 2021; Mamani et al., 2021; Radha et al., 2020). In this context, an American Medical Association viewpoint was written by Galea et al. (2020) where it was argued the need for approaches during COVID-19 social isolation that ensures children have "structure, continuity of learning, and socialization to mitigate the effect of short- and long-term sheltering in place" (p. 817). Loades et al. (2020) analyzed 80 previous studies about loneliness and measured the impact on the mental health in children and adolescents during the COVID-19 isolation period. As a conclusion of their paper, they argued that children and adolescents are "probably more likely to experience high rates of depression and most likely anxiety during and after enforced isolation ends" (p.1). Hence, teachers needed to accelerate their learning about digital learning tools to embrace this professional challenge. One shared concern in this isolated period is how to

> […] maintain a highly interactive environment in the online classroom to reduce the anxiety and frustration of being away from friends and the classroom. Online learning does not allow private interaction among students, leading to boredom and dissatisfaction in this setting. However, activities that encourage social interactions and private conversations among students should be encouraged, keeping the spirit of learning intact (Baber, 2020, p. 10).

Both, students and teachers during COVID pandemic needed to increase their digital competencies (Díaz & Loyola, 2021). Massively multiplayer games favor virtual social interaction among students. In the words of Squire (2005) "e-learning educators are wise to look toward games as models of next-generation learning environments" (p. 6).

This paper aims to provide preliminary classroom experience using Roblox in game-based learning activities through action research. This exploratory study was conducted during the 2020-2021 academic year during the COVID-19 pandemic, forcing Mexican schools to go digital. The research questions that guided this study were: How students experience the learning of content and skills through Roblox´s game-based learning activities? How is interaction among peers behaved in the context of online learning with Roblox during COVID-19 confinement? What are some advantages and disadvantages of the incorporation of Roblox during learning activities?

## 1.1. Game-based learning

### Early studies focus on video games.

Early studies of video games during the 1980s focused on the addiction danger of video games. Still, some years ahead, studies began to center on the positive effects of learning with digital games. Some researchers claimed that video games enhance the performance of spatial, visual, and motor skills (Greenfield, 1994; McClurg & Chaillé, 1987; Orosy & Allan, 1989).

On the other hand, studies about the alternatives that games, not necessarily videogames, and simulations bring to education started in the middle of the 1950s and expanded in the 1970s and 1980s (Butler, 1988). However, research focused on video games in education had little attention until the end of the 1990s (Gros, 2007).

The publication in 2001 of the book *Digital game-based learning*, by Marc Prensky, opened a new perspective about videogames applied for learning purposes (Gros, 2007). Alongside Prensky, there were four other leading-edge thinkers in the field of Game-Based Learning in the earlies 2000s: James Paul Gee, J. C. Herz, Randy Hinrichs, and Ben Sawyer (Foreman, 2004). According to Foreman´s overview of these forerunner contributions, they can be synthesized in six topics:

> (1) The dysfunctions of conventional instruction; (2) The power of simulations; (3) The importance of game-based learning communities; (4) The reasons videogames promise a better learning future; (5) The changes necessary for the new paradigm to take hold; and (6) The practical steps that colleges/universities and influential academics can take to move institutions down the trail blazed by USC and others" (Foreman, 2004, p. 1)

Afterward, a growing learning interest of educational researchers focused on the uses of videogames to enhance the learning of content (Gee, 2003; Squire, 2005; Squire & Barab, 2004). The learning of personal and social skills and the boost of literacy learning in schools (Hung et al., 2020).

In 2009 Fengfeng Ke presented a meta-review of 89 studies of computer games as learning tools. The author reported that 65 out of 89 studies evaluated the effects of the game upon learning. From the empirically-based

studies, 34 out of the 69 found positive outcomes from using games, 17 had mixed results, 12 reported "no significant difference" with traditional instruction approaches – and one study found traditional methods more effective (de Freitas, 2018, p. 78; Ke, s. f.).

### 1.2 Game-based learning with MMOGs

MMOG's are among the most recent in the videogame genres. One of the pioneer studies focused on MMOG's was Steinkuehler (2004) who analyzed MOMGs from an ethnographic, or cultural, perspective and stated that learning occurs naturally in these communities of practice. Further, Delwiche (2006) recognized MMOs as an instructional promise "because they immerse students in complex communities of practice, because their immersive nature invites extended engagement with course material, and because they encourage role-playing" (p. 162).

According to Delwiche (2006) a challenge of using MMOs in the classroom is to engage students in role-playing and community of practice to connect with the academic goals of the course.

Delwiche (2006) early study with MMOs reported his findings from two undergraduate courses using this kind of video game in situated learning theory. In the first course, he used *EverQuest* to teach ethnography research methods to 36 students. In the second course, he used *Second Life* to teach the videogame design criticism approach to 15 communication students. Delwiche's learning goal was to explore cyberculture studies "through sustained interaction with other gamers" (p. 165).

A Horizon Report document from 2007 describing potential uses of MMOs in schools suggested its use to improve the study of foreign language and culture, develop leadership and management skills, and practice strategy and apply knowledge competitively.

Since its official release in 2011, *Minecraft* has been one of the most popular games used for Game-Based Activities in schools (Nguyen, 2016). *Minecraft* has a "broad range of examples from education and research" (Nebel et al., 2016, p. 362) and even has released a teacher-friendly version MinecraftEdu. "Due to its numerous modifications, easy structure, huge player community, and countless forums, blogs, and YouTube videos on how to implement different features and rewrite source code, this game can be used even by game development novices" (op. cit., p. 358).

More recently, Bokolas y Panagouli (2019) presented an action research with 5th and 6th graders in an elementary school in Greece promoting historical-cultural education using the popular games *Fortnite* and *Civilization* during a three-year program (2016-2018). As the students played real-time strategy games (*Civilization* placed in the Middle Ages and *Fortnite* in the 20th century), they explored the "relationship with the documented historical knowledge" (p. 74).

