Learning self-efficacy, academic engagement, and participation in Minecraft: opportunities of the game in communication sciences teaching

Autoeficacia en el aprendizaje, compromiso académico y participación en *Minecraft*: oportunidades del juego en la enseñanza de las ciencias de la comunicación

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RESUMEN

Introducción. *Minecraft* ha sido utilizado ampliamente en espacios educativos con efectos positivos en el desarrollo de la creatividad, el compromiso o la colaboración. **Metodología.** Este artículo muestra los resultados de una experiencia de aprendizaje basada en el juego *Minecraft*, en estudiantes de posgrado en el campo de la comunicación dirigida a la distinción de los procesos de acceso, interacción y participación online. El análisis de la percepción sobre la autoeficacia del aprendizaje, el compromiso académico y la participación incluyó técnicas propias de la etnografía virtual como observación y

entrevistas semiestructuradas. **Resultados.** Este trabajo ofrece una visión tridimensional del proceso de aprendizaje basado en juegos como consecuencia de una combinación de la autoeficacia percibida, la participación y el compromiso. **Discusión.** El análisis de las relaciones entre las perspectivas teóricas empleadas muestra la necesidad de contemplar en el diseño de experiencias educativas la participación para contrarrestar los déficits de autorregulación y aumentar la motivación y el compromiso de los estudiantes. **Conclusiones.** La integración de perspectivas teóricas es necesaria tanto para la investigación de experiencias de aprendizaje basadas en juegos como para su diseño. La mixtura de perspectivas probadas en este estudio puede expandir la comprensión empírica y teórica del problema en investigaciones futuras.

PALABRAS CLAVE: Aprendizaje, autoeficacia, compromiso, participación, *Minecraft*.

ABSTRACT
Introduction. Minecraft has been widely used in educational spaces with positive effects on the development of creativity, engagement or collaboration. **Methodology.** This article shows the results of a learning experience based on the Minecraft game, in postgraduate students in the field of communication aimed at distinguishing the processes of online access, interaction and participation. The analysis of the perception of learning self-efficacy, academic engagement and participation included techniques typical of virtual ethnography such as observation and semi-structured interviews. **Results.** This paper provides a three-dimensional view of the game-based learning process as a consequence of a combination of perceived self-efficacy, participation and engagement. **Discussion.** The analysis of the relationships between the theoretical perspectives employed shows the need to contemplate participation in the design of educational experiences to counteract self-regulation deficits and increase student motivation and engagement. **Conclusions.** The integration of theoretical perspectives is necessary both for the research of game-based learning experiences and for their design. The mixture of perspectives tested in this study may expand the empirical and theoretical understanding of the problem in future research.

KEYWORDS: Learning, self-efficacy, engagement, participation, Minecraft.

Translation by **Paula González** (Universidad Católica Andrés Bello, Venezuela)

1. Introduction

The integration of game-based methodologies in educational practices seems increasingly common due to the exponential growth of game-related technologies and their industry, as well as the constant search for teaching strategies that favor student learning and motivation. (Hanus and Fox, 2015; Hainey et al., 2016; Iosup and Epema, 2014; Jossan et al., 2021; Krath et al., 2021).

This pedagogical approach is based on socio-constructivism, according to which human beings are born with the ability to learn and build reality, but it is in the experience that this knowledge is developed (Coll, 1996; Gutiérrez, 2005; Kolb, 2014). In this sense, the integration of games as a learning experience enriches and enhances these knowledge construction processes (Krath et al., 2021; Van Roy and Zaman, 2017). Furthermore, it offers advantages such as the promotion of quality in educational interactions, promoting a positive climate, allowing the understanding of knowledge in an applied scenario, enabling student reflection on their decisions, facilitating the learning of concepts, and improving processing skills. (Abdul and Felicia, 2015; Anastasiadis et al., 2018; Chen and Law, 2016; Karagiorgias and Niemann, 2017; Krath et al., 2021).

However, although the potential of games in educational contexts is recognized, various authors (All et al., 2021; Foster and Shah, 2015; Kim et al., 2009) recommend that, in game-based learning methodologies, prevail a teaching guide with a clear objective that avoids leaving all the focus on the action of playing.

Regarding Minecraft Education Edition, there are also concerns about its educational use due to persuasive strategies by large companies to encourage consumption among boys and girls through video games (Willett, 2018); while it generates risks similar to those that gambling and its financing models can present (Gambling Regulators European Forum, 2018).

These challenges, however, don't seem to obscure the advantages of Minecraft. Since its launch in 2009, results have been reported that attribute benefits to problem-solving, innovation, and communication (Fogel et al., 2021). In the last decade, Minecraft has attracted considerable attention due to its possibilities to increase digital literacy in children and young people (Dezuanni, 2018), develop resilience (Balnaves, 2020), or facilitate the emergence of new forms of collaborative participation (Jensen and Hangdj, 2020). Specifically, a review of the use of Minecraft in the participatory field shows that children share their knowledge, build social connections, and collaborate with their peers in creative and fun ways (Le De et al., 2020).

