

Gamified Activities to Improve the Learning of Addition in the Third Year of General Basic Education

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Abstract

This paper explores how to improve the learning of addition in students in the third year of General Basic Education at the EducaMundo Bilingual Educational Unit. It is noted that, in the wake of the COVID-19 pandemic, information and communication technologies have become fundamental tools in education, offering new ways to enrich teaching and learning methods. These can make classes more interactive and engaging, resulting in a significant increase in students' interest and confidence towards subjects, particularly Mathematics. Therefore, it was proposed as an objective to implement gamified activities to contribute to solve the problem posed. Theoretical methods such as analytical-synthetic and modelling, empirical methods such as observation and pedagogical and statistical testing were used. The results indicate a remarkable improvement in academic performance and retention of mathematical knowledge, reaffirming the effectiveness of gamification as an educational strategy. In addition, it highlights the need to train teachers in innovative resources such as gamification to further enrich the educational process.

Keywords: Addition, Learning Enhancement, Mathematical Skills, Gamification, Educational Games.

INTRODUCTION

The use of digital tools has acquired an increasingly notable presence in everyday life, particularly in the wake of the COVID-19 pandemic, where they played a crucial role in the educational process. During this period, information and communication technologies (ICTs) not only became essential tools for maintaining educational continuity, but also opened new ways to enrich and diversify teaching and learning methods. During the pandemic, educational institutions found it necessary to resort to virtuality to continue developing their educational activities. Teachers had the need to prepare themselves and look for tools to help them in this new modality. As time went by, it was observed that students became more motivated with the use of these tools. However, the use of ICT did not begin with the pandemic. In 2013, the UNESCO Institute for Statistics [UIS] stated that 82% (31 out of 38) of countries in Latin America and the Caribbean were already adopting initiatives to implement ICTs at all educational levels (UIS, 2013).

On the other hand, the isolation of the pandemic also resulted in the fact that many students, accustomed to traditional classes, did not advance as expected in terms of the level of knowledge. These difficulties became evident when they returned to the face-to-face modality, where they had to develop autonomously in different areas. The complications became more noticeable as the level of content increased. In the case of students in the third year of General Basic Education (EGB) of the EducaMundo Bilingual Educational Unit, difficulties arose in Mathematics, especially in addition without carrying and with carrying, since they started the addition with the ten, not the unit, and did not consider the carrying, among other problems. Thus, it became a priority content for teachers of this grade, due to the importance of mathematics and the

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development of these skills. The authors of the article focused on studying and trying to solve this problem. They then developed research that determined as a scientific problem how to improve the learning of addition in third grade students of EGB of the EducaMundo Bilingual Educational Unit?

When looking for possible alternatives to minimize the problems of learning of addition and considering the importance and relevance of ICT in education, the preference of students for their use, as well as the need to develop skills for their use from an early age, gamification was chosen for this purpose. These ideas are based on the impact of games at this age and their benefits for learning. Sánchez Domínguez et al. (2020, citing Vygotsky, 1988), highlights the importance of play in children's learning, since it is a space where they can experiment through reality. The researchers refer to the fact that, through this activity, children can construct their own learning, turning the teacher into a guide in this process. Through play, students develop cognitive and social skills, thus creating new mental structures and facilitating the process of appropriation of content.

LITERATURE REVIEW

In line with this perspective and considering ICTs as mediators in the game process, Cueva et al. (2019) introduce connectivism as a valuable pedagogical approach that enriches the teaching and learning process. When implemented in an adequate and organized manner, considering the individual needs of students, connectivism can be a great contribution to the educational process. In this context, technology becomes a crucial tool, without neglecting the student's protagonism and the teacher's guidance. As a result of the analysis of these issues, the effective application of ICT aligned with the idea of Vygotsky (1989, as cited in Sánchez Domínguez et al., 2020) provides an educational environment in which students can explore, build knowledge and develop skills in a meaningful way, being the gamification strategy the ideal one to combine these elements.

Another author, Siemens (2004, as cited in Sánchez Pacheco et al., 2020), emphasizes that connectivism and gamification can complement the learning process. By using games, interactions among students are promoted, facilitating the exchange of ideas and knowledge. This approach not only encourages peer-to-peer feedback, but also seeks to increase the motivation and engagement of students in their own educational process. For these reasons, when trying to solve the problem posed, gamification is considered as an educational strategy that can contribute to its solution. Gamification facilitates learning through interactive games that promote motivation, collaborative work, increased interest, among other crucial processes. In addition, it is a relevant strategy to apply the necessary skills that strengthen the development of the additions without leading and carrying. Based on the above, the objective of the research is to implement gamified activities to improve the learning of addition in third year EGB students of the EducaMundo Bilingual Educational Unit.

Gamification and Its Advantages

In the first instance, it is necessary to mention that gamification arises in the digital media industry as a term associated with the game. The first recorded use dates to 2008; however, its popularization began in 2010. More generally, gamification uses aspects of game design in areas that are not traditionally considered as such, such as behavioral change therapies, sales strategies, human talent management, marketing, among others (Londoño and Rojas, 2020).

