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Didactic sequence using virtual games for teaching biology in remote education: an experience report

Sequência didática usando jogos virtuais para o ensino de biologia no ensino remoto: um relato de experiência

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ABSTRACT

The use of varied teaching tools, whether in person or virtually, makes classes attractive, motivating and less routine. During emergency remote teaching, the need to innovate and improve student interaction became a challenging task. Therefore, the present work aimed to report the experience of beginners in teaching on the planning and socialization of a didactic sequence (DS) involving virtual games on the Evolution of Living Beings, in addition to the contributions of this pedagogical action to improving student interaction in classes and for teacher training. This production portrays a qualitative, descriptive study based on an experience report (ER) experienced in 1st grade high school classes at a State School in Alagoas, field of activity of PIBID/UFAL, Biology subproject. The DS consisted of three didactic games created on the Wordwall virtual platform, in order to promote greater student engagement during classes, in addition to contributing to the retention of content, namely: quiz, word search and maze. Additionally, other didactic activities were carried out. It was observed that the students' involvement in the games was significant, however, the students had a greater affinity for the quiz, the first game applied. SD contributed both to better learning and helped the teacher to obtain greater interaction and participation from students. The use of online educational games associated with the continuity of the subject in different activities and assessments showed positive results. Finally, it is important to diversify and explore these interactive activities so that students feel more motivated to learn dynamically and give meaning to their learning.

RESUMO

O uso de ferramentas de ensino variadas seja de forma presencial ou virtual torna as aulas atrativas, motivadoras e menos rotineiras. Durante o ensino remoto emergencial a necessidade de inovar e melhorar a interação dos alunos tornou-se uma tarefa desafiadora. Portanto, o presente trabalho objetivou relatar experiência de iniciantes à docência sobre o planejamento e socialização de uma sequência didática (SD) envolvendo jogos virtuais sobre a Evolução dos Seres Vivos, além das contribuições desta ação pedagógica para a melhoria da interação dos alunos nas aulas e para a formação docente. Essa produção retrata um estudo qualitativo, descritivo baseado num relato de experiência (RE) vivenciado em turmas da 1ª série do ensino médio de uma Escola Estadual de Alagoas, campo de atuação do PIBID/UFAL, subprojeto Biologia. A SD foi constituída por três jogos didáticos elaborados na plataforma virtual *Wordwall*, a fim de promover um maior engajamento dos estudantes durante as aulas, além de contribuir para a fixação do conteúdo, sendo eles: quiz, caça-palavras e labirinto. Adicionalmente, outras atividades didáticas foram realizadas. Observou-se que o envolvimento dos estudantes nos jogos foi expressivo, no entanto, os alunos tiveram uma maior afinidade pelo quiz, primeiro jogo aplicado. A SD contribuiu tanto para o melhor aprendizado quanto serviu de auxílio para o professor obter maior interação e participação dos estudantes. O uso dos jogos didáticos *on-line* associado à continuidade do assunto em diferentes atividades e avaliações mostrou resultados positivos. Por fim, é importante diversificar e explorar essas atividades interativas para que os estudantes se sintam mais motivados a aprender de forma dinâmica e dando significado ao seu aprendizado.

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Introduction

From the context of the Covid-19 pandemic in 2020 and the need to implement remote teaching, the use of digital games has been one of alternatives to provide greater engagement and encourage students to assimilate the content more efficiently (Costa et al, 2022; Gomes & Barros, 2022). The use of a variety of tools, whether in person or virtually, tends to enrich the teaching and learning of students in the classroom. As they are used in the school space, they promote attractive, motivating and less routine classes. Therefore, to instigate knowledge and promote greater student interaction within the classroom, especially in remote teaching, some methodologies using different and practical teaching materials are necessary, such as, for example, the use of digital games as highlighted by some studies (Soares et al, 2016; Santos et al, 2020; Ramos & Campos, 2020; Costa et al, 2022).

In conceptual terms, according to Ramos and Campos (2020), digital games are virtual environments and cultural artifacts that have their own rules, therefore, many researchers try to discover this capacity as a possible resource assisting in the teaching and learning process of various disciplines. For Soares et al (2016), didactic games have been used as a pedagogical material that acts as an aid in fixing biology subjects, being a useful tool for teaching and learning content applied in secondary and elementary education, as they present themselves as alternative that helps the construction of students' knowledge.