Furthermore, it seems to be a suitable tool to promote 21st-century skills because it requires players to communicate, seek, and evaluate information, create, innovate, and cooperate (Scholten, 2017). Thanks to the discursive, material and performative possibilities of this game, researchers such as Dezuanni (2018) assure that it is possible to increase media literacy as the result of an assembly between the players, the game itself, and the technology.

Despite the large theoretical body on Minecraft, there are still few studies that report in-depth on how self-efficacy, understood as the learners' perception of their abilities to perform tasks (Bandura, 1977, 2001); engagement, associated with motivation, enjoyment, concentration, interest, or effort to achieve a learning objective (Shernoff et al., 2014; Shernoff, 2013), and participation mechanisms that affect collective decision making (Carpentier, 2016) influence.

From this order of ideas, this article addresses these three dimensions to examine the relationship between self-efficacy in learning, engagement, and participation in an educational experience in Minecraft. To this end, the text deals with clarifying the central concepts on which the research revolves and then delving into the design of the game experience and the methodology addressed in the analysis. The results, discussion, and conclusions make a significant contribution to the field in three lines: 1) the empirical data contribute to the research on game-based learning; 2) the theoretical approach combines and relates fields that are usually approached independently, such as self-efficacy, engagement, and participation in educational settings; 3) identifies key factors that could strengthen the design of educational experiences in Minecraft.

1.1. Game-based learning

Game-based learning is a teaching approach in which students receive instruction and context from the teacher concerning a learning objective, recognize the rules of the game, participate, and reflect to make explicit the relationship between their experience and the educational objective of the session (Garris et al., 2002; Pivec et al., 2003).

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Solving problems in this environment allows students to understand how a system works and how they interact with it (Chang et al., 2015; Toprac, 2011). At the same time, it demands the staging of their skills, being faced with a challenging scenario to achieve the best possible result (Barnett and Koslowski, 2002). This model proposes an iterative learning cycle in which students, first, receive an initial context with the objective of the experience within the framework of their class; second, they face the experience proposed by the teacher; third, they develop a reflection guided by the teacher around what was lived in the experience; and finally, they participate in a closure in which they develop the concepts related to the formal learning content.

This process is repeated throughout the entire experience until the moment the teacher decides to end the session. It is important to keep in mind that it is not necessary to isolate oneself from the experience in any of the four moments, the second moment of reflection can even happen while the student is still in the experience, but making a brief guided pause based on questions that promote critical thinking and argumentative abilities (Noroozi et al., 2020).

The relationship between the gaming experience and the learning objective is facilitated by the very conditions of a game, defined as an activity that places the learner in an active role in which they must make decisions in a simulated scenario to meet a specific objective. (Brathwaite and Schreiber, 2009; Schell, 2008).

1.2. Self-efficacy in learning

Self-efficacy deals with the incidence of personal beliefs in one's abilities to perform a task (Bandura, 1977, 2001). In academic fields, self-efficacy has recently been used for two purposes: to predict the level of participation in an activity or to improve the attitude or way of thinking of students (Punyasettro et al., 2021).

Concerning game-based learning, this methodology has been shown to offer advantages for the acquisition of concepts or the improvement of processing skills (Anastasiadis et al., 2018). Along the same lines, Lu and Lien (2020) explain the existence of different factors that mediate the success of game-based learning when it comes to facilitating the internalization of learning content. For the authors, self-efficacy is a personal factor that, although it is not decisive in the learning process, has important effects since it facilitates the maintenance of attention and interest in the development of activities, which can translate into a better general understanding of academic content.

These results are consistent with those of Ellison and Drew (2020), who found that learning experiences with games allowed students to improve their confidence levels. Games make it easier for students to dare to explore possibilities and repeat situations that cause them problems in case they make mistakes (Carr-Chellman, 2016). In this sense, it is suggested that individuals with high levels of self-efficacy are more likely to remain linked to activity with games since the feedback they receive in their interaction with the game allows them to increase their self-confidence and therefore improve their motivation toward the activities (Lu and Lien, 2020).

1.3. Academic engagement

One of the aspects that are most favored by the use of games in learning scenarios is academic engagement, defined as the level of involvement of a student with a teaching practice from its cognitive, affective, and behavioral dimensions (Ochoa-Angrino et al., 2018).

Academic engagement is part of the field of motivation theories in education, in which issues such as learning while having fun, concentration on educational activity, interest in what the teacher proposes, or effort to achieve a learning objective, among others (Shernoff et al., 2014; Shernoff, 2013) are addressed. A learning experience with these characteristics has the potential to make it easier for attendees to face challenges that, in other scenarios, such as evaluations or class presentations, could generate anxiety and tension (Csikszentmihalyi, 2008).