In the educational context, it is very important to apply different strategies such as gamification, since their purpose is to facilitate the learning process. Navarro et al. (2021) define it as a strategy that favors "the use of playful elements in non-game contexts, which is characterized by increasing the interest and involvement of students in the teaching-learning processes" (p. 508). Regarding its advantages, they highlight some very important ones such as enabling motivation, improving behaviors and capturing students' attention, contributing to the creation of a more conducive environment for the development of the teaching-learning process, as well as encouraging cooperation, creating a safe environment, supporting knowledge retention and inducing changes in behavior (Batistello and Cybis, 2019; Martínez et al., 2019; Navarro et al., 2021; Gualpa et al., 2022).

Ortiz et al. (2018) cite Werbach (2012) to add that, in the educational field, the fundamental pillars of gamification encompass dynamics, mechanics and components. Dynamics are defined as relating to the conception and structure of the game. Mechanics are the procedures that facilitate the progress of the game, and finally, components are the concrete implementations of the previous two (such as avatars, badges, scores, levels, rankings, among others). Valderrama (2015) highlights gamification as a technique to increase motivation

and engagement in different areas, such as learning, and in that sense, the keys to motivation should be considered to design games that engage the participants.

In an additional perspective, there is the participation of the teacher, who faces the arduous task of planning. In this sense, he/she must carry out a careful analysis and select appropriate gamified activities, adjusted to the characteristics, particularities and interests of his/her group of students. The implementation of a gamified curriculum design facilitates the retention of students' interest, transforming the teaching-learning process into an attractive and fun experience. In this context, gamification is experiencing significant growth due to its relevance within the educational field (Ortiz et al., 2018).

By using different educational applications, the teacher can select or modify activities according to the students' needs. In this way, it allows them to solve mathematical operations and develop addition skills through games, reducing the fear of making mistakes (Sánchez, 2021). These applications should be easy to use and reviewed in advance by the teacher, in order to provide support in their use. In addition, they allow repeating similar exercises, making it easier for the student to practice and thus be able to move up levels while developing skills, in this case, mathematical skills (Sánchez, 2021).

Teaching Addition

Mathematics education in the early years of school life is essential for students' academic and cognitive development. One of the fundamental pillars of this education is addition, a mathematical skill that lays the foundation for the understanding of more advanced operations. To start the addition process, work begins on the conceptualization of addition, where the student is clear that this term refers to the action of adding or adding elements (Castro, et al., 2017). In this process, it is essential to use several strategies such as the use of concrete material, in order to facilitate the representation and reasoning process.

Hodnett (n.d.) refers that the process of addition in children is achieved gradually as they develop certain basic skills. Learning to add and subtract begins with learning to count. Children begin counting forward and backward, putting single-digit numbers together and comparing amounts to see the difference. This process usually occurs between kindergarten and fourth grade.

Once the work with these strategies is done, more formal exercises will follow, where students are already familiar with the plus (+) and equal (=) signs. Here they can solve simple additions such as $4+5=9$. From this learning point on, reinforcement exercises should be performed. This is done in order to increase the difficulty of the operations and at the same time remove the concrete material.

The Ministry of Education of Ecuador (2021), in the Prioritized Curriculum, determines essential mathematical competencies for the third year of EGB, where the development of the following is considered important:

Recognizes the notion of addition, i.e., students identify that the action of adding is to put or increase.

Identifies ones and tens, favors positional location of quantities. Students recognize two-digit numbers, which correspond to ones and tens.

Uses concrete material to solve simple additions, e.g. abacus, pencils, counters, beads, etc.

Uses concrete material to solve additions while carrying. In these additions greater difficulty is generated, since the process is more complex and tends to present greater confusion. For this reason, support material can be used.

Decomposes numerically and identifies how a quantity is formed, i.e., how many units and tens it has.

Solves horizontal additions up to two digits, which contributes to the process of solving operations mentally.

Places the addends vertically, since this skill strengthens the positional location of quantities to help in the resolution of additions.

Solve additions starting from units, continuing with tens and ending with hundreds. The correct application of this process is very important especially in solving additions by carrying. This sequence is specific in that it guides students through a structured process for approaching additions, ensuring that they consider the position of the digits.

Identifies, in carrying additions, that ones add to tens and tens add to hundreds, as appropriate. This process represents a more solid understanding of number structure. Logical, analytical thinking is developed and the basis for solving the following operations is fostered.

Solves the additions with guidance from the teacher, who gives them more confidence so that later they will have the ability to solve exercises independently.

In line with these skills, some current technological tools that can support the implementation of gamification for addition resolution are Kahoot, Quizziz, WordWall, Arcademics, ScratchJR, Educaplay, Edmodo, among others (Sierra and Juste, 2018; Zambrano et al., 2020). These resources provide different activities based on interactive games, in which skills related to addition are reinforced. Based on the analyzed sections, the objective of this research, as mentioned above, is to implement gamified activities to improve the learning of addition in third-year EGB students of the EducaMundo Bilingual Educational Unit.

METHODOLOGY

The research is based on a mixed approach that combines quantitative and qualitative elements to address the problem. This approach allows obtaining and analyzing numerical information related to the level of addition learning in the participants and its changes over time, as well as the detail of the observations made in the classroom and the perceptions of teachers regarding strategies developed with gamification. In this way, it is possible to obtain a complete vision of the students' addition skills and to evaluate the viability of gamification as an innovative educational tool to provide a solution to the problem posed.