Thus, by integrating playfulness with cognitive aspects, the game is considered a relevant didactic strategy to be used in the teaching and learning process of subjective or abstract and complex concepts, encouraging reasoning, argumentation and engagement between teachers and students. (Campos et al, 2002; Pedroso, 2009).

For the teacher in training, it is essential to be able to experience these methodologies at school. In this sense, the Institutional Teaching Initiation Scholarship Program - PIBID, financed by the Coordination for the Improvement of Higher Education Personnel (CAPES, 2020), aims to provide students with less than 50% of the degree course completed, the introduction into practice and daily life in public basic education schools. Thus, the pibidianos (degree students who are part of the program) experience what it is like to be a teacher and difficulties of basic education in the public education network, so that their experiences in the classroom guide the guidance of the proposals to be developed with the supervising teacher (teacher at the school who welcomes and supervises the pibidianos). Therefore, as highlighted by Ferreira (2021), the union between the University and the School is strengthened and definitely beneficial for both.

In Brazil, from limitations imposed by the Covid-19 pandemic, most of the country's education departments, in a short time, developed a plan to continue school activities and guarantee student learning in a non-face-to-face way (Cunha et al, 2020). In this context, state

education departments adopted emergency remote teaching as a strategy, which was based on the use of online platforms, recorded video classes and sharing of digital materials (Centro de Educação para Educação Brasileira [CIEB], 2020).

With this new emergency teaching model, offering knowledge and conducting learning through virtual platforms was a reality for the school curriculum subjects and required the adaptation of teaching strategies. Rosa and Landim (2015), in their study in the context of Biology teaching, defend the use of diversified teaching and assessment strategies to achieve meaningful learning. Furthermore, the use of Didactic Sequences (DS) and other teaching strategies that provide better student learning is very well known in Biology teaching, seeking to promote significant learning of different contents, within a new context and surrounded by difficulties for teachers and students (Almeida et al, 2019; Farias et al, 2020; Lopes et al, 2020).

Therefore, when reflecting on the application of DS in school teaching, it appears when the use of this methodology allows for greater dynamism during pedagogical moments, being a rich, viable strategy that goes beyond merely expository classes, since according to Lopes et al (2020), is dialogical and contextualized, allowing a relevant interaction between teacher and student, with scientific knowledge being able to be worked on based on prior knowledge.

The emergence of DS began in France in the 1980s, beginning to used on in Brazil in the 1990s through the implementation of the National Curricular Parameters (PCN), as highlighted by Lopes et al (2020). For Zabala (1998), DS is a union of organized, structured and planned activities with the aim of achieving certain educational objectives, which have a beginning and an end known to both the teacher and the students. The author refers to the elements that make up DS, which aim to promote the understanding of the content covered by teachers.

So, when observing students' interaction difficulties in remote Biology classes in high school classes, whether because they feel unmotivated or because of the feeling of distance that the class format requires, the following question emerged: the use of didactic sequences with games that could help, with digital technologies, students overcome the lack of interaction in classes? It considered that, with the use of a DS with games, it would be possible to achieve greater interaction between students and the teacher and between the students themselves. Thus, the present work aimed to report the experience of beginners in teaching on the planning and socialization of a DS involving virtual games on the Evolution of Living Beings, in addition to analyzing the contribution of this pedagogical action to improving student interaction in classes and to the teacher training.

Methodology

This production portrays a qualitative and descriptive study based on an experience report (ER) of a DS with digital games carried out by PIBID Biology Subproject of the Federal University of Alagoas - UFAL, Campus Arapiraca, in a state basic education school located in the same municipality. The pedagogical intervention was carried out in a remote classroom, by Google Meet app, with three classes from the 1st year of High School, called T05, T06 and T07, which together had a total of 125 students enrolled. The DS construction and application process took place between March and April 2021, under the supervision of the Biology teacher responsible for the classes.

Therefore, in order to develop a DS that would be beneficial to students, it was defined that didactic games and other activities would be applied after students had prior knowledge on the subject. DS was conducted in accordance with the school's organization of Biology classes. These aspects and other pedagogical issues were defined together in the didactic planning.