Regarding engagement, research works such as that of Shernoff et al, (2014) underline the role of games as an ideal scenario to promote academic engagement and favor significant learning because games contain a series of attractive and challenging characteristics for students. The game scenario allows for failure without serious consequences, the player must make decisions, constantly evaluate a simulated system, and interact with others (Adams and Rollings, 2006; Brathwaite and Schreiber, 2009). Besides these characteristics, the literature refers to the importance of three components in games to promote academic engagement and learning: scaffolding, rewards, and learning tools (Abdul and Felicia, 2015; Tan et al., 2013). Scaffolding refers to the ability of games to guide the user through their experience through hints, guides, feedback, and the opportunity to go back to correct mistakes. The rewards are understood as the possibility of obtaining medals or achievements as the game progresses, which plays an incentive role that helps reinforce the feeling of achievement after working hard on a task. Finally, learning tools are associated with the potential of games to become artifacts for teaching, through methodological integrations that promote the demand for high-order skills such as systemic, creative, strategic, or critical thinking (Tan et al., 2013).

On the other hand, academic engagement and game-based learning have been connected with states of flow among students while performing educational activities. These states are understood as the period of constant concentration that is related to the enjoyment and understanding of the activity that is being carried out (Csikszentmihalyi, 2008). The possibility that the student has of feeling in a highly immersive environment favors the different ways of interacting with the game and satisfaction (Admiraal et al., 2011).

Usually, the state of flow that games generate in students is connected to an improvement in the construction of concepts and knowledge. In this way, at the end of the session, it is possible to return to the game experience as an input to address the learning objective of the session and the associated concepts (Hamari et al., 2016).

1.4. Participation

Participation has received significant attention in recent years. In industry 4.0, user-oriented services take on a fundamental role (Raja et al., 2013). During the last two decades, it seems that interaction with users ceases to be a useful means of improving products and ends up becoming the product itself (Noguera, et al., 2013). Developments in the area of digital marketing have turned participation into a bargaining chip within a new economic paradigm and the necessary interactions for all kinds of social relationships, in transactions that go unnoticed by the subjects more and more frequently (Van Dijck, 2013). The growing participatory culture observed by Jenkins (2006, 2008), underlines the role of users in the creation of all types of content, media, and platforms, and encourages the emergence of a series of theories based on the birth of a new power thanks to the possibilities opened by mass self-communication (Castells, 2009).

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However, authors such as Carpentier (2007), from a critical perspective, underline the need to distinguish participation from other phenomena, as an activity that seeks to have an effect and influence the actions of others. Beyond the repertoire of possibilities provided by technology, participation attends to the ability to influence decisions, with a focus close to studies on power.

Concerning the teaching-learning processes, the question of the students' ability to influence decision-making about what they learn, how they learn it, or how they are evaluated is crucial. All this in a much more horizontal process between students and teachers, guided by trust, solidarity, and reciprocity, which leads to a change of hierarchy between the parties.

Seen in this way, participation in a class goes beyond access as the possibility of having a presence in the classroom or as a collection of technical tools designed to facilitate interaction or to attract, motivate, or engage students. At the same time, it is important to distinguish participation, according to Carpentier (2016), from interactivity or interaction. The first is provided by the possibility that the media or platforms have to allow interactions, and the second is understood as a communicative process of exchange between users and a technical system, users, and content, or between users themselves.

In the educational field, participation frequently refers to the ability of individuals to intervene at certain moments of the process, mainly with their active involvement in scheduled activities (Zou and Zhang, 2016).

However, when we talk about virtual learning environments, participation acquires new dimensions as a central activity to reach knowledge through cooperative or collective work (Sánchez, 2017). Here, the findings derived from studies on collective intelligence are essential to understanding its scope, since information and communication technologies increase the possibilities for large groups of people to be able to solve tasks unthinkable for disconnected individuals (Malone and Bernstein, 2015).

Finally, research such as that of Rubio et al. (2010) make a call to overcome the behavioral theory to analyze the teaching and learning processes from other paradigms close to the constructivist theories of education, in which the participation of the students is essential, since the knowledge is created by them, and therefore, they must be involved not only in their learning process, but also in all stages of planning, development, and evaluation of the classes.

2. Objectives

Taking into account the above, this research addresses the following general objective:

To identify the relationship between self-efficacy in learning, engagement, and participation through learning based on the game Minecraft in a group of postgraduate students from the Universidad EAFIT in Colombia.

Additionally, the following specific objectives were established:

a. Discover the personal beliefs derived from the previous experiences of the students of a motivational, cognitive, or affective type that condition learning based on the game Minecraft.

This objective is set taking into account the definition and the dimensions that structure the concept of self-efficacy in learning used by Bandura and Adams (1977), Maddux (1995), and Zimmerman et al. (2005). In this sense, how students value the level of complexity of the tasks to be carried out and their

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possibilities to carry them out, their self-confidence, their perception of the achievements reached, the usefulness of knowledge, and its transfer to other areas of life is explored.

b. Identify students' academic engagement during the Minecraft game-based learning experience.

Following the study by Ochoa-Angrino et al., (2018), academic engagement is understood as the level of involvement of a student with a teaching-learning practice. Engagement addresses three dimensions: cognitive, defined as all actions that show interest, concentration, or effort on the part of students (Lam et al., 2014; Shernoff and Bempechat, 2014; Strati et al., 2017). Affective is characterized by enthusiasm, enjoyment, encouragement, or satisfaction in performing tasks (Hill & Werner, 2006; Lam et al., 2014; Shernoff & Bempechat, 2014). Behavioral, related to their persistence, effort, and intensity to meet a goal (Skinner and Belmont, 1993).

c. Examine the mechanisms of student participation based on the processes, the actors, the decisions, and the tactics used to collectively carry out activities.

