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The influence of playfulness on the teaching of chemistry to young people: An adaptation of the game "The Wall"

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ABSTRACT
The game can be considered an educational and teaching tool. It is a very favorable resource to alleviate the problems faced by teachers and students in the discipline of chemistry. Therefore, this work is an adaptation of a television game, developed in the 1st, 2nd and 3rd years of High School, aiming to analyze the development of students during gamification. In a first moment, a theoretical class with experimental practice was adopted, and in a second moment, the application of the game. Questionnaires were applied to the students before and after the execution of the game, aiming to analyze the learning of the discipline and the content proposed by the teacher. Following this context, distinguish as propositional the use of contextualization and interdisciplinarity as a teaching methodology, placing the game as a resource that contemplates these points, but in an instigating way. From the results obtained, we can conclude that the use of the game contributed to the students' learning about general chemistry and through a differentiated and contextualized teaching.

Keywords: Gamification, Chemistry Teaching, The Wall.

1 INTRODUCTION

To seek improvements for classes and work on games in the classroom, the study and construction of a playful game has a significant relevance for students and teachers who seek to understand the contents with a touch of fun (KIYA, 2014). The intention of this work goes beyond fun and play, it seeks to contribute to knowledge, the awakening of skills and socialization. There is an increasing search for knowledge among students and teachers, during changes in methodologies of the National Common Curricular Base (BNCC).

In Brazil, the teaching of science disciplines is still developed in an abstract way and this type of teaching does not promote scientific or critical learning. Before starting science teaching, it is necessary to invest in the training of teachers, as well as to have equipment in schools, curricular reforms, incentive awards, or exchange programs between schools and research centers. (LOPES, 2019).

The use of games has been shown to be a relevant way to stimulate the participation of students in Chemistry classes. Didactic games are one of these resources. According to Soares (2016, p.7) since

the year 2000 there has been a significant increase in the use of games and playful activities applied to the teaching of Chemistry. They can instigate the student's interest and demystify the conception of Chemistry, usually as an area responsible for the different damages caused to the environment and human beings (AFONSO et al, 2019 apud SOARES, 2016).

It is essential to apply various options of methodologies in order to streamline classes and stimulate interaction between educators and students, allowing their broad participation, especially listening to their opinions, in order to improve the teaching and learning process.

A didactic game can encourage a broad knowledge of the representations that are in the curricular component, especially when it aims to develop in the student the ability to recognize chemical definitions, such as: nomenclatures of chemical elements, periodic table, atom, homogeneous and heterogeneous mixtures, formulas, among other contents. This is fundamental for your understanding of the importance and impact of Chemistry in your life (SANTOS et al, 2021).

2 GENERAL OBJECTIVE

The purpose of this work was to apply gamification in the classroom in order to assist in the teaching and learning of general chemistry content for students of the three stages of high school.

3 SPECIFIC OBJECTIVES

- Observe how gamification aids student learning.
- Describe the relevance of playfulness as a teaching-learning resource for the classroom;
- Evaluate, through questionnaires, the students' understanding of the concepts covered before the application of the game.
- Analyze, after the use of the didactic resource, through questionnaires, how the students understood the theme and the contents addressed.

4 THEORETICAL FRAMEWORK

4.1 THE PLAYFUL: HISTORICAL ASPECTS

According to Sant'Anna and Nascimento (2011), in ancient history there are reports that the act of playing was developed by the whole family, even when parents taught the crafts to their children. In each era and society, the conception of education has always had a different understanding, therefore, the use of play followed this conception.

Primitive peoples gave great importance to physical education, giving total freedom to children to enjoy the exercise of natural games, thus enabling them to have a positive influence (COSTA; RÊGO; ROCHA, 2019).

The game is one of the tools that makes students have a deeper development in relation to the contents, the games will help them in the teaching and learning process. The use of this method allows the development of students' creativity and imagination, and leads students to seek more prior knowledge of the contents used in classes (KIYA, 2014).

With this understanding, it is possible to observe that although games are not a guaranteed way for students to have pleasure in their socialization, it is a way in which they know the rules, where they will build a social experience and will have the possibility of developing and inserting themselves in the world of adults (MARQUES, 2017).