Due to the suspension of face-to-face activities in March 2020, due to the pandemic caused by COVID-19, the start of classes in 2021 had a new teaching schedule. The Curricular Continuum aimed to fill the gaps in this atypical year that was 2020. Therefore, it was necessary to work on skills and competencies from the 2020/2021 cycle in a single year (Ordinance n.11.907, 2020), this explains the subject Evolution of Living Beings having was covered in the 1st year of HS, as it was a review of the content seen in the 9th year of Elementary School.

Planning and construction of virtual games

In the first stage of producing virtual games, the team, made up of four beginners in teaching, designated by supervision to build an intervention plan for the playful activity. For the development and creation of the game, research was carried out on platforms that could offer this demand for free virtual games, therefore, several platforms were found for this purpose. However, two were selected to carry out a test phase and, thus, be able to identify the one that met the needs and met the demands of the classroom. Therefore, the digital platform WordWall (available at: https://wordwall.net/pt) was tested to create the games and after previous tests, this platform was chosen, as it has several interactive features and positively met the implementation needs of the dynamics with the game.

This digital platform is used to create educational resources in a playful way, ranging from questionnaires to anagrams. Such interactive resources can be played on any web-enabled device, such as a computer, tablet, phone or interactive whiteboard, where they can be performed individually by students or led by teachers with students, taking turns during the lesson (Wordwall, 2012). Therefore, following the intervention plan, the team of beginners in

teaching prepared questions about the determined content (evolution of living beings), which were distributed in the elaboration of the word search, quiz and maze games, presented in figure 1.

Figure 1.
Elaborate virtual games (from left to right, quiz, maze and wordsearch).

Note: Game screenshots. Authors' collection (2021).

Evaluation instruments

Seeking to verify performance related to the use of games, two evaluation instruments (AV1 and AV2) each with 6 multiple-choice questions were created. There were the same questions in both instruments, differing only in AV2, which contained two open questions focusing on the perception of the game. One instrument to be applied before the games (AV1) and the other after the games (AV2), with the aim of collecting information about students' understanding, in addition to also evaluating the understanding of the subject explored in class and assimilation after the games.

Application of the didactic sequence

The content “Evolution of Living Beings” was taught in a remote class synchronously by the supervising teacher in classes T05, T06 and T07 of the 1st grade, using slides and the textbook as a basis. Subsequently, AV1 was made available to students, by Google Forms app., one class before applying the games.

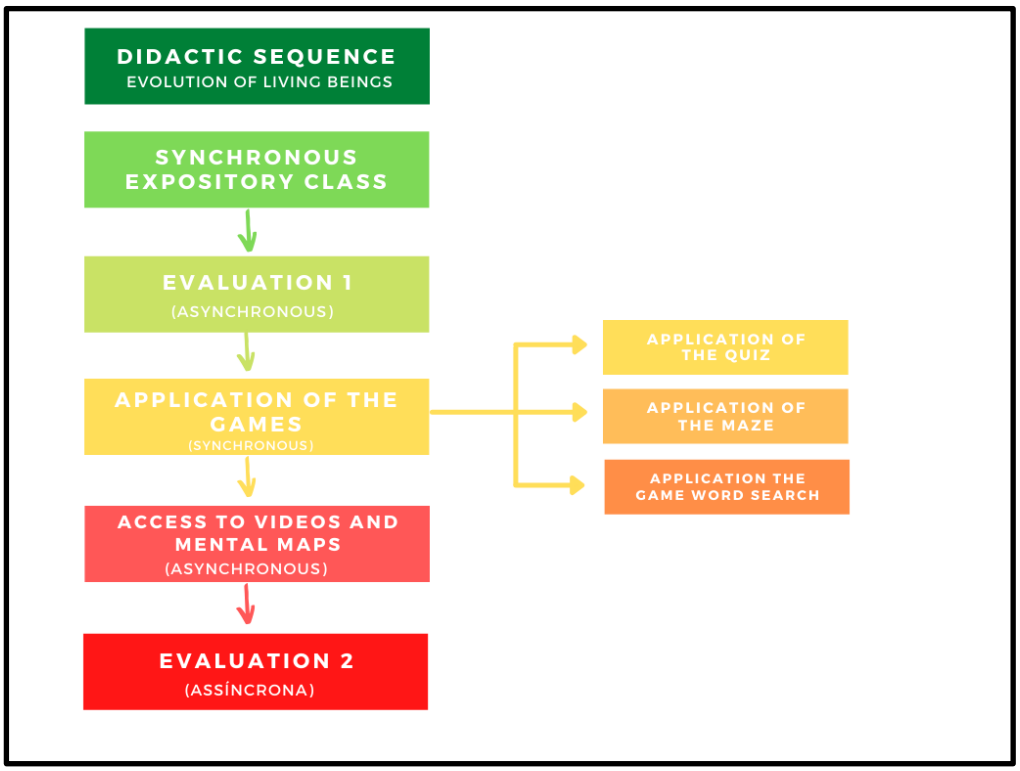
The following week, at the end of the content review conducted by the supervising teacher, the virtual educational games were applied in the following order: quiz (https://wordwall.net/play/15332/804/473), maze (https://wordwall.net/play/15331/734/134) and finally, the word search (https://wordwall.net/play/15331/229/309). Students played collectively, that is, everyone interacted and participated by responding both via chat and audio in the Google Meet room. Thus, two moments of remote classes were used to deliver the content and execute the games.