In line with Carpentier's proposal (2016), in the participatory process, all the activities carried out by the group to achieve the learning goals, the positions of the students, their roles and functions, decision-making, and power strategies that take place in the development of tasks are taken into account.

3. Methodology

The methodology used in this research is qualitative. This approach has been frequently used in the analysis of learning experiences based on Minecraft because it provides enough data to understand the user's role in the game scenario (Fogel et al., 2021) and allows understanding, from the player's point of view, their interactions within a specific context (Balnaves, 2020).

In line with the qualitative studies carried out in Minecraft (Balnaves, 2020; Dezuanni, 2018; Dezuanni et al., 2015; Malvasi et al., 2022; Pink and Lazeni, 2018), in this work, we apply tools of ethnography as a "useful method to understand the narratives that run between various physical spaces and digital platforms during the game" (Balnaves; 2020, p. 41). With this methodological perspective, it becomes possible to research the practices and meanings that subjects attribute to their actions (Klastrup, 2008).

In the realm of digital media, Pink (2013) suggests ethnography as an approach to understanding the users' knowledge status and what they produce through a perspective that takes into account place, movement, and perception. The breadth of tools contemplated by ethnography seeks to account for the possibilities of interaction and expression of the participants. Consequently, as data collection tools typical of this methodological approach, in this work, the observation of the game and the built virtual world are combined with the analysis of their interactions and semi-structured interviews.

This seeks to achieve a complete vision of what happens in a digital field, taking into account the actors, the game, and the objects (Pink, 2016), while recognizing the social and sensory complexity of the virtual world (Boellstorff et al., 2012).

Twenty students (eleven women and nine men) from the Universidad EAFIT, Colombia, from the postgraduate Master's Degree in Transmedia Communication, from the subject Audiences and Participation Cultures, participated in this study. The subjects who were interviewed were of both genders (five women and four men). The participants were not chosen a priori by the researchers; these were presented freely after the invitation was made to the whole group to take part in the interviews.

The course teacher described this class as a group of enthusiastic students, easily motivated through collaborative activities, and performing well academically. The interviews carried out included questions related to the perception of their level of learning with Minecraft, how they solved the problems that arose during the game and their evaluation of the experience on all the platforms involved in the activity. The interviews lasted approximately 45 to 60 minutes.

The synchronous gaming sessions conducted during the remote class were recorded using the tool offered by Microsoft Teams and the world created by the students in Minecraft, which was downloaded for later analysis. The analysis took into account the activities carried out by each of the subjects to achieve their objectives, as well as the text, image, or audio messages shared through Microsoft Teams and WhatsApp.

The collected data were subjected to a thematic analysis that involved the transcription and open coding of the interviews, the analysis of the interactions in Microsoft Teams, the observation of the conversations in WhatsApp, and the cooperative system to carry out the constructions of the world in Minecraft. These analyzes allowed establishing aspects related to self-efficacy in learning, engagement, and participation. After this, the group of researchers identified conceptual categories and crossed the theory with the empirical data collected in the study.

3.1. The design of the learning experience

Studies on digital culture suggest implicitly assuming the problem of participation as an essential characteristic of a society of active agents, capable of producing their own meanings (Deuze, 2006). However, the learning of this phenomenon often takes place in classrooms far from the encounter between humans and machines and their mutual influences.

In the same way, the concepts related to participation, interaction, or access can be seen in the academic field as abstract theories that do not solve in practice the problems faced by professionals in the development of digital strategies. For this reason, the learning experience designed for this research puts the student at the center. Instead of transmitting knowledge so that students understand the meaning of participation in online environments, it is decided to design an experience that facilitates the understanding and analysis of participation through the participatory practice itself.

The experiment was carried out on the downloadable world The Community, designed by Daniel Kwan, for the Welcome to the Community lesson, available in Minecraft Education Edition. The template was adapted according to the learning purpose of the course: to differentiate the possibilities and characteristics of access, interaction, interactivity, and participation in transmedia strategies. The students had to build a self-sustaining community, where each one had their own land to contribute with their construction to the community.

Figure 1. Images of the self-sustaining community built on Minecraft.

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Before the game, the students read the text Participation, access, and interaction: changing perspectives (Carpentier, 2007). The experience was carried out on January 26th, 27th, and 28th, 2022. The students had these three days to build a self-sustaining community, present their constructions, and raise postulates or premises as a group about the specific ways in which the access, interaction, interactivity, and participation processes were presented during the game. It is worth clarifying that these postulates were not part of this research. They were raised to address the development of concepts and definitions by students from the correspondence of the game with the theory. Thus, for example, a student states after the game: "To have access to Minecraft we need video game skills, therefore, access demands specific skills, besides motor skills" (J. Montoya, February 2nd, 2022).