### 1.3 Roblox in education

Another MMO game, trendy among youth, is *Roblox*. Compared to the rising attention of *Mindcraft* in educational research, *Roblox* has been only slightly studied. An advanced search in Google Academic in April 2021 looking for research papers with titles using the words "Minecraft/ Education" found 67 results. The same investigation by the phrase "Roblox/Education" in the title prompted only one paper. This is an example of the lack of attention that this videogame has received from the educational research community.

Roblox was developed in 2005 by Dave Baszucki and Erick Cassel in San Mateo, California. It is defined on its web page as a "global platform that brings people together through play" (Roblox Corporation, 2020). Roblox is a platform to both play and design 3D online playing games. It also functions as a social network; users can follow friends, chat with them, and send private messages (Powers, 2019).

Roblox Corporation has created two different sets of software: *Roblox Studio* and *Roblox Player* (see icons in Figure1). *Roblox Studio* is an entirely free software program used to create and develop 3D games (Roblox Corporation, 2020). It is "a simple and intuitive program in which no previous programming skills are required" (Meier et al., 2020, p. 268).

Roblox creates the tools and infrastructure for sharing, and the community makes the open content. On the other hand, *Roblox Player* is a massively multiplayer online role-playing game (MMORPG). Users can access Roblox for free on any device - PC, Mac, iOS, Android, Amazon Devices, Xbox One, Oculus Rift, and HTC Vive (Roblox Corporation, 2020). The platform currently features a huge catalog of over 40 million games, most of which are user-generated (Chowdhury, 2020).

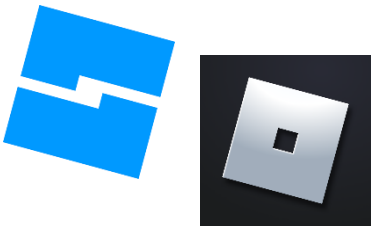

*Figure 1*. Roblox Studio (a) and Roblox Play (b) Icons

Source: https://bit.ly/3vnSl4L and https://bit.ly/3sogYwm

Roblox Corporation counted in December 2020 a total of 37 billion hours played since 2008, 3 billion total engagement hours each month, 5.2 million peak concurrent users, and 241 million dollars paid to the community developers (Roblox Corporation, 2020). Roblox has a "young demographic, with players ranging in age from six to early 20s" (Crecente, 2019). To start playing Roblox, you must personalize your Avatar (see Figure 2), choose a game among a vast range of options (see Figure 3 as an example of Games´ Menu), and then contact friends to interact in the virtual world (see Figure 4 as an example of Friends Screen).

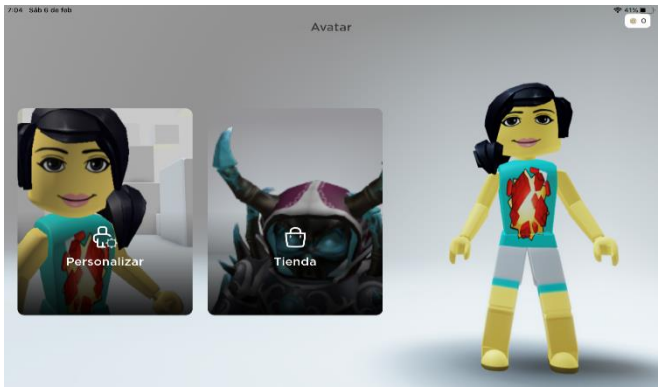


*Figure 2*. Roblox´s Avatar example

Source: Screenshot from a personal account

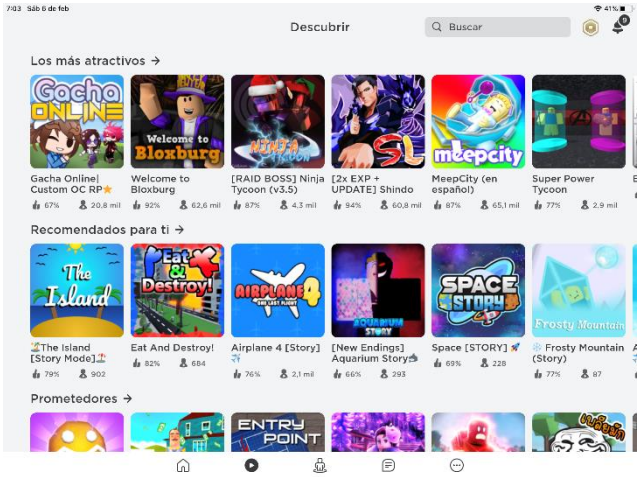


*Figure 3*. Roblox´s Games Menu Example

Source: Screenshot from a personal account

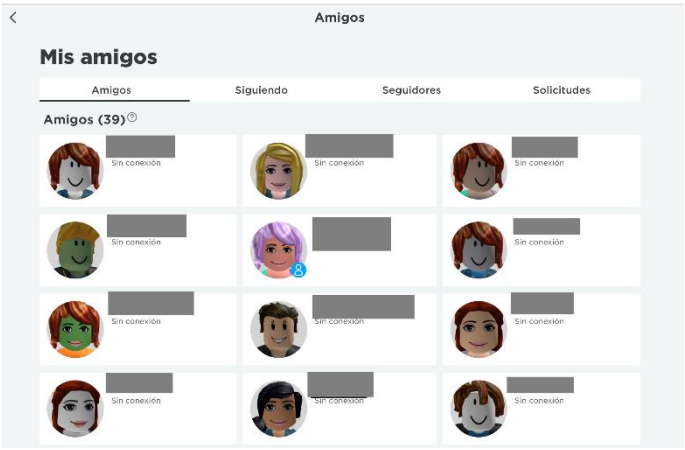


*Figure 4*. Roblox´s Friends Screen Example

Source: Screenshot from the personal account[2].

Teachers, researchers, and other educational centers are starting to explore the potential uses of *Roblox Player* and *Roblox Studio* for enhancing particular knowledge and skills. A curious fact is that the forerunner of Roblox was an education tech startup called *Knowledge Revolution,* developed by Dave Baszucki and Erick Cassel in 1989 to provide teachers and students a program that could serve as a 2-dimension lab for modeling physics problems like virtual levers or ramps (Knapp, 2018). Two decades later, Roblox "was created with the goal of teaching children to code and program" (Teach Radar Pro, 2019).