After this stage, links corresponding to games were made available through the remote classroom chat and also, on the padlet platform (https://padlet.com/hxlen/4x2ylv30pn00r2g7), a virtual wall of the subject prepared by the PIBID team. In this virtual space, pibidianos placed materials to assist students in the process of learning the content, also including some materials on the evolution of living beings, both videos and mental maps, so that it was possible to contribute even more to learning and retention of contents by students. Students were also asked to build mental maps as a way to increase interaction and assimilation of the subject.

To conclude the DS, in the following asynchronous class, the AV2 link was made available by Google Forms app., with multiple-choice and open-ended questions for students to answer. Figure 2 shows the DS steps.

Figure 2.

Organizational chart of the teaching sequence on the evolution of living beings



Note: Production by authors (2021).

Recording and analyzing observations

All observations and reflections obtained throughout the stages of the pedagogical activity were recorded in a teacher training diary, an instrument used in PIBID Biology, which served as the basis for preparing this experience report. In this way, the experience was

organized into three aspects: 1) pedagogical perceptions during the application of the didactic sequence; 2) analysis of student performance and; 3) learning obtained and contributions to initial teacher training.

RESULTS AND DISCUSSION

Pedagogical perceptions during the application of the didactic sequence

In classes monitored, it was observed that few students discussed the subject "evolution of living beings". Even though the class was taught with the help of slides and teaching material, when the teacher questioned the students with questions about the topic, only 2 to 3 students responded out of a room made up of approximately 40 students.

In locu, the teaching and learning process is challenging, however, with the new remote class format, new paradigms have been created in the classroom. The majority were already accustomed to classes in which socialization between teacher and student is possible, access to physical libraries and experimental activities in the laboratory, however, this practice was broken without the choice of teachers and students (Feitosa et al, 2020). However, the new class format generates student disinterest, both due to the loss of access to resources mentioned above and to complex subjects that are difficult to understand, as mentioned by Nobre & Farias (2016).

Furthermore, even teachers trained in the area of Biological Sciences, with a wealth of knowledge about biological evolution and developmental, may have difficulties in addressing the content, including remotely, especially considering the emergency use of educational technologies and the need to give new meaning to teaching practices.