Students recorded their premises in a Word document shared on OneDrive in a synchronous class session through Microsoft Teams. The teacher posed guiding questions that gave rise to the students to propose their own logical reasoning from a deductive perspective, through which the students were expected to make direct inferences about the phenomena seen during the game.

The experience that lasted for three days ended with the discussion and analysis of what happened and a test of theoretical concepts in Quizizz. The questions, true or false type, were drawn at random from the postulates proposed by the students themselves.

Several platforms were involved in the design of this learning experience. Microsoft Teams, an institutional channel in which three class sessions lasting two hours each were held and in which the teaching and learning process was centralized; Minecraft Education Edition, a gaming platform; WhatsApp, a means of communication for the students, and Quizizz, an evaluation platform in the final session of the unit.

The objective of the learning activity was to improve the theoretical understanding of the concepts of access, interaction, interactivity, and participation by solving a real problem in a game and cooperating to achieve a common goal of creating a self-sustaining community. Therefore, rather than using Minecraft as a tool to teach participation, the learning experience sought to develop a meaningful link between what happens in the game and the participatory aspects of the game.

The group of students began community building with little prior knowledge of the game. Of the 20 players, only one had previous Minecraft experience. So the first synchronous class session was almost entirely devoted to learning about the ways players could move around in 3D space and what the tools were for building. After class, the world remained open for students to build for the next two days. This time allowed students to consult video tutorials, seek help, and improve their skills. WhatsApp communication was frequent during the gaming experience.

WhatsApp was a useful tool for the research because it allowed us to know how the actors see themselves, describe the game, support each other, and give an account of the context in which it was developed. In total, 266 interactions were collected, thanks to the fact that one of the researchers, with the informed consent of the students, was part of the WhatsApp group assuming the role of observer participant (Vela and Cantamutto, 2016). This role facilitated the access and understanding of students' social interactions.

In the last synchronous class session through Microsoft Teams, a guided tour of the community was conducted to learn about the different constructions, such as a school, a hospital, a farm, a hotel, a restaurant, a water treatment plant, and a civic center for the design of community solutions, among others. Some students built in pairs, others asked their children or relatives who were experienced Minecraft players for help. None of them assumed the role of general coordinator or leader and one student was unable to build because her computer was damaged during the week in which the game was developed.

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4. Results

4.1. Self-efficacy in learning

The students expressed various personal beliefs based on their previous motivational, cognitive, or affective experiences that conditioned their performance during the game. Those who declared in the interviews that they liked construction games were more willing to solve the problems raised and showed a high level of satisfaction with their achievements. Likewise, the student who had previous experience in the game was confident and sure of himself and his knowledge, even before knowing the objective of the exercise: "I had more possibilities because I knew how the game worked" (S. Escobar, personal communication, February 25th, 2022).

While the students who did not know Minecraft or did not express an affinity for the games during the interviews, perceived failure more acutely with the problems presented: “I had never played and I am not a gamer. At times I felt so frustrated that at one point I didn't want to know anything about the game” (A. Henao, personal communication, February 25th, 2022). “We are very used to the teacher at the center, giving a class, and when a methodology arrives through a game, one does not take it seriously and the first idea that comes to mind is that it is a waste of time” (S.D. Gil, personal communication, February 25th, 2022).

However, it is noteworthy that, despite the diversity of perceptions related to motivation in the game, the students revealed that they had not learned less because they had no previous experience in the game. The data collected on WhatsApp showed that the lack of skills in the game prompted them to seek resources to solve the problems that were presented to them and support each other. A student went to work with a classmate at her house to find out together how to build. Another student, who is also a professor and is in Ph.D. training, asked his 9-year-old daughter for help with his construction and several students agreed to meet at the same time on the server and thus support each other with the construction.

Although several students expressed in the interviews and the WhatsApp chat that they were initially frustrated due to the difficulties with the Minecraft tool, they expressed a valuable level of satisfaction with their constructions and learning: “Not having experience in the game did not limit me. This was part of the learning process. I saw several tutorials, then I damaged things, even from my colleagues, then I had to repair them. I think that these obstacles are also part of learning” (L. Rodríguez, personal communication, February 25th, 2022).

The prior ignorance of the game seemed in many moments to be assumed by the group as an opportunity for encounter and conversation, according to what was observed in the WhatsApp group. “That the group had not played Minecraft before was a challenge. This situation prompted the dialogue. Everything lent itself to talking and asking. These kinds of situations make you think more creatively and reflectively” (S. Escobar, personal communication, February 25th, 2022).