[22] Names of friends were delated for security reasons.

Guerrero (2019) states that "Educators around the world use Roblox to engage students with real coding, digital civility, and entrepreneurship, and more." However, at this moment, the page only presents two case studies of educational centers that teach programming to children: The Koding Kingdom and ConMásFuturo.

Roblox Corporation has actively promoted programming skills learning among young users of *Roblox Studio*. It organizes an annual developer´s conference where Roblox developers from all over the world can meet and exchange tips. It also has paid internship programs, summer camps, and self-guided classes on the website to help young developers create games (Kay, 2020; Teach Radar Pro, 2019).

Whereas the use of Roblox for teaching coding skills started from its inception, its adoption of informal educational settings happened more recently. In 2019 on the Web Page Common Sense Education, Mellissa Powers reviewed the classroom potential of Roblox. "Roblox is a commercial product that inherently has a lot of learning opportunities. Like Minecraft, this popular gaming platform can be used to teach and demonstrate specific skills, with careful planning and structured implementation" (Powers, 2019). She recommends using Roblox for 8-12 grades, with great Instructional Design, Game-Based Learning, Media Literacy, and Coding opportunities. Powers also suggests the potential of Roblox to enhance communication and collaboration skills, creativity, character and SEL, and critical thinking.

Teachers can take advantage of Roblox's versatility to use it in a variety of ways. In a computer science classroom or after-school program, Roblox offers a real-world experience as students use code to develop games that can be quickly published and shared with an audience of millions. In learning about game design, students practice storytelling, sequencing, graphic design, 3D modeling, and various skills that translate across disciplines. For older students, teachers could even use Roblox's monetization feature to teach business and entrepreneurial skills. Subject area teachers can use Roblox as a digital platform for demonstrating content knowledge. Students could make a simulation for a historical event or experience (think Oregon Trail) or create a choose-your-own-path adventure (Powers, 2019, p. 1).

Meanwhile, Powers´ review offers a complete description of the broad potential uses of Roblox in the context of formal education, but fails to present case studies or research about these uses. Further documented research only returned two previous papers about the uses of Roblox in the context of formal education, seeking to promote the development of specific knowledge or skills in students (Long, 2020; Meier et al., 2020). This situation contrasts with the extensive research focused on the similarly featured game Minecraft.

"Roblox and effect on education" is previous research presented by. They gathered opinions from elementary school teachers in two different districts in the USA on utilizing the Roblox platform as an educational tool. The results showed that 90 % have heard of Roblox, and 46 % of students have played Roblox. In the survey, teachers were asked to rank up to three teaching strategies they prefer when using technology. These three were: motivation, problem-solving, and STEM. When it comes to using Roblox as an educational tool in the classroom, they stated a positive opinion (Long, 2020, pp. 2-3).

The second paper of Meier, Meier et al. (2020) describes their experience incorporating "virtual routes about the sculptural heritage of a city in the classroom by developing a simulation of the urban environment" (p. 268). They used Roblox Studio during a complete academic year with 53 secondary school students who "were given

the task of designing a virtual environment in which they had to include 3D models of the sculptural heritage of the city of Santa Cruz de Tenerife" (p. 268).

The learning activity was conducted on plastic, visual and audiovisual education in a Spanish School. As part of the results of Meier et al. (2020) they found that students "felt that the use of Roblox motivated them to learn and study in class. Concerning the subject, they considered it to be an appropriate activity for plastic and visual expression (3.39 out of 5). They believed that more digital activities (3.27 out of 5) should be incorporated into secondary school studies" (p. 277). Guerrero (2019) has an extended version of this paper that can be read in Spanish.

## 2. METHOD AND MATERIALS

This study adopted an action research approach to explore the use of Roblox as an educational tool in the school context. Action Research was coin in 1946 by social psychologist Kurt Lewin who proposed to "integrate science and practice" (Argyris, 1985). Action research include the active participation of researchers in the problems they identify. This approach of taking action and doing research at the same time has been proven to be pertinent in real-life situation such as teach and learn process (Messikh, 2020).

The learning activities whit Roblox were guided by three participant researchers. Once the activities were finished, participants' learning perception and experience were explored through a questionnaire that gathered both quantitative data (Likert scale 1-5) and qualitative data (open questions). The participants' behavior was observed through the participatory observation technique and the learning goals were evaluated through the learning products. In other words, the action research was conducted using a mixed method in which quantitative and qualitative data were "simultaneously collected, analyzed and interpreted" (Zohrabi, 2013, p. 254).

The data collection through the mix instruments had the purpose to strengthen the validity of the findings through triangulation. Multiple participant researchers allowed to increase the internal reliability during the study, as well, through verification and confirmation during the data collection, analysis and interpretations (Zohrabi, 2013).

### 2.1 Participants

A non-probabilistic convenience and quota sampling was selected since the action research happened in real classroom groups from the participant researchers. Convenience sampling allows accessibility of a target population and their availability at a given time (COVID confinement). It is suitable for exploratory scope studies and research that "does not aim to generate results that will be used to create generalizations pertaining to the entire population" (Etikan, 2016, p. 1).

On the other hand, the quota sampling allows researcher to investigate and compare characteristics of a certain subgroup (Bornstein et al., 2013). The participants selected in this study correspond to three different educational levels subgroups located in Mexico: secondary (group 1), high school (group 2), and college (group 3 and 4). A K12 or primary school group quote was searched to include in the research, but any teacher invited showed interest to participate.

The Institution name, categorization between private or public schools, grade of each group, number of participants, age range, and subject of the classroom are presented in table 1.

Table 1

*Participants*

| Group | Institution | Public/ Private | Grade | Number of participants | Range of age | Subject |
|---|---|---|---|---|---|---|
| 1 | Anonymous while review | Private | Secondary | 13 | 12-13 | Biology |
| 2 | Anonymous while review | Private | High School | 28 | 16-18 | Health Education |
| 3 | Anonymous while review | Public | College/Entrepreneur Innovation Bachelor´s degree | 15 | 21-25 | Negotiation and Conflict Management |
| 4 | Anonymous while review | Public | College/Entrepreneur Innovation Bachelor´s degree | 29 | 20-31 | System Thinking |

Source: own elaboration.