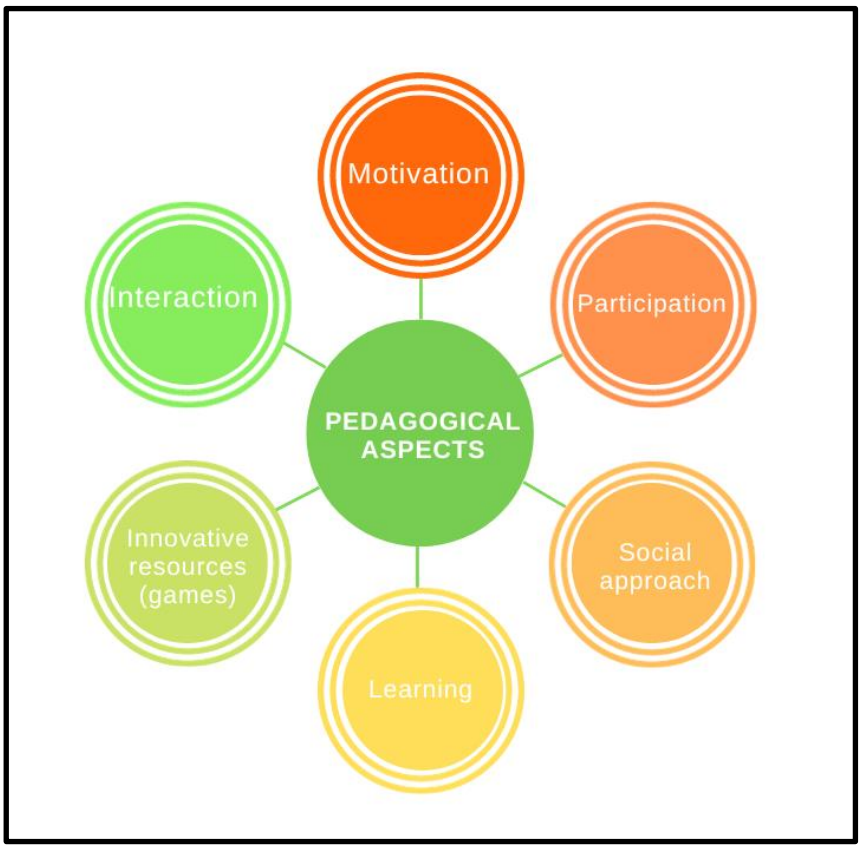
Through the observations made, it was possible to highlight some pedagogical aspects during the application of each game throughout DS. Students' involvement in the three games was significant and there was interaction in all of them, however, the students had a greater affinity for the Quiz, the first game applied. On the platform that was built, the Quiz allowed greater diversification, as in addition to containing questions, during the round "magic" cards appear that contain both bonuses and point withdrawals, so students have to pay attention to acquire a good card and thus increase the score.

Thus, skills that the three games allowed students to develop: concentration, teamwork, agility and knowledge. According to Ramos (2011), collaborative work mediated by the use of technologies can be designed, organizing and developing activities in which students share common objectives and interact to make decisions, raise hypotheses, solve problems, exchange experiences and build knowledge.

Based on pedagogical aspects, it can also be observed that the didactic sequence using virtual games provided greater engagement among students, in addition to enabling meaningful and dynamic learning. With the inclusion of innovative resources, classes became more attractive, as there was a noticeable increase in interaction, participation and motivation in learning the content. Additionally, through the students' reactions during and after the activities, it was noticed that virtual educational games provide curiosity and excitement during classes and, as a result, contributed to greater social proximity (figure 3).

Figure 3.

Organizational chart representing pedagogical aspects observed in the application of the didactic sequence.



Note: Authors (2021).

The use of virtual didactic games contributed both to better student learning and helped the teacher to obtain greater interaction and participation from students during the remote class, as shown in figure 4. This type of interaction was also evidenced in the study carried out by Gomes & Barros (2022), when applying digital biological games available on the wordwall platform during a DS aimed at High School students.

Figure 4.
Student interaction during the quiz.

Note: Screenshots, by Authors' collection (2021).

It is important to highlight that, during expository of remote classes, even when presenting the content on slides, students rarely participated in the class and answered the questions that the teacher asked, even if the answer was written on the slide. This change in attitude revealed the relevance of DS applied by beginners to teaching, who through PIBID brought innovation to the remote classroom and gave a new meaning to Biology classes.

The availability of videos, mind maps and game links on the padlet increased student participation, providing access to those who were unable to participate in the synchronous class, including allowing students to play several times, reinforcing the acquisition and assimilation of content. Gomes & Barros (2022), in addition to videos, also explored several games during the application of a SD Biology in remote teaching, experiencing several difficulties faced by students.