In addition, the exploratory and descriptive scopes were combined, with the aim of making the problem known and, at the same time, detailing the initial circumstances and the results obtained from the intervention carried out. Each scope adds relevant information for a holistic understanding of the situation and to disseminate it correctly, in order to project its results to similar contexts. Regarding the type of research, according to the source of obtaining the information, a field design was chosen, supported by bibliographic and documentary elements, with a longitudinal perspective to capture the evolution of the students' skills throughout the first partial of the second quarter, during the 2023-2024 school year, where the gamified activities were implemented.

The research used theoretical methods such as analytical-synthetic and inductive-deductive with the aim of examining the constituent elements of the problem by studying each aspect independently, identifying their properties, characteristics and relationships with other constituent elements. This made it possible to understand the object of study in a holistic way, determining its dynamics. Modeling was also used in the creation of the proposed gamified activities.

The research was developed in the EducaMundo Bilingual Educational Unit, which is located in Ecuador, province of Guayas, canton Daule. It offers educational services at the Pre-school, General Basic Education and High School levels, privately supported. It has an adequate technological infrastructure, since each classroom is equipped with devices and internet, required for the use of ICT in the educational process. In addition, it has computer labs and electronic devices for each student, such as tablets, since it belongs to an upper middle class.

In order to develop the research, a diagnostic test was applied to the 50 students who made up the three third-year parallel classes. It was decided to study those who obtained a grade lower than seven points in order to evaluate their integration into the research population. This test was developed at the beginning of the 2023-2024 school year. The instrument was designed as mentioned in the Ministry of Education's Learning Together at Home Educational Plan (2020). This agency states that the diagnostic evaluation is the starting point of an educational process and serves to know the current state of the students' school and personal situation, which allows determining an adequate approach to curricular development.

To evaluate these skills, the quantitative scale provided by the Ministry of Education of Ecuador (2016) was used as a reference, which corresponds to the grading system in force in the country for the EGB and High School: levels, which is used by the EducaMundo institution:

Score of 9 to 10: Mastered the required learning.

Score of 7 to 8.99: Achieves the required learning.

Score of 4.01 to 6.99: Close to achieving the required learning.

Score of 0 to 4: Does not achieve the required learning.

This system provides a quantitative measure to classify and compare student performance in relation to the standards established by the Ministry of Education. It was used in the initial and post evaluation to categorize the participating students.

Analysis of the results showed that 15 students scored below seven points. These were taken as population, because they are carriers of the problem to be investigated. It was decided, because it is a small and manageable population, to assume it as a sample. Subsequently, a detailed observation was carried out, confirming that these students faced significant difficulties in learning addition. Another result of the observation was the identification of specific skills that needed attention based on the needs detected during the initial assessment.

Regarding the methodology, a series of steps were designed to achieve the purpose of the research, each one responding to specific objectives. Table 1 shows the distribution and sequence of the steps:

Table 1: Distribution of research phases

Nº	Phase	Method	Activities to be performed	Objective
1	Diagnosis	Pedagogical test (diagnostic)	It focused on the application of a diagnostic test at the beginning of the 2023-2024 school year to assess the initial knowledge level of students in addition.	Check the initial state of addition skills.
		Classroom observation	It was carried out from a series of observations in 12 classroom sessions, focusing on participation at the blackboard and review of individual activities in the notebook.	It was conducted from a series of observations in 12 class sessions, focusing on participation at the blackboard and review of individual activities in the notebook.
		Interviews (teachers)	Structured interviews were conducted with the teachers in charge of the third year EGB parallel classes.	Gain insights into the strategies teachers used to teach addition, as well as the level of knowledge about gamification as a strategy for learning addition.
2	Creation and application	Modelling	A series of six sessions with activities based on gamification was designed to facilitate the learning of addition. The didactic proposal was implemented in the group being studied.	Implement gamification to promote learning of addition in the selected sample.
		Pedagogical test (final)	An evaluation was applied to know the level of mastery of addition of the group of 15 students, after the intervention.	Evaluate the state of the addition skills after the implementation of the proposal and identify the changes that occurred with respect to the initial state.

Note: Own elaboration

Each method provided important information for the analysis required in the research. In the Diagnostic Pedagogical Test method, the initial state of addition skills was known, as well as the students who had more difficulties, considering those who scored less than seven points, as mentioned above.

Continuously, with the Classroom Observation method, the participation on the blackboard and the development in the notebook in the mathematics classes were recorded during two sessions consisting of two 45-minute class periods, focused on the 15 students in the sample. An observation sheet was designed to record the information of each student for each session. This instrument evaluated the 10 indicators equivalent to the essential skills, which are supported by the Prioritized Curriculum of the Ministry of Education (2021), as mentioned above:

Identifies that the notion of addition refers to putting or adding.

Identifies ones and tens.

Uses concrete material to solve simple additions.

Uses concrete material to solve addition by carrying.

Decomposes quantities up to two digits (ones and tens).

Solves horizontal additions up to two digits.

Places addends vertically considering positional order (ones and tens).

Solves additions starting from ones, continuing with tens, and ending with hundreds.