Every cultural and educational heritage must be used for the universal learning of students, given that we deal with various ethnicities, races and peoples and, therefore, we must rescue and develop what is most important of each one for the teaching of students today. The use of play in education also has, in addition to the objective of developing learning in a more attractive way for the student, the objective of the historical-cultural rescue of these activities. It is a great time to recognize your family history and your regional culture (SANT'ANNA, 2011).

4.2 THE RELATIONSHIP OF GAMES IN THE SCHOOL ENVIRONMENT.

The incidence of problems involving school, learning and teaching leads us to think about how to rescue the school as a space for pleasure, knowledge and production. The difficulties faced by students and teachers are possibly clues that school has lost the pleasure element and has become a boring obligation (CARDOSO, BATISTA, 2021).

The definition of a space of "fun and recreation" or, in its Greek version, of rest, rest, free time, hour of study, occupation of a man with idleness, free from servile work was replaced by demanding, results and mechanical and solitary processes (CUNHA, 2018).

Within the scope of the construction of learning, some games have the purpose of assisting the student in the learning and development of mathematical reasoning and linguistic knowledge. At other times, they help in affective, physical-motor and social development (LAMBLEM, JESUS, 2018).

However, the teacher needs to respect each one's process, but in practice this is unfortunately not the case. The teacher doesn't have much time and many students don't look for the teacher, they don't show a desire to learn, and when they have new activities they don't want to participate, turning the moment of learning and fun into stressful and discouraging practices for the teacher.

In this way, the student seeks to be interested in research, in the development of group work, in answers through play, he will be learning in a pleasurable way with these proposed activities and, consequently, by assimilating these new concepts he will have a significant learning (COTONHOTO; ROSSET; MISSAWA, 2019).

The didactic game can help the teaching and learning process in chemistry contents, serving as a guide for teachers to visualize that there are several possibilities to work on a content, not only in an expository way, but combining and relating with mechanisms and resources that enhance the learning of the content and the construction of knowledge (OLIVEIRA et al, 2019).

4.3 THE IMPORTANCE OF THE TEACHER FOR PLAYFUL EDUCATION

The teacher has an important role within education, especially in this format of the use of playfulness, which uses games as a way to fix knowledge and develop motivation in the classroom. For these professionals to direct the contribution of this learning, they need to be well-prepared for the activity, always seeking knowledge and easy-to-understand methods (FREITAS, BECKER, 2020).

The educator, through his knowledge and sensibility, must dose theory and practice gradually, combining the appropriate stimuli for the type of student to whom he intends to teach, it is not only teaching to read, to solve a problem, to give shape to a thought. It is, mainly, to meet the needs of the development of the students in order to provide for the full realization of their personality. To this end, it is necessary for the school to satisfy the interests through playful games, learning and teaching (MENDONÇA, 2018).

It is noteworthy that addressing the theme of playfulness can contribute to the development of a more productive and comprehensive teaching-learning process. The teacher, responsible for the systematization of this process, can provide students with a dynamic and pleasurable way of learning, because education through playfulness proposes learning through play, inspiring a conception of education beyond instruction, that is, for the learner's autonomy (ALVES; FAN; SOARES, 2015).

The teacher needs to make use of new methodologies, as well as research alternative strategies so that teaching happens in a more comprehensive, contextualized way, understanding that through play, it is possible to establish a bridge between the real and the imaginary (BANDEIRA, 2015).

That is why it is important to have a well-planned pedagogical strategy, in which the educator knows how to stimulate his students through dynamic and pleasurable activities. Therefore, the educator needs training that values games in the school environment and believes in the strength that games have for the teaching and learning process (SILVA, 2019).

Through playful activities, we form concepts, select ideas, establish logical relationships and integrate perceptions that contribute emphatically to the socialization of the subjects. Pedagogical practice through playfulness can provide the development of activities that stimulate logical reasoning, creativity, and pedagogical growth in a more significant way (ALVES, et al, 2019).