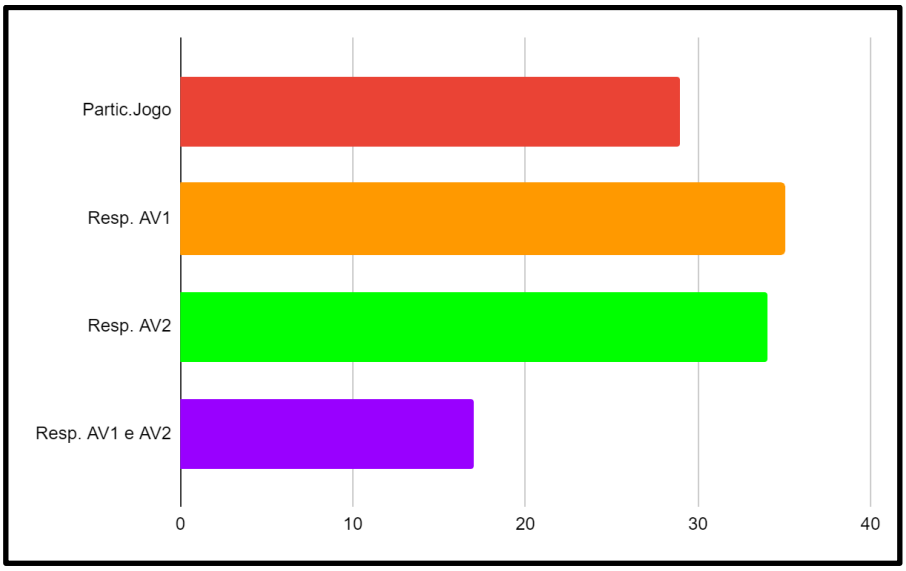
Regarding the activity of constructing conceptual/mental maps on the evolution of living beings, it was observed that there were difficulties in the feedback, however, for those who managed to carry out this complementary task, it showed promise in consolidating the content. According to Rosa & Landim (2015), the practice of building concept maps can contribute to meaningful learning.

Analysis of student performance

Regarding participation in activities, it was observed that 69 students participated in at least one of the stages of the didactic sequence. Thus, 29 students actually participated in the games in the classroom, 35 students responded to AV1 and 34 students to AV2. However, some of the students responded to AV1 but did not respond to AV2 and so on, so that only 16 students responded to both assessments (Figure 5).

Figure 5.

Distribution regarding the participation of High School students in the activities of the proposed didactic sequence.



Note: Observation data (2021).

Firstly, the deficit in participation in SD activities involved several factors such as difficulties accessing the internet, dropout rates, in addition to the student's lack of will/interest. Some responses found in AV2 report that 4 students did not participate in the dynamics due to work, and others due to the lack of a stable internet connection, corroborating similar difficulties observed in other studies (Gomes & Barros, 2022).

It is understood that some difficulties faced in the educational context of remote teaching are the result of the limitations imposed by the pandemic period, as there is a disadvantage for the working class with regard to access to education. Reaffirming this type of situation, Almeida & Dalben (2020) report that although the school offers alternatives to overcome such limitations, not all students have access to these. Problems faced by students go beyond the lack of access to technology; that they are also linked to the basic needs to have a quality of life.

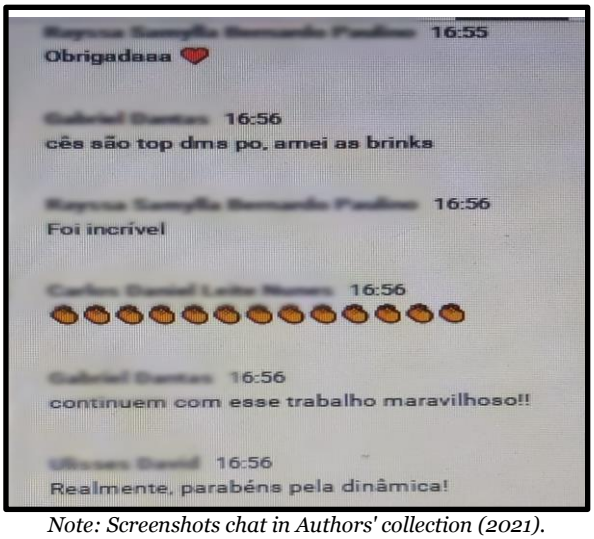
When results are compared with questionnaires administered before and after the games, it can be seen that students who participated in the games performed better. Furthermore, with the application of the games, student involvement and interest in classes were observed, as, through reports from the supervising teacher involved in the application of DS, students who were not participating in classes returned after applying the playful activity.

Therefore, despite the low participation of students due to external factors, it is possible to affirm that this DS was promising for those who had the opportunity to experience it fully. At the end of the pedagogical intervention carried out in the classes, it was possible to ascertain, through the students' reports (figure 6), that virtual didactic games enable the learning of the

content “Evolution of living beings”, in addition to highlighting their satisfaction for participating in a more attractive teaching methodology, especially given the reality resulting from the pandemic period.

Figure 6.

Reports and thanks from high school students after socializing games in a remote classroom.