## 2.2 Procedure

The learning activities were conducted during the 2020-2021 Academic year during the COVID-19 pandemic that forced Mexican schools to go digital. The procedure was divided into five main activities listed below.

Activity 1. Teacher´s previous familiarization on Roblox and game selection

Teachers who were participating in this study created their own Roblox account and avatar. They needed at least 10 hours of free play with Roblox to gather coordination skills and specific game knowledge. The three teachers of this study organized a learning group to prepare the "Roblox learning activities." They received help from small children from their surroundings to anchor their learning process of Roblox. Dialogue among teachers helped to choose the game that made the best fit for the class purposes.

Activity 2. Student preparation before class

Before the "Roblox learning activity," students were asked to install the Roblox app, log into their account (or sign in), and send their avatar name to the teacher or a friend request to play together in the same playroom during class. Students of all the groups used their own devices (tablets, smartphones, and computers) for playing.

Activity 3. Learning activity instruction

An online synchronous session was carried out with a web-based video conferencing tool (Zoom in groups 1 and 2 and Google Meet in groups 3 and 4). During this session, teachers took about 10-20 minutes to introduce the learning purposes, lesson plan, topic guidance, orientation about the learning products, and introduced the game(s) before the Roblox gaming. The topic reviewed during the learning activity with Roblox was chosen from each study program and is presented in column 2 from Table 2.

Activity 4. Learning activity with Roblox

The experimental learning activity in each group took between 30-60 minutes. Students and the teacher simultaneously interacted in the Roblox virtual world and in the web-based conferencing tool (using voice and chat). A synthesis of the Roblox game used in each group, the game description, and basic game data are also presented in Table 2 (columns 3-5).

*Table 2*

Roblox game election to match the class topic

| Group | Class Topic | Roblox Game | Game Description | Game Data |
|---|---|---|---|---|
| 1 | Dinosaurs: Scientific names, classification of animals based on food habits, predator-prey interaction, and adaptive survival characteristics | Dinosaur World Mobile | Dinosaur Mobile World has different settings that allows players to experience the Prehistoric World as choosing from a variety of species. The game allows players to interact in a survival fight while they have to cover their basic needs (sleep, hunger, thirst, health, stamina and oxygen) | 50 players per playroom. Rated 78%. 28,6 M visits |
| 2 | Interaction between environment and | [Alpha] Infection | Alpha Infection simulates a world where infected players become zombies. | 14 players per playroom. Rated 69%, 20.1 M visits. |

| | | | | |
|---|---|---|---|---|
| | disease-causing agents | | The goal of the players is to avoid becoming a zombie and once becoming one infect healthy players. Players can choose between 8 types of zombies. | |
| 3 | Cooperation vs no cooperation. First impressions, affiliation and trades | Baby Simulator | Become a baby and play with a wide range of toys while earning happiness and coins also exploring different areas to increase your baby Power! Unleash your inner Baby rage on other players to show them the baddest baby is! | Baby Simulator. 15 players per playroom. Rated 82% 181M visits. |
| | | Adopt me | Adopt Me! is a role play game where player can feature two roles: baby, who gets taken care of, and parent, which cares for the baby. Houses, pets and objects can be customized and tradeoff between players | Adopt Me. 48 players per playroom. Rated 84%. 19,300 M visits. |
| 4 | Complex system definition. Tangible and intangible components, system purpose, macro-system and subsystems. Input, throughput and output. | Break In | Eleven strangers move to a house and their goal is to survive 5 days from the Break in of Scary Larry and his follower's villains. A house full of secrets waiting to be unfolded. | Break in, 70 players per playroom. Rated 90%, 660M visits. |

*Source. Own elaboration with Games Data was gathered from Roblox platform on 06/02/2021*

Activity 5. Final learning products gathering and questionnaire.

Three groups finished the activity with a learning product of the topic: an infographic of a Dinosaur species made individually in group 1, a learning product with graphics of infection rates behavior during the game in group 2, and an infographic about "The system of *Brake In*" made in small groups in group 4. Because of the nature of

the topic (social skills), group 3 finish the learning activity with oral conclusions shared by the group in a plenary through the web-based video conferencing tool.

Once the activity finished, participants filled in a questionnaire to explore their perception of the use of Roblox as an educational tool in the school context (10 minutes).

## 3. RESULTS

The questionnaire applied after the activity, explored the previous familiarity with Roblox in each group. Results are presented in Figure 5 labeled with letters the following criteria: A. Play Roblox regularly, B. Play Roblox occasionally, C. Previously knew about Roblox, but didn´t play it; and D. I didn´t know about Roblox. As it can be seen in Group 1 (secondary Level), 46,2% Played regularly and 38,5% occasionally. That sums an 84.7% of users, which contrasts the High schools and College students with the 0%, 0%, and 10%.

A. Play Roblox regularly, B. Play Roblox occasionally, C. Previously knew about Roblox, but didn´t play it; and D. I didn´t knew about Roblox.