4.4 GAMIFICATION IN CHEMISTRY TEACHING

By using a gamification resource with students in the classroom, we can expect greater interactivity between them in the face of what will be presented to them (PAULA, 2016).

The Atomic Deck was developed in the classroom from the perspective of a didactic game within the concept of a formalized educational game, as pointed out by the authors Gama and Alves (2021). The game was developed to enhance a concept previously introduced through a paradidactic text, which was used as a basis for the playful activity.

It is very important that games are used in the classroom as elements to support the educational process, constituting useful elements in the improvement of previously learned content (CLEOPHAS; CAVALCANTI; SOARES, 2018).

The use of the game Dama Química was a very interesting pedagogical strategy to make the application of the content dynamic, facilitating the student's learning and considered as an excellent auxiliary/complementary alternative in the teaching of chemistry. The playful activity provided a more favorable and stimulating environment for the intellectual and creative development of the students, making the content more accessible and meaningful. Thus, it was characterized as a viable proposal to streamline the Science class, as it is low-cost and easy to make (SANTOS et al, 2021).

The games are an attempt to make chemical knowledge more pleasurable for this audience. We understand from the article that adult play is not fundamentally different from children's play or adolescent play. The characteristics of cooperation, competition, pleasure and fun are very similar. (MIRANDA; SOARES, 2020).

The main aspect that differentiates the types of games is the characteristic in relation to the importance and seriousness of an activity in the classroom, when we consider that adult play has a direct relationship with leisure, which in the initial moments leads students to a small resistance. For them, class is not leisure. This resistance is broken down as the game evolves. Students come to understand that there is conceptual discussion at the same time that they are free to move around the classroom. (CARNEIRO, 2015).

As all students are workers, the class has not ceased to be an environment of leisure and relaxation after work, which is a feature of the adult game. However, this aspect can be used in favor of teaching, especially in this type of education. Even though the activity was premised on the discussion of concepts at a more superficial level, students were able to differentiate what is scientific from what is everyday, understanding their proper applications in their proper places, whether in the classroom or in everyday life (LEITE, SOARES, 2019).

5 QUALITATIVE APPROACH

According to Oliveira (2011), qualitative research presupposes the direct and prolonged contact of the researcher with the environment and the situation that is being investigated, usually through intensive fieldwork. The data collected is predominantly descriptive. The material obtained in these researches is rich in descriptions of people, situations, events, photographs, drawings, documents, etc. All the data of reality is important. The concern with the process is much greater than with the product.

The researcher's interest in studying a given problem is to verify how it manifests itself in daily activities, procedures and interactions. The "meaning" that people give to things and to their lives is the focus of special attention by the researcher. In these studies, there is always an attempt to capture the "perspective of the participants", that is, they examine how the informants face the issues that are being focused on (SILVA et al, 2018).

In this case, the students are the objects of research and the classroom is the environment in which they will be observed in their daily activities. For the development of the research with a qualitative method, the case study was used, in which the researcher tries to understand the multiple data obtained, collected at different times and situations, and can also count on numerous informants (LÜDKE, ANDRÉ, 2013).

6 METHODOLOGY

6.1 SITE DEFINITION

The present work was developed during the first semester of 2022, based on the contents taught by the regent professor. The study was carried out at the Sister Teodora State High School, located in the municipality of Marabá, Pará. Classes and number of students participating in the research are described in chart 1 below. The activity was developed only in the evening (hours/class) and in the time of Chemistry classes, from 7:30 pm to 8:20 pm (in the first class) and from 8:20 pm to 9:30 pm (in the second class) on another day (in the first class) it was from 8:20 pm (in the second class) and from 9:30 pm to 10:30 pm. The game was the same for all classes.

Table 1. Number of classes that were worked in high school

Number of Classes	Series	Students
1	1st year	30
1	2nd year	29
2	3rd year	20
		79

Source: Author (2023)

The students participated in the activity in groups and the chemistry contents contemplated in the game were: atomic models, periodic table, colligative properties and oxygenated functions

according to the contents taught in the bimester, according to a previous conversation with the teacher of the school subject.