In carrying additions, identifies that ones add to tens, and tens to hundreds, as appropriate.

Solves additions with accompaniment or guidance.

The teacher interview sought to complement the previous data, from the teachers' perspective in relation to the strategic methodologies they applied. To achieve this, a nine-question structured interview guide was designed to recognize the strategies recurrently used by teachers to teach addition in particular, as well as to identify their level of knowledge about gamification to improve the learning of addition.

The modeling method was applied for the elaboration of the proposal. Based on the results obtained and taking advantage of the benefits of gamification in the learning process, a set of gamified activities was designed based on the mastery of addition skills. The proposal is constituted by six sessions, which combine the game, the use of ICT and the active participation of the students.

During the planning of the proposal, applications were carefully selected to enhance students' participation, confidence and interest in the topic of study. These applications were chosen for their ability to offer an interactive and motivating approach, which contributed significantly to overcoming the difficulties identified.

Overall, the gamified activities involved a variety of game mechanics designed to make the learning process more engaging and effective. Elements of friendly competition, graded challenges, and meaningful rewards were incorporated to encourage participation and achievement. The formulation of the activities allows the teacher to apply them to work with students who are challenged in addition, providing them with a proven and effective strategy to address learning difficulties.

The implementation process lasted six weeks, responding to the need to address the problems identified. The group of students developed the activities in an extracurricular way, that is, after the school day, they were carried out for one hour, twice a week.

Finally, the *Final Pedagogical Test* method was applied to the 15 students in the sample during the week following the implementation of the gamified activities to finalize the process. The students were observed to be much more enthusiastic in the development of the test and the results correspond to the preparation received. The evaluation format used was designed according to the contents related to addition. For the processing of the results, mathematical-statistical procedures were used, such as the calculation of

percentages. The Microsoft Excel program was used to perform calculations and represent the results obtained.

RESULT AND FINDINGS

In the initial pedagogical test, the results shown in Figure 1 were obtained:

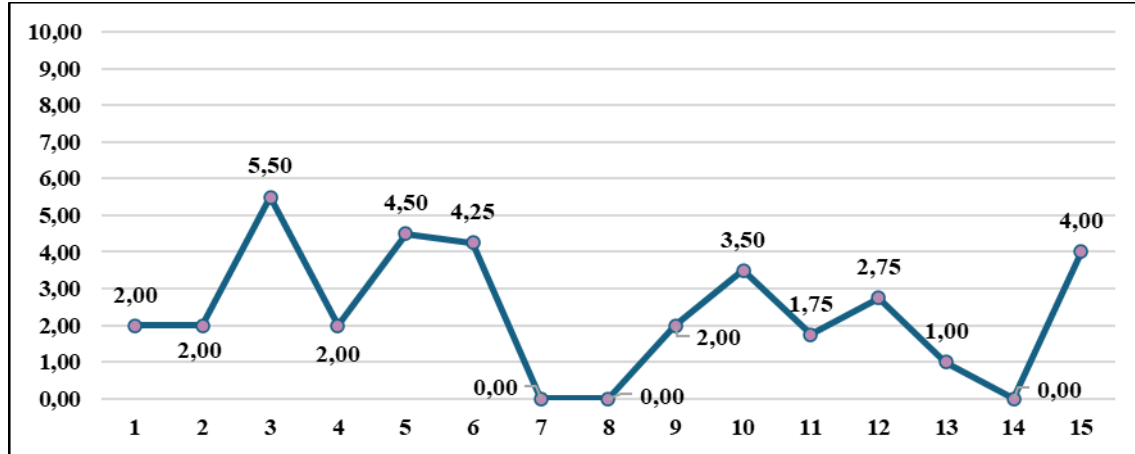


Figure 1: Results of the initial pedagogical test

Note: The scores obtained fluctuate between 0 and 5.50, well below the minimum acceptable score of 7.

Figure 1 shows that the students obtained grades below the minimum required, since most of them are below 3.50 (73.33%). There are even students who scored between 0 and 1, which demonstrates the need to level their knowledge in Mathematics. Regarding addition, students have greater difficulty in completing the numerical sequence and in solving additions, which reaffirms the relevance of the intervention. In general, the average achieved by the participants was 6.02, which represents the category "Close to achieving the required learning", according to the quantitative rating scale, which demonstrates the need to work on the development of these skills.

Classroom observations allowed obtaining information related to 12 complete activities, where participation on the blackboard and development in the class notebook were distinguished. Results were obtained for the 15 students in the sample. Figure 2 shows the observations corresponding to the resolution of sums on the blackboard.