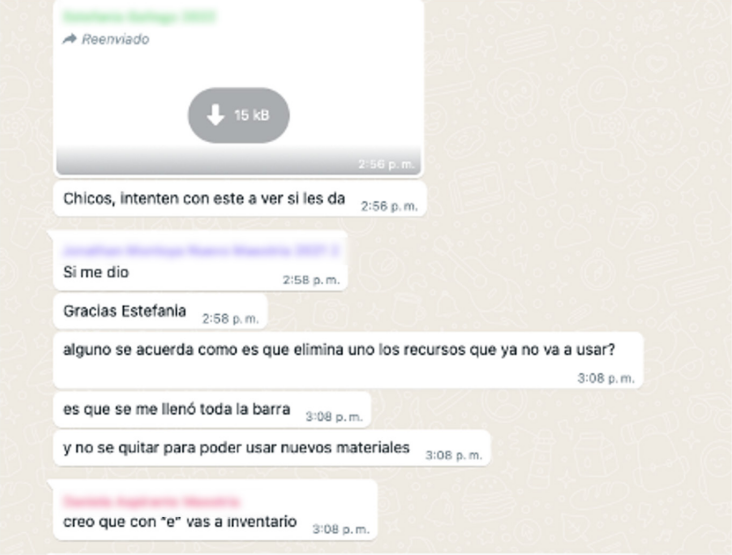

Figure 2. WhatsApp conversation. Players ask and solve game problems with the help of others.

The interviews also showed important differences concerning the confidence of the individuals to carry out the tasks and meet the goals: "When they told me that I was going to play Minecraft, I thought: finally, something that I have mastered. I felt safe because I knew the rules. I think I was able to be more creative than my colleagues because I already dominated the game" (S. Escobar, personal communication, February 25th, 2022).

Regarding the understanding of concepts and the achievement of disciplinary learning goals, the synchronous class session in Microsoft Teams and the results in Quizizz express a high level of performance, even in those who had not played.

In the interviews, the students stated that the exercise allowed them to put into practice what they had read and actively reflect on their knowledge, even though they presented heterogeneous learning practices. "For me, it is very rare to learn by playing because my way of studying is reading, but I managed to appropriate the concepts and acquire them from my own experience" (A. Henao, personal communication, February 25th, 2022). "My way of learning is from experience. I find it very important to be able to experience theory. I read, but without experience, I cannot internalize or question what I read" (D. Toro, personal communication, February 25th, 2022). "I think that the game strips what you are learning. Facing what you don't know raises questions and you become curious. You build knowledge with the tool as you appropriate it" (M.C. Reusch, personal communication, February 25th, 2022).

After the knowledge evaluation, the students agreed in the synchronous session in Microsoft Teams, after the game, that the practice made it easier for them to understand the concepts raised thanks to experiential learning. "Reading alone does not generate the same level of understanding. I felt that what I had read passed through my body" (L. Rodríguez, personal communication, February 25th, 2022). "I now relate the concepts of access, interaction, and participation with Minecraft. I think it is easier because it is something experiential" (S. Escobar, personal communication, February 25th, 2022). "The game makes the brain expand in its capacity. One thing is to read the concepts and another is to live them. From practice, understanding the concepts is very useful" (L.E. Gómez, personal communication, February 25th, 2022).

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Similarly, the subjective value placed on concept acquisition seemed to be increased by the game. This was the case of the notion of the digital gap, addressed in the reading that the students did before the game. "The digital gap made a lot of sense to me because I had not played before and I understood the weight of structural skills and I questioned myself" (M.C. Reusch, personal communication, February 25th, 2022). Another student who did not initially manage to enter the platform said: "The first thing I thought was: I am in a gap and I understood the importance of the topic" (E.Gallego, personal communication, February 25th, 2022).

4.2. Academic engagement

The engagement of students in academic contexts implies cognitive, emotional, and behavioral involvement. In the first stage, of an exploratory nature, the students carried out reading as a mechanism to find out about the theoretical definition of the concepts of access, interaction, and participation. Then, they played to link the theory with the phenomena that occur during the practical experience, and finally, they raised postulates that externalize the generation of new learning.

During the three days that the construction took place, the cognitive engagement was lower, compared to the last class session carried out through Microsoft Teams. When the collective validation of individual postulates, the review, and evaluation of learning through Quizizz were carried out, it was found that the average accuracy in the answers was 83% according to the results that the platform produced.

The instructional design thus prioritized the performance of disciplinary cognitive tasks for the end of the activity, while during the game sessions the search and acquisition of knowledge about the game prevailed. Likewise, it is worth noting that while the students advanced their constructions, they used the theoretical concepts to playfully narrate their experiences through WhatsApp.

Figure 3. WhatsApp conversation. Students incorporate theoretical concepts such as the digital gap in their dialogues to describe their practice.

This conversation highlights the affective engagement to learning, also characterized by enthusiasm and enjoyment of the game, as well as how the subjects elaborate on their own learning, develop an awareness of their actions, and associate theory with practice.

> I saw how each one was building, and I wondered how place and space are defined through participation. I was thinking how can it be that a platform that is thousands of kilometers away

> gives you the feeling of a place. I think this helps to question oneself and everything takes on another meaning. (M.C. Reusch, personal communication, February 25th, 2022)

The engagement was also noted in the persistence of four students who stayed online two more hours after finishing the first class session. It was observed that, although in the first game session the students only acquired the minimum skills necessary to move and build, three days later, the whole group had achieved, thanks to personal and collective effort, constructions that they valued as very advanced for its level in the session in Microsoft Teams.