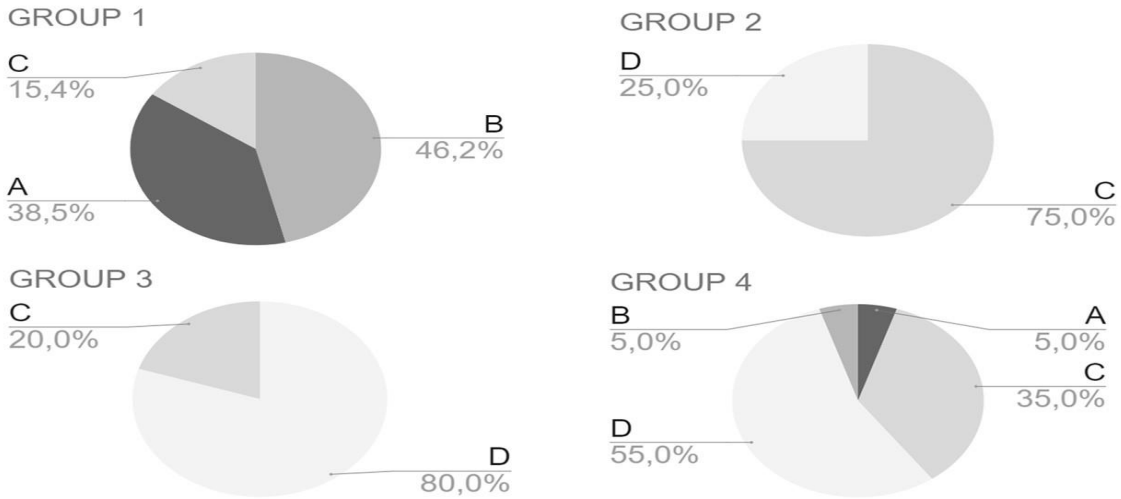


*Figure 5*. Previous Familiarity with Roblox

*Source. Own elaboration with questionaries' data.*

Further exploration indicates that the favorite Roblox´s game used by the students from the four groups previous to the intervention, they mention: *Adopt Me* (7), *Tower of Hell* (3), *Climb Time* (2), *Jail Break* (2). *Among us*, *Power Defense*, *Cotton Tower*, *La Colonia*, *Brookhaven*, and *Identity Fraud*.

Eight questions explored the student perception about the Learning Activity with Roblox measured on the Likert scale valued from 1 point (Nothing agreed) to 5 points (Totally agreed). Table 3 shows the results of the four groups.

Table 3

*Questionnaire Results after Learning Activity*

| Question | GROUP 1 Media (Est. Des.) | GROUP 2 Media (Est. Des.) | GROUP 3 Media (Est. Des.) | GROUP 4 Media (Est. Des.) |
|---|---|---|---|---|
| The class session was conducted in an agile way. | 3,90 (1,29) | 3,62 (1,41) | 3,93 (1,33) | 4,59 (0,57) |
| How easy was it to generate a Roblox account and a personal profile? | 4,38 (0,52) | 4,28 (1,15) | 4,40 (0,83) | 4,56 (0,71) |
| I prepared previous activities for the class development? (Create a Roblox account and send a friend request to my teacher). | 4,40 (1,26) | 3,96 (1,19) | 3,47 (1,60) | 4,79 (0,49) |
| I received clear instructions from my teacher on how to play the game. | 4,20 (1,48) | 4,07 (1,26) | 4,13 (1,55) | 4,93 (0,26) |
| I was able to follow my teacher during the game without problems. | 4,10 (1,66) | 3,59 (1,36) | 3,67 (1,54) | 4,31 (0,85) |
| I understood how to play the Game | 4,00 (1,50) | 3,88 (1,36) | 3,53 (1,38) | 4,66 (0,67) |
| I had fun during the class session. | 4,00 (1,49) | 4,03 (1,28) | 4,00 (1,60) | 4,90 (0,41) |
| I consider the Roblox activity facilitated my learning about the topic of class | 3,08 (1,19) | 3,18 (1,17) | 4,07 (0,88) | 4,21 (0,68) |

Source: own elaboration based on analysis.

The findings show that most students experienced fun during the session (84,6%, 77.7%, 73.3%, and 96.5% answering Agree and Totally Agree to that question). Inquiring about other emotions present during the learning activity, the participants reported: felt "joy because of the interaction with friends" (3), "camaraderie" (1), "entertainment" (1), "bored and angry" (1), "nostalgic about his childhood" (1), "scared because of the villains of the game Brake-In (3), "a bit frustrated as the game was slow to load" (1) and confusion/frustration because I didn't understand the game (11). Frustration was linked with the lack of knowledge about how to play Roblox in high school and college students. One of the participants reported being helped by her son during class, and the same happened with another student who received help from her little sister (small kids teaching young adults how to play Roblox).

Regarding learning perception, only 38.46% (Group 1) and 37,03% (Group 2) answered Agree and Totally Agree on the Likert scale to the question "I consider the Roblox activity facilitated my learning about the learning topic." Higher rates were founded in college groups, 73.33% (Group 3) and 86.20% (Group 4).

The most important content that students in Group 1 learned during the Roblox class as documented in their qualitative answers: Did not answer (1); Did not learn anything (1), predator-prey interaction (3); dinosaur species (5); adaptive survival characteristics (3); and classification of animals based on food habits (1).

Another way of assessing class effectiveness is to look at the quality of student's learning products. Students used the knowledge acquired about dinosaurs through the game for the elaboration of infographics about

dinosaur species. Some students' screenshots about the Dinosaur World Mobile game are presented in Figure 6, and three learning products are shown in Figure 7.


*Figure 6*. Students' screenshots during Learning Activity with *Dinosaur World Mobile*

Source: Students´ screenshot from personal accounts.


*Figure 7.* Students' examples of dinosaur reports after Learning Activity with *Dinosaur World Mobile*[3]

Source: Students´ learning products

During the Roblox activity Group 2 reported the following qualitative answers about their learning outcomes: did not answer (4), how diseases spread (5), diseases (3), game knowledge (2), learning through gaming (1), teamwork (1).

Students made a graph about the number of infected people overtime in the game. They also compared the characteristics of an infected virtual zombie with real diseases: similarities and differences between rabies and zombies; ways to control infectious diseases; exponential spread of real diseases; and an analysis of virtual zombie infection. An example of the learning product made in teams is presented in Figure 8.

[3] The learning products are written in Spanish since the learning activities in this study were developed in the students' native language.