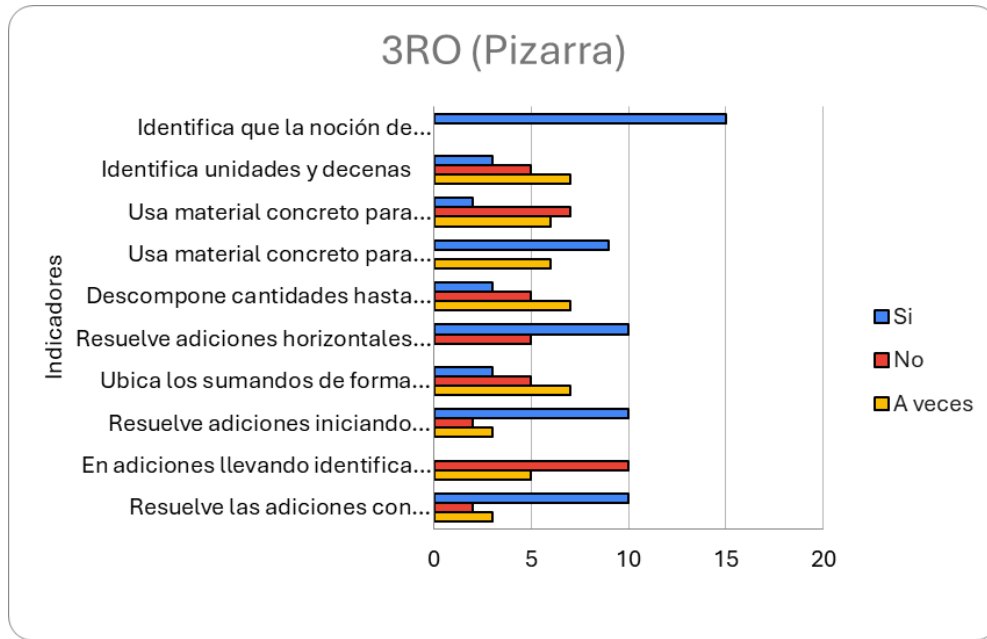


Figure 2: Performance in solving additions observed on the blackboard.

Figure 2 shows a good level of understanding of the basic concepts of addition. Students identify the notion of addition as putting or increasing, they recognize units and tens. In addition, they are able to decompose quantities of up to two digits and solve horizontal addition correctly. Regarding the use of concrete material to solve additions, it can be seen that there is more incidence in carrying additions compared to simple operations. In addition, when solving carrying additions, 13.34% of the students do not take into account the number they are carrying either in the ten or hundred and 20.01% forget, which causes erroneous results. It is important to mention that most of the students require the direct support of the teacher, since they show insecurity in this process.

Figure 3 shows the results corresponding to the resolution of sums in the notebook.

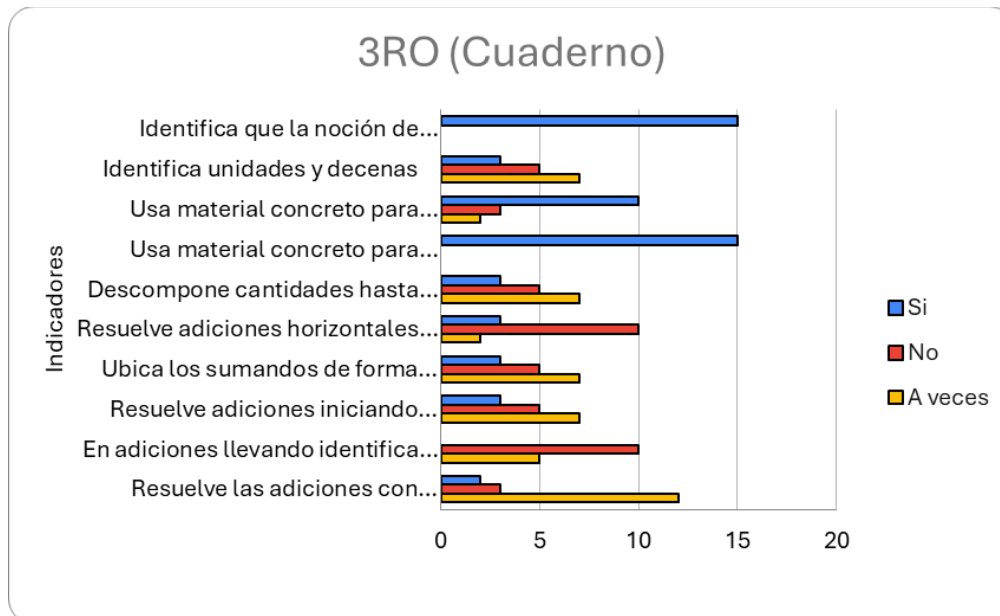


Figure 3: Performance in solving additions observed in the notebook.

An exhaustive analysis of the results obtained in the activity recorded in the notebook was carried out. In this study, a total of 12 activities were reviewed in detail, covering the period from the second observation to the end of the first partial of the second quarter. Figure 3 shows that 100% of the students prefer the use of concrete material, such as the creation of small balls in the notebook, the use of base 10 material and the use of colored pencils for counting. This occurs in carrying additions, and 66.70% in simple operations, i.e., in non-carrying additions. Moreover, this observation agrees with the previous one in the fact that all students have acquired the notion of addition. On the other hand, the difficulty in identifying that units add to tens and tens to hundreds is maintained.

The results of the observations reveal that some students show a strong dependence on both teacher and peer support when tackling addition problems. This could indicate a lack of confidence in their mathematical abilities. In addition, there was an evident need for students to draw on additional resources during the learning process. These results suggest the importance of strengthening students' confidence in their mathematical skills, as well as providing them with the necessary support and resources to improve their performance in developing addition independently.