4.3. Participation

Each student had a plot in the world of Minecraft with a sign at the entrance indicating their name. In this way, even if a joint challenge was established (to build a self-sustaining community), each student enjoyed sufficient autonomy to build what they wanted. "I participated and I think I was important. I built a community social design center (…). Some colleagues had problems with the game, but together we helped them". (L. Rodríguez, personal communication, February 25th, 2022)

Figure 4. WhatsApp conversation. Student asked for help and another one of them offered it.

The division into individual plots did not prevent it from being perceived as a participatory community that learned through all the means that were part of the pedagogical strategy as a whole. Although some had problems accessing the game, they were also learning through WhatsApp. "I think I learned a lot during the game (…). There was a sense of community in the group because we all participated" (L. Rodríguez, personal communication, February 25th, 2022).

Figure 5. WhatsApp conversation. One of the students playfully tells the group that he cannot solve the construction.

The students expressed their problems freely, playfully, and without the feeling of failure, as can be seen in the figure above. None acted as a leader and the group did not discuss their general work plan. Each player moved around the world, explored each other's constructions, and came up with their own construction ideas to add to the whole. The lack of deliberative processes did not seem to affect the perception of participatory or collaborative work. What's more, one of the subjects even found the process useful for increasing group creativity, motivation, and engagement.

> We learned and there was no need to debate or agree. As a whole, the small society we created was the result of the role that each one had. With a guideline, I wouldn't have been as creative. We would have been bored because it was imposed. (S. Escobar, personal communication, February 25th, 2022).

These findings lead to a reflection on participation, frequently framed in deliberative processes typical of democratic systems. In the digital environment, the perception of participation seems greater the more possibilities of expression the individual has, the more control the user is granted over the final result, the content, or the medium that is being used (Carpentier and Grondin, 2018).

Following the notion of collective intelligence proposed by Surowiecki (2004), we find that the diversity of skills improves the final result of the community built in Minecraft, through a process of decentralization.

It is important to keep in mind that according to Surowiecki (2004), collective intelligence is not promoted by group interests, but by individual and independent interests. It is precisely this level of autonomy, which allows groups to solve problems intelligently not because there is a consensus led by a subgroup of them or a member, but because intelligence distributed among individuals, symbolic systems, and tools produced by them are activated (Herrero and Brown, 2010).

Unlike environments where arbitration is required to achieve a final goal, the game platform facilitated learning horizontally. “With these types of tools, the idea that the teacher sets up the class and has power collapses” (M. Reusch, personal communication, February 25th, 2022). It is remarkable in this reflection how students organize themselves and value autonomy. During the game they did not ask the teacher for help to solve their constructive problems, functionally displacing the usual role of the tutor in the classroom.

5. Discussion

The results provide empirical support to the study of the subject's previous experiences as confidence generators (Bandura, 1977) to evaluate the motivational response of the subject during the game. Future research interested in behavioral engagement, which addresses the degree of attention, effort, and persistence of students in participatory learning activities (Dezuanni, 2018), could be enriched if they included dimensions typical of studies on self-efficacy which also evaluate the effort and confidence of students to take on tasks and their self-regulation strategies (Komarraju and Nadler, 2013).

The affinity between the categories related to cognitive engagement (Strati et al., 2017) and self-efficacy (Bandura, 1977) was also evident in the results of this study. Students with previous positive experiences in video games, construction games, or Minecraft, expressed self-confidence, persisted in the face of obstacles that were presented to them during the game, and put effort into their constructions. We identify links in students' creation of possible scenarios about Minecraft game-based learning and how they process their gaming experience. The conversations in the WhatsApp group exposed the problems that the students faced to access the platform, build, or move, as well as a positive response of support from their classmates that facilitated the collaborative achievement of the learning results.

These interactions may indicate that, to a large extent, their cognitive self-efficacy is influenced by the social and collaborative environment of the game, as well as by the common cognitive engagement, since all the interactions took place in virtual public spaces, visible to every player. Personal performance is thus subject to collective action and, therefore, to group conversations on WhatsApp, to colleagues' constructions in the collaborative world in Minecraft, and even to the scoring board offered by Quizizz in real-time. While the group performed the theoretical knowledge test, it contributed positively to motivation and individual affective engagement.

Regarding participation, students with signs of high behavioral, cognitive, or affective engagement and with an outstanding sense of efficacy were likely to participate. The observation of subjects who expressed in the interviews a liking for games or previous positive experiences in their professional or academic performance in the study area expressed enthusiasm and satisfaction with the game. These emotions seem to encourage them to take an active role in the learning experience and cooperate with others to achieve learning goals.

Thus, it seems that the greater the engagement and self-efficacy in learning, the greater the participation could be, but this statement should be tested in future research. Focusing on the participatory processes that took place, we highlight in the findings of this study the influence of motivation and self-efficacy from their emotional perspective in the teaching-learning processes. The students' role in Minecraft and decision-making seem to emerge from their enthusiasm and enjoyment of the game. However, it is noteworthy that their self-assessment on the acquisition of knowledge of a disciplinary nature does not seem to be conditioned by their performance in the game, but by the educational process as a whole and all the platforms on which the experience took place, such as Microsoft Teams, WhatsApp, and Quizizz.