6.2 DATA COLLECTION INSTRUMENTS

Also called *a survey* , the questionnaire is one of the most widely used procedures to obtain information. It is a reasonably expensive technique, presents the same questions to everyone, ensures anonymity, and may contain questions to meet specific purposes of a research (CHAER; DAVID; RIBEIRO, 2011).

Carefully applied, this technique has high reliability. They can be developed to measure attitudes, opinions, behavior, circumstances of the citizen's life, and other issues. As for the application, the questionnaires make use of simple materials such as pencil, paper, forms, etc. They can be applied individually or in groups, by phone, or even by mail. They may include open-ended, closed-ended, multiple-choice, numerical answers, or yes-or-no questions (BARBOSA, 2008).

Observation is also one of the steps in data collection, when other forms of communication are impossible. In addition to the observation that was used, a questionnaire was applied by the author responsible for the theoretical and experimental classes to the classes selected for the application of the game, in which they could report if the class with experiments contributed to their teaching and learning. Another questionnaire was also applied to the students of the classes that had the experience of playing the game "The Wall", to obtain the results about the effectiveness of the game as a didactic tool.

6.3 KIT BUILDING MATERIAL

The game "The Wall" is a readaptation of a television game, applied in a playful and also low-cost way. To make the game, the following low-cost and easily accessible materials were used:

1. Half sheet of plywood.
2. Clear plastic.
3. Sheet of eva gum paper.
4. Cola de silicone.
5. Adhesive tape.
6. Ping pong ball.

6.4 GAME APPLICATION ROADMAP

1- First, the first questionnaire was applied, about the students' self-knowledge.

2- Classes were given on the contents. During the classes, experimentation and drawings were used for better exposition, in addition to all these resources, a mind map was used;

3- After the explanation of the content, another questionnaire was applied about the discipline and, soon after, the game was applied;
4- For the applicability of the game, the classes were divided into groups with an equal number, without exception, as it was important that everyone participated in the dynamics;
5- Each team was assigned a leader. This leader would be responsible for organizing the group and being the one who would both throw the ping-pong ball at the wall, and answer the questions, with the help of his team, just in case;
6- The questions were selected from the subjects studied by each class. In total, there were 4 questions for each team to answer.

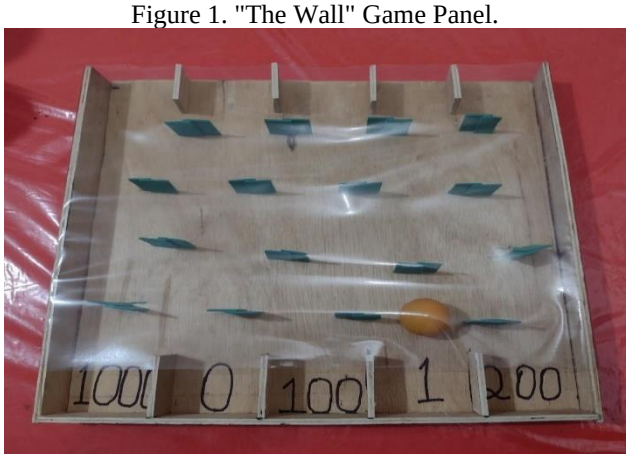
At the end of all the questions answered, each team had two rounds that were called 'losing play', where that team could lose points, which can be decisive for the result. At the end, the points are added up and the team that scores the most points wins the game. At the end of the game, the students received a questionnaire to evaluate it.

7 RESULTS AND DISCUSSION

7.1 CONSTRUCTION OF THE GAME "THE WALL".

The game "The Wall" is a readaptation of a television game in a playful and low-cost way. The game was built in a handcrafted manner. Due to the time required to carry out the entire research, it was decided not to carry out this stage in the classroom with the students. In the assembly of the game, from the EVA gum sheet, "obstacles" were elaborated imitating small steps, which aimed to deflect the ping-pong ball, which was positioned by the players, the markings in numerals as can be seen in the Figure below, aimed to instigate the competitive spirit.

Figure 1. "The Wall" Game Panel.