In summary, students show a basic understanding of addition, but face challenges in terms of accuracy in number placement, independence in solving additions, and must be supported by concrete material to solve the operations. These results observed in Figures 2 and 3 provide valuable information to adapt the teaching and provide personalized support to students, in order to improve their learning, and to design gamified activities in a focused way.

The Teacher Interview was applied to the six teachers in the third year of EGB to obtain a detailed understanding of the teaching strategies and tools they plan to use to address the topic of addition. Regarding their professional profile, five of them have a bachelor's degree in education sciences and one has a Master's degree in Mathematics Teaching, registered at the Secretariat of Higher Education, Science, Technology and Innovation (SENESCYT). Regarding their work experience, they have more than five years of experience applying their talents.

The professionals emphasize the relevance of concrete material and interactive games as effective resources to attract students' attention and maintain their interest in learning mathematics, specifically in addition. Additionally, they emphasize that interactive games became more important after the pandemic, since they were positively received by students as a didactic resource.

The interviewees report that they have observed that some students face challenges when dealing with more complex additions, especially those that involve carrying. This highlights the need to develop specific procedures and provide them with additional support, so that they can overcome these difficulties and strengthen their skills in the area of mathematics. The teachers point out that one of the strategies that has helped them the most is feedback at the end of each class.

All the professionals share a unanimous perspective on the importance of learning to add, stressing that this skill is essential for everyday life. However, despite this understanding, five of the teachers continue to focus on traditional approaches, such as the use of concrete materials, and show a resistance to exploring more innovative forms of intervention such as gamification. They claim that this resistance is due to a lack of training and little information about more participatory forms of intervention.

Although teachers recognize the potential benefits of gamification, there is a disconnect between knowledge and the application of this strategy in the classroom. However, four educators point out that gamification has the potential to increase students' motivation, engagement and information retention, which can significantly enrich the learning process. In addition, they add that it can foster healthy competition, teamwork and skill development, which could also be used in other subjects.

From the above evidence, the need for teachers to know, first-hand, the active methodologies that allow them to innovate in the classroom, leaving aside the traditional organization, because children have other characteristics and needs nowadays, stands out. For this reason, gamification becomes a favorable alternative

for learning addition. Teachers must know its structure and implementation and adapt it to the needs of their students.

In the development and implementation phase, in the first instance, the legal representatives were asked to authorize the academic reinforcement as an extracurricular activity and to comply with 100% attendance in the 12 sessions that were distributed during the six weeks. The use of digital didactic resources, participation in the blackboard and the use of the notebook were distributed, maintaining the interest of the children and establishing reinforcement individually, in teams and with individual tutoring which caused a high impact on the learning of addition in the students of the study group.

In the following link, you will find the activities that were developed and implemented:

https://docs.google.com/document/d/10yDDn-PYGDrxZhWjNw9EyyFSzoGhik7eOIx_OkQ2xyw/edit?usp=sharing

The final pedagogical test showed that the students achieved the required learning for the level in which they are, obtaining grades between 8 and 10, according to the quantitative scale. Given the importance of the results, the grades obtained in the initial and final tests are presented, focusing on the skills that were evaluated in both. Figure 4 shows the results obtained in the skill Representing quantities with concrete material:

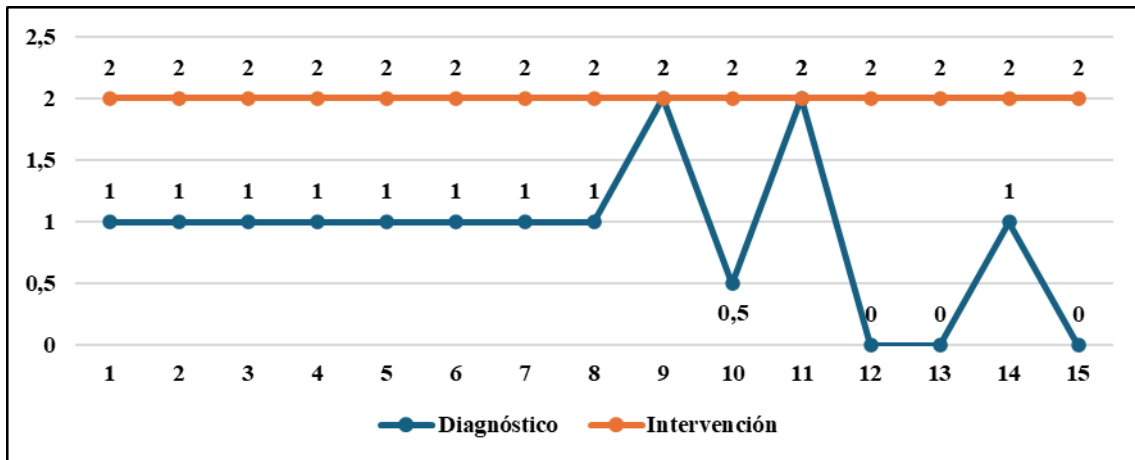


Figure 4: Comparison of the scores obtained in the skill Representing quantities with concrete material.

Note: The reagent was scored for 2 points.

At first glance, the figure above shows that after the intervention, 100% of the students achieved the maximum score, surpassing the ability to use concrete material. In addition to this, the final test combined the use of concrete material to solve simple addition (using the abacus). This skill is necessary for learning addition, since it facilitates the identification of units, tens and hundreds and the notion of adding or putting.