Evaluating the gaming platform, the results observed in this research confirm that the use of Minecraft facilitates learning, besides increasing information technology skills. All the students who participated in the practice showed a positive assessment of the game in their learning process, especially for offering them the possibility of learning and deepening the concepts through experience. The level of construction reached by the group indicates that the students developed skills to search, select, or build their ideas in a three-dimensional world.

Minecraft has been frequently used in educational settings of basic education, but the use of the game in postgraduate studies did not generate major inconveniences. On the contrary, attention problems, reported in studies with children such as those by Staniewska and Konopacki (2021), were not found.

Taking into account the problems related to the lack of experience in the game, it was necessary to provide enough time for the students to learn to move and work in three-dimensional spaces. This period was essential to stimulate creativity and increase levels of digital literacy.
For postgraduate students who are training to design strategies in transmedia environments, just as it happens to children (Dezuanni, 2018)

> [...] it makes sense that media literacy on digital platforms is carried out, at least in part, on digital platforms, and that digital platforms are organized in ways that try to improve children's opportunities for the production agency (p.247)

The mechanics of Minecraft in creative mode seem to be accessible to inexperienced subjects, able to quickly develop simple constructions that make abstract thinking cognitive processes concrete. Furthermore, it is verified, following Le De et al. (2020), that the tool contributes to strengthening social connections and collaboration between peers.

The research of Dezuanni (2018) and Buckingham (2007) suggest, coinciding with the findings of this work, that the use of Minecraft helps students to develop a critical orientation towards digital culture and technology, taking into account that it almost equally requires social and material skills for the development of tasks. In this study, during the interviews, the participants declared having reflected at the time of construction, on the organic way in which participation arises in a multiplatform digital environment, the importance of the barriers imposed by the digital gap, or the key to interactions in individual performance in online contexts.

In this case, the construction of a self-sustaining community also worked as a metaphor that allowed the creation of new meanings for the concept of participation through experience. Just as each student had a plot and its construction contributed to the community, participation in the digital environment can be seen as the individual engagement that connects with others, sometimes in unstructured ways. The autonomy referred to being able to build what each one wants, exemplifies the great role of freedom in democratic participation.

Figure 6. Images of the self-sustaining community built in Minecraft.

The data collected in the observation of the game and the interviews confirm the statements of Sánchez (2017), who states that Minecraft has characteristics that allow it to ethically approach participation, involving a community that organically and in a decentralized way develops knowledge for the common good.

6. Conclusions

The general objective of this study was to identify relationships between self-efficacy in learning, engagement, and participation on an empirical basis. A good part of the academic literature in the area studies these problems in isolation as important factors within the educational field. The results of this work extend the findings of the field, showing some links between the categories of analysis derived from self-efficacy in learning and engagement, as fundamental dimensions to understand the processes of participation in the classroom in game-based experiences. Specifically, three fundamental elements are found to support this statement.

First, based on results obtained through observation of the virtual world and interviews, an outstanding relationship was found between self-efficacy and affective engagement. The students who expressed a liking for construction games or video games were more animated and satisfied during the gaming experience. Second, the analysis of social interactions in WhatsApp and Minecraft revealed that some features of self-efficacy perception in its vicarious dimension can drive participation. When the students see that their classmates get involved in the game and achieve their construction goals, they feel that they can do it themselves and, therefore, they are encouraged to participate, even cooperating

to collectively achieve the learning objectives. Third, mood, humor, and expressiveness, identified in group interactions through WhatsApp, influenced personal engagement and willingness to take an active role in the community.

At the end of the game, once the activity was over, the entire group agreed to express high levels of satisfaction with the results obtained, which seems to suggest that the lack of technical skills does not substantially limit learning through the platform.

Student comments highlight the possibility of broadening the understanding of theoretical concepts from the game experience and overcoming feelings of anxiety, frustration, or confusion during practice. The conversation that developed around the game, mainly on WhatsApp, shows enthusiasm and appropriation of key concepts, such as the digital gap, for understanding the participatory phenomenon on the Internet.

The research presents important limitations regarding the theoretical approach used. The three perspectives used: self-efficacy in learning, engagement, and participation, are derived from multidimensional concepts. It is then necessary to fine-tune the dimensions that will be addressed from each model to avoid overlaps, specifically, around the cognitive and affective variables to enhance the complementarity between approaches.

From the methodological point of view, important limitations were found to take into account in future works. It is important to conduct a pre-game inquiry into the levels of self-efficacy among the students. In this study, the self-efficacy analysis was performed during the post-game interviews, which could bias the results. Likewise, it is important to consider the methodological problems to capture all the interactions during the game. In the three days that the server remained open, it was only possible to analyze the conversations that took place through WhatsApp, leaving aside perhaps important data for analysis, the result of personal conversations, or that occurred by other means.

The results of this work can be useful for educators, researchers, and designers of game-based learning experiences. In coherence with Pink (2016), it is necessary to carry out more research to increase the understanding of the knowledge status from the point of view of the students and their actions through a perspective that takes into account, as fundamental conditions of participation, their assessment of the complexity of the tasks and their affective and cognitive engagement.

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