Note: Screenshots chat in Authors' collection (2021).

Table 1 shows the answers to the open questions in the AV2 questionnaire from some students providing feedback about SD using games. The relevance of pedagogical action for the teaching of biology and the contributions of SD to encouraging students to be more interested in classes were evident. Thus, it was observed how new didactics awaken curiosity and involvement in the educational environment, in addition to enabling a better understanding of complex subjects, as highlighted by some students.

Table 1.

Student feedback regarding the games applied by PIBID Biology.

How do you think your development was after applying games? And what activity suggestions do you think would help with your development?
“I have no idea about this technology stuff etc... these dynamics classes are incredible, you can learn a lot and I have fun too”
“I think it was good! I suggest more appearances by PIBID professionals and topics and activities about science fiction films, and others related to biology”
“Very good, the game helps to fix the content, in a dynamic way, it helps a lot!”
"In my opinion, PIBID work is fundamental to our development. And, games also help a lot in our learning”

"It helped me remember the subject and helped me a lot with this simulation, true or false games seem more efficient"

Note: Authors' collection (2021).

Learning obtained and contributions to initial teacher training

From this experience, learning about the application of new strategies and methodologies was added to teacher training. Due to the use of these new strategies, it was possible to provide greater student engagement and interest in classes, and even though the intervention took place during the remote period, we were able to adapt them very well, providing better interaction in the classroom and better assimilation of subjects by students.

Considering the impacts on the training of beginners in teaching, Santos et al (2020) state that active participation in PIBID enables the development of different skills that are important not only for teaching, such as group work, planning, people management, bibliographical research and synthesis of results.

The application of DS also promoted a friendly insertion of pibidianos in the classes monitored, which possibly greatly facilitated the interaction between pibidianos and students during the school year, in future pedagogical interactions. In this way, creating an important bond that was clearly established after the socialization of virtual educational games.

For Idarlene (2017), affection is very important with regard to the good training of students who are already inserted in the school environment. Furthermore, Dessen & Polonia (2007) portray that both the school and the family share several educational and social functions that influence the formation of citizens, as both are responsible for the construction of knowledge.

Still in this perspectiva, Idarlene (2017) highlights that the emotional bonds between teachers and students are fundamental in improving the teaching-learning process, mainly due to the fact that it is in the classroom that the student expands their skills, contributing to educational growth, emotional, affective and ethical, thereby enabling quality education.

When observed from the perspective of future graduates, this intervention provided pibidianos to exercise the ability to observe the development of students, an experience that will be of great value to them not only during the pedagogical subjects during the undergraduate course, but also when they go to teach after formed. According to Jesus (2020), applying and developing a DS is a primary task for building teaching, as it allows beginners in teaching the opportunity to signify and re-signify the school reality, so that the scholarship holder assumes a role, with the responsibilities inherent to this profession, experiencing up close the challenges of teaching in public schools.

Final Considerations

The pedagogical approach described proved to be extremely valuable, providing continuity to the topic explored through various activities, including online educational games, videos, mind maps and assessments, and allowing students to understand the content covered.

Furthermore, students in the benefited classes had the opportunity to experience methodologies different from those traditionally used at school, due to the graduates' access to innovative methods and tools during their training at the university. This exchange of knowledge brought new things and, above all, stimulated creativity in the school environment.

In fact, it is important to highlight the relevance of this intervention for undergraduate students, as they will make the most of the experience acquired throughout their future development in teaching. It is essential that teachers in initial and continuing training increasingly seek new strategies to provide students with innovative, attractive and easy-to-understand classes, while continuing to delve deeper into the subject, encouraging and instigating the student's curiosity so that they participate in many classes, and thus, the learning process becomes something more quickly.

Due to the new class format, the lack of interaction and lack of interest on the part of students was constantly evident, a situation that was partly overcome by the inclusion of DS with an emphasis on games, a strategy that enabled student involvement. But even so, some students were prevented from participating in classes, due to the need to work or because they did not have a stable internet connection.

Finally, given the above, it is essential to apply DS using virtual games as a teaching strategy, whether in remote or in-person teaching. However, in addition to games, it is important to diversify and explore other interactive activities, such as conceptual or mental maps, interactive murals, videos, among other strategies, so that the student feels more motivated to learn in a dynamic way and giving meaning to your learning.

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