Figure 5 shows the results obtained in the skill Identifying units and tens from base 10 material.

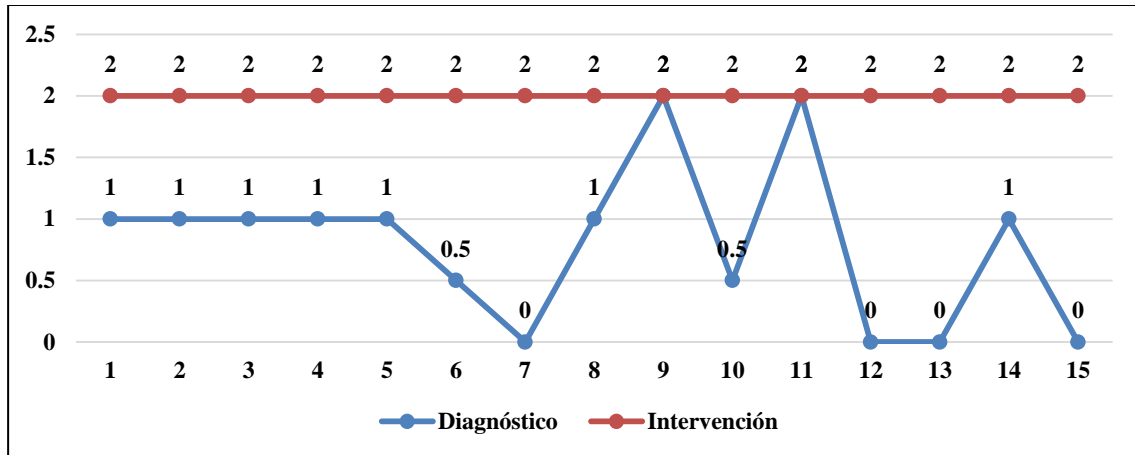


Figure 5: Comparison of the final scores obtained in the skill Identify units and tens.

Note: The reagent was graded for 2 points.

Again, the result obtained after the intervention evidenced that the students mastered the writing of the number represented in the base 10 material. In addition, the post-test item was more complex, since they had to write the number represented by the base 10 material, while, in the diagnostic, they were only expected to identify the number.

Figure 6 shows the results obtained in the ability to solve vertical sums.

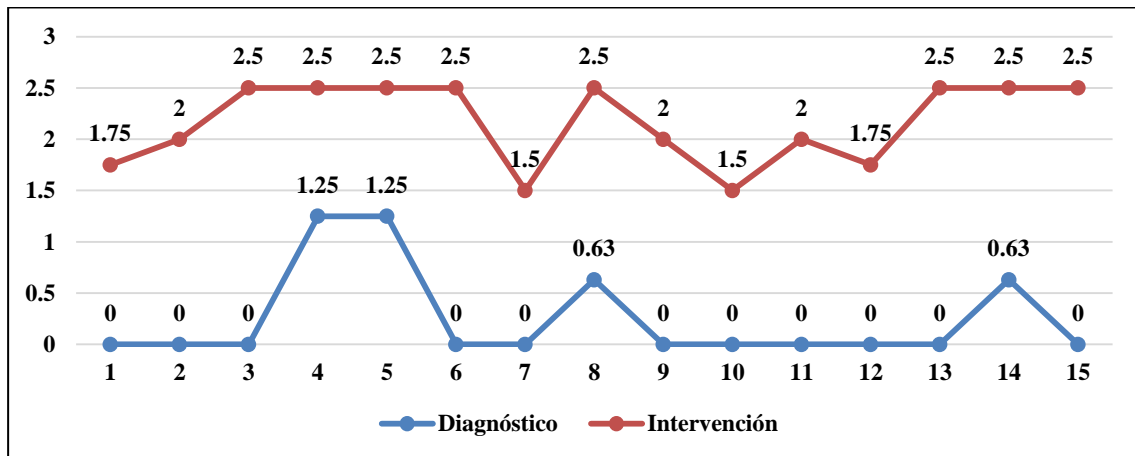


Figure 6: Comparison of the scores obtained in the ability to Solve vertical sums

Note: The items were graded for 2.5 points.

An interesting aspect that can be observed in Figure 6 is that 73% (11) of the students obtained a deficient score in the resolution of additions in their initial test, that is, they had little knowledge acquired on this topic; and, the rest reached around 50% of the maximum. Comparing these evidences shows the progress achieved by the students, since they were able to solve vertical additions in the final test. These competencies also allow solving everyday problems that require their use, which develops children's critical thinking from an early age.