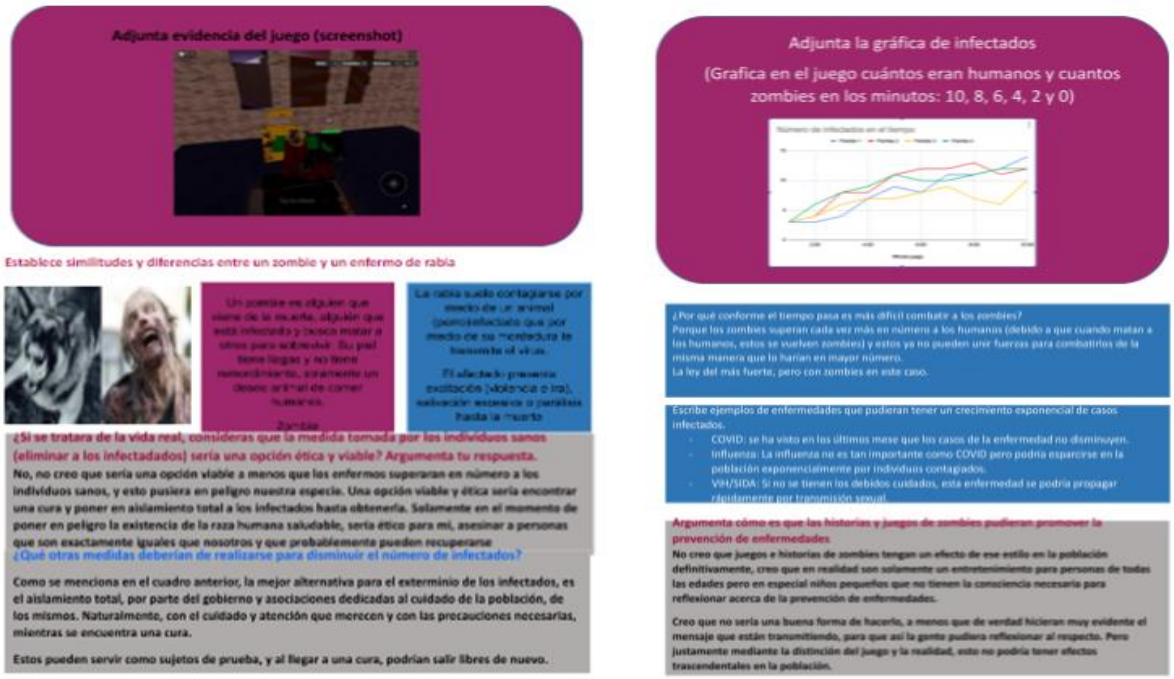


*Figure 8*. Students' example of diseases report after Learning Activity[4]

Source: Student´s learning products

The most relevant skills that students in Group 3 learned during the Roblox session were: aspects of negotiation skills (8), collaboration (4), importance of first impressions (2), strategy (2), and others including how to reach strangers, perseverance, communication and teamwork.

An oral discussion after the Roblox activity in Group 3 took place where students shared their learning insights about the trades (objects and food from the same game) they made with other unknown players and their strategies that allowed their achievement. Some students were not able to make trades with other players in the small amount of time of the activity. Other students succeeded faster in the task.

The answers about the content of learning in Group 4 can be summarized as follows: Did not answer (4), Components of a system (9), generally about systems (5), System function (3), Linking systems theory to a game (3), System interaction (3), three levels of the systems (3), simulated experience of systems (3), solve doubts (1), follow-up instructions (2) and teamwork (1). Some students answered more than one aspect.

After the Roblox class, in another session, students elaborated learning products in teams that incorporate elements of *Brake In-game* in a system definition. They use their screenshots taken during the game to give some visual elements to their infographics. An example of the learning product is shown in Figure 9.

[4] The learning product are written in Spanish since the learning activities in this study were developed in the context of student's native language

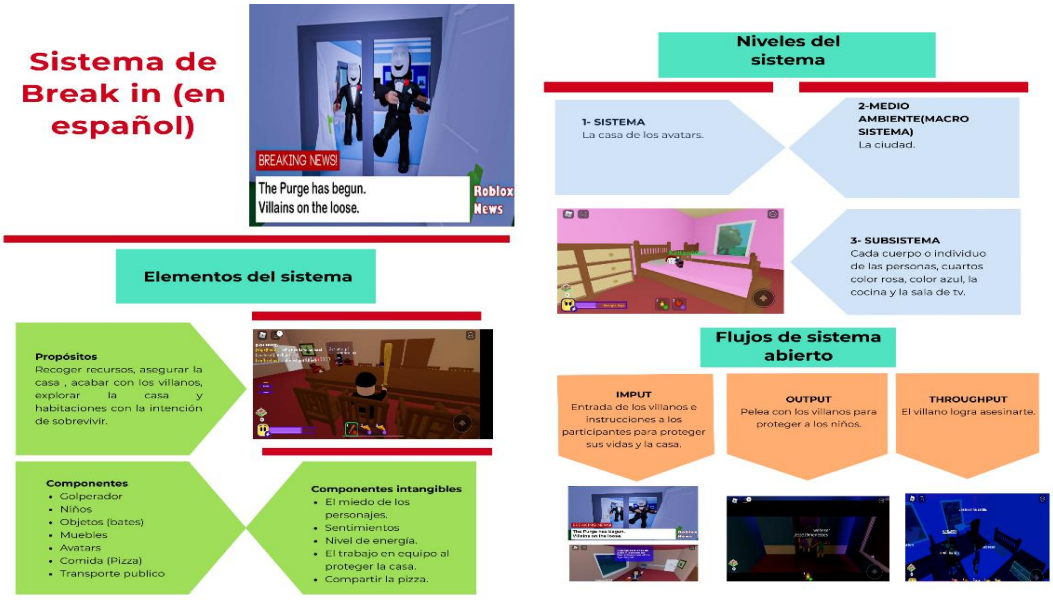


*Figure 9*. Student's example of the System definition learning products[5]

Source: Students´ learning product.

One of the final questions from the survey was: Would you recommend using Roblox to teach the same topic in future learning activities? The results of this question are synthesized in Figure 10. The majority of the students recommended future use of Roblox in class 92.3% (group 1), 79% (group 2) 80% (group 3) and 100% (group 4).