Figure 7 shows the results obtained in the initial test and in the final test:

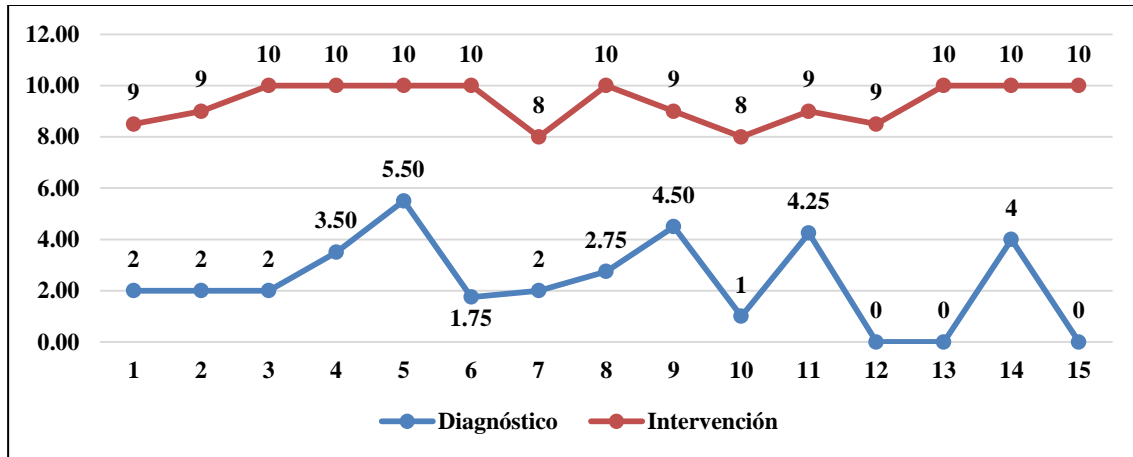


Figure 7: Comparison of the scores obtained in the initial diagnostic test and the final diagnostic test

Note: The final grades obtained in each evaluation, weighted out of 10, were considered.

Figure 7 shows the development achieved by the students in the study group after the intervention. In the initial pedagogical test, they obtained an average of 2.35, which represents the category "Does not achieve the required learning". In the final pedagogical test, they achieved an average of 9.33, which represents the category "Mastered the required learning". This shows an increase of 6.98 points in their school performance. In other words, the evaluation demonstrates the learning of addition acquired by the students as a result of the implementation of the gamified activities, transforming the forms and resources used to improve the learning of addition.

DISCUSSION OF RESULTS

As could be seen, the results obtained are satisfactory and have motivated students' participation in learning addition, which is shared in other studies such as Holguín et al. (2019). Mathematics learning requires special attention from early ages, so knowledge such as quantity representation and addition are fundamental cognitive skills. Through the implementation of gamified activities in the third year of EGB, the students in the sample improved the learning of addition. These findings show the relevance of strategies such as gamification in the students' mastery of the content (Gil and Prieto, 2020; Trejo, 2020).

It should be added that, in solving vertical and horizontal sums, the most complicated skill to achieve, students achieved representative changes. Through the gamified activities, students acquired combined skills that allowed them to solve addition exercises. These constitute a notion that is recurrently used in everyday life. By virtue of the results, students improved the learning of addition and their skills in Mathematics, strengthening their cognitive abilities, which is supported in studies focused on this area such as those of Holguín et al. (2019), González et al. (2021), Sánchez Pacheco (2021), Ordóñez (2022) and Delgado et al. (2023).

CONCLUSION

The COVID-19 pandemic marked a turning point in education, accelerating the adoption of ICTs materialized both in the use of virtual environments and in the use of digital resources. However, there were difficulties that led to unevenness in student performance, highlighting important areas such as Mathematics. In the return to the classroom, the need to level essential knowledge such as addition, numerical sequence, representation of quantities, among other skills, became evident. Thus, the implementation of gamification was proposed as a strategy to transform classes into interactive and attractive experiences, thus improving the learning process of addition.

This effort provided encouraging results at the EducaMundo Bilingual Educational Unit, as students with difficulties in addition mastered addition-related learning. The results show an increase in the retention of the mathematical concepts considered, as well as an increase in the students' confidence and interest. This strengthening of competencies demonstrates the significant improvement in academic performance, so that the stated objective was satisfactorily achieved. As a complement, this progress shows that, when the proposed strategy is correctly applied, changes in learning can be achieved.

Focusing on the benefits of gamification, it is relevant to mention that it is not only a temporary solution to the problems detected, but a valuable opportunity to renew education. The research allowed recognizing gamification as an innovative procedure related to the game, which awakens interest in learning, reaffirming acquired skills, avoiding boredom and frustration. At this point, it is essential to highlight the experience resulting from the design of the proposal, since it was a satisfactory process that allowed the effective application of the knowledge acquired in the Program of Master in Education with mention in Pedagogy in digital environments, developed by the Bolivarian University of Ecuador.

Despite the above advantages, the research revealed that teachers face obstacles to the implementation of this type of strategies, due to lack of knowledge and training. This underscores the need to provide them with additional support, training and resources so that they can integrate these tools into their teaching methods effectively. With proper follow-up, gamification and the use of ICT can enrich the educational process, offering a promising path for the future of education.

In summary, the implementation of gamified activities proposed to improve the learning of addition has proven to be effective and motivating. The introduction of playful and competitive elements has managed not only to capture the attention of students, but also to encourage more active and participatory learning. Gamification has made it possible to turn the educational process into a more dynamic, stimulating experience, adapted to the needs of the students. However, it is crucial to recommend evaluation and readjustment processes to ensure its long-term effectiveness and to adapt it to the specific needs of each group of students; and even to adopt it in other subjects. In short, gamification emerges as a valuable pedagogical tool to enhance the learning of mathematics, particularly addition, by providing an innovative, effective and attractive way of learning mathematics.

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