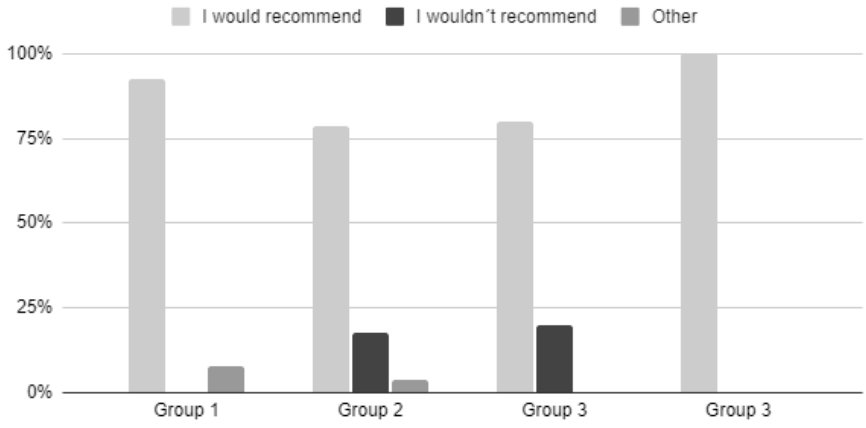


*Figure 10*. Results expressed in percentage from the question: Would you recommend the use of Roblox for future classes?

*Source. Own elaboration with questionaries' data.*

The last question the survey explored was the students' beliefs about video games as a means of learning relevant knowledge. Of the 85 participants in this study, 67 (78.8%) believe that students can learn relevant

[5] The learning products are written in Spanish since the learning activities in this study were developed in the context of student native language

knowledge through video games. The higher number was from group 3 the college level (86,6%), followed by Group 1 (84,6%), Group 4 (82,2%), and finally, group 2 (67,9%) (See Figure 11 for complete results).

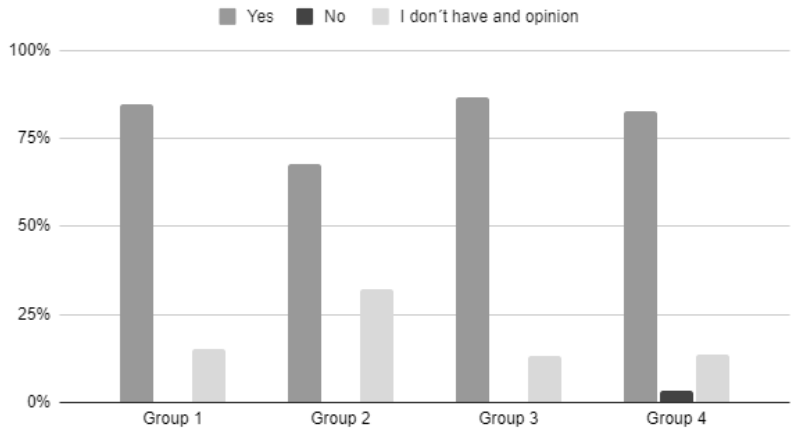


*Figure 11*. Results expressed in percentage from the question: Generally speaking, do you think you can learn relevant knowledge through video games?

*Source. Own elaboration with questionaries' data.*

## 4. DISCUSSION

### 4.1 Benefits and Limitations of Roblox

We consider that the immersive nature of massively multiplayer games such as Roblox promoted extended engagement with course material. MMOs immerse students in different scenarios in relatively "safe learning environments" (Delwiche, 2006, p. 166). For example, the traditional teaching of the topic of Dinosaurs involves the use of presentations, books, visit to museums, or exploring through the Internet. Experiencing a virtual Jurassic scenario where predator and prey interact for survival in a safe, simulated environment heightens significant learning in students.

MMOs provide a safe environment to promote social interaction and skills. In a previous Delwiche (2006) study:

> students were asked to do something that can provoke as much anxiety as public speaking: they were asked to interview other people.... the safety of virtual environments, combined with a mood of playful intellectual freedom, made it easier for students to throw themselves into the role of inquisitive social scientists... (p. 166).

In the present study, were promoted building negotiation skills in a safe virtual environment where students could interact with strangers spontaneously. In this sense, we consider Roblox to have considerable potential for social and language skills promotion.

In comparison with Minecraft that has gained a lot of attention for game-based learning in schools, Roblox has the comparative advantage that it is free of charge, making it more feasible to adopt as an instructional innovation in some class sessions.

Some students experienced frustration during the learning activity with Roblox. We believe that this kind of situation enables teachers to work directly with students in recognizing managing and navigating frustration and other negative emotions that can be obstacles for learning in, the previously called, the *Glass Generation*.

Despite the benefits of Roblox, we also found some limitations and obstacles to Roblox activities in the classroom. Roblox requires gaming skills in teachers and students. Students who were completely unfamiliar with gaming were stuck and perplexed since did not know how to move their avatars; they stayed paralyzed or ran in all directions. This situation was experienced by a minority of students (1 or 2 students from each group), causing frustration and wasting of time. In Gros (2007) words, "the main disadvantage of the use of games in the classroom is the amount of time it takes for both the student and teacher to guide themselves within the game" (p. 33). Another limitation is that each student needs a tablet or smartphone in a Roblox learning session. Some schools forbid the use of these devices during school time, while others equip each student with technology as part of their learning model. This learning activity also requires efficient internet access.

A considerable challenge for Massive Online Games is a child's security "with millions of users worldwide, it's impossible to control the people and content students will encounter on Roblox" (Powers, 2019). Grooming and cyberbullying are two concrete threats in these virtual spaces. Since 2019 Roblox has invested in digital civility as a key issue for gaming online by creating safety settings for the game and educating players and parents on how to use them (Crecente, 2019).

Another critical concern is the latent risk of game addiction. You et al. (2015) examined the relationship between psychosocial variables such as self-esteem, social skills, and depression related to online addiction in Massively Multiplayer Online Role-Playing Games (MMORPG). Delwiche (2006) also suggested to "warn students about the potential for addiction" (p. 167).

Finally, a huge limitation in some developing countries like Mexico are the number of students that, during COVID-19 crisis, had to migrate to asynchronous distance learning because of the lack of internet access (Gómez & Quijada, 2021).

### 4.2 Suggestions for the use of Roblox in Education

1. Don´t be afraid to experiment in virtual worlds such as Roblox, since they are a trend in younger generations. As Delwiche (2006) points:
   As we explore the potential of virtual worlds, we should remind ourselves that they are not a panacea. In many situations, traditional methods of instruction will work just fine. Yet, we should not be afraid to experiment. Experimentation, like play itself, is ripe with possibility (p. 169).
2. Teacher´s previous familiarization with Roblox is required. Prepare at least 10-20 hours of free play before designing an educational activity with Roblox. Young kids in your surroundings could be helpful to succeed in this task as well as creating a community of practice with other teachers. We also suggest including additional time for inexperienced gaming students to become familiar with Roblox. You can

support previous familiarization of students and teachers by “detailed access tutorials, lesson resources, and an incredibly active worldwide community” (Powers, 2019).

3. In our own experience, having a video conference call simultaneously as the play happens helped newcomers overcome the barrier of lack of game skills. Experienced players can advise inexperienced students as they interact in the activity. Playing together in a conference call or a face-to-face session adds fun and in-depth insights about the topic.
4. Alert your academic coordinator you are planning a Roblox Class. Use academic research on game-based learning to argue this innovative instructional choice. Additionally, "some features, like the ability to chat with strangers, may even violate your school's policy, so be sure to check with your technical staff and administration before making plans to use Roblox with students" (Powers, 2019). For younger students (elementary school and high school), we recommend asking for written parental consent.
5. Take time to choose the specific game carefully in Roblox that you will use during the class activity. Since games in Roblox are user-generated content, some of them are boring and lack plot. While some are very well designed and have great plots like, for example, *Adopt Me!* and *Break-In*. Review game data such as user reviews and the number of visits for a first impression of the game and then play for some minutes to evaluate if the game fits your instructional purposes. Be aware that each game has multiple playrooms to distribute players, which can be an obstacle for the whole class playing together. Look for "total player per playroom" data and try to choose games with a high capacity of players so students can interact together in the gaming experience. Some games allow only 11 people to play together, while others allow 50 or 70. If a game has limited players per room, you can organize your classroom into teams and divide your playtime among them.
6. Split the class session into three segments. A) Topic introduction. Introduce the learning purposes, lesson plan, topic guidance, orientation about the learning products, and introduced the game(s) before the Roblox gaming. B) Playing time. Take at least between 30-60 minutes for the learning activity with Roblox. C) Learning products. Finish the activity with a learning product of the topic made by students. Invite your students to make a Screenshot of the play during the game to incorporate them into their learning products.
7. Warn students about the potential risks of addiction to virtual games and security issues. Playing these games with students is an opportunity to build digital citizenship and netiquette. Teachers can take advantage of the gaming experience to talk about potential digital threats such as grooming and cyberbullying.

### 4.3 Future Research

Further research is needed to explore more uses of Roblox in educational settings. One possible area for research is to explore how students from engineering and business programs can learn about Roblox´s monetization. Roblox sells virtual current to the players (clothing, accessories, vehicles), and Roblox corporation takes a fraction of these earnings. “Developers can charge Robux, a virtual currency, for various items and game experiences, and they can exchange the Robux they earn for real money” (Teach Radar Pro, 2019, p. 1). Players

can buy, for example, 800 Robux for $10 US Dollars, and developers can exchange their Roblux earnings for real US Dollars as well, which is undoubtedly a current trend for income.

Another unexplored field for Roblox is its potential for psychological help with kids and adolescents with a social scare, extreme shyness, or autism. As Vincelli et al. (2003, as cited in Delwiche, 2006) suggest, virtual reality could be effective in agoraphobia and other anxiety treatments.

The use of Roblox Studio for developing programming and design skills is an open field for future studies. We see a vast potential of using Roblox Studio to enhance content and storytelling abilities creation for language, literature, history, communication and writing curricula.

Finally, we consider Roblox has a huge potential for the learning of foreign languages. For example, in the game *Brake In!* players receive instructions (in English or Spanish) to move around a house. If students are learning a foreign language, it could be fun to practice vocabulary in a playful scenario.

## 5. CONCLUSIONS

This study was conducted to provide preliminary classroom experience with Roblox in four groups from different educational levels: secondary, high school, and college. Regarding the general objective, results suggested that a majority of students enjoyed working with Roblox in class and reported significant learning insights. Positive emotions were experienced by teachers as well, and planning the activity promoted their creativity.

This Massively Multiplayer Game favored virtual social interaction among students. In the context of 2020-2021 virtual pandemic classes, the lack of interaction between students was a challenge, and gaming allowed students to interact with each other in a virtual world. Students stated that they enjoyed playing with their classmates. This interaction and the playful dynamic also promoted bonding between teacher and students. In one case, it seemed to have a positive impact on the teacher assessment.

Finally, advantages and disadvantages of the use of Roblox in learning activities were identified and reported as well.

Further research about the use of Roblox in game-based learning activities in other settings or with other subjects would allow to generalize the result of this study to a wider population.

**Conflicto de intereses / Competing interests:**
Los autores declaran que no incurren en conflictos de intereses.

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Lorena Hernández: conceptualización, curación de datos, análisis formal, adquisición de fondos, investigación, metodología, administración del proyecto, recursos, software, supervisión, validación, visualización, escritura - preparación del borrador original, escritura - revisar & amp; edición.

Verónica Hernández: conceptualización, análisis formal, investigación, metodología, administración del proyecto, recursos, software, supervisión, validación, visualización, escritura - preparación del borrador original, escritura - revisar & amp; edición.

Farah Neyra: conceptualización, investigación, metodología, administración del proyecto, recursos, software, supervisión, validación, visualización, escritura - preparación del borrador original, escritura - revisar & amp; edición.

Julieta Carrillo: conceptualización, investigación, metodología, administración del proyecto, recursos, software, supervisión, validación, visualización, escritura - preparación del borrador original, escritura - revisar & amp; edición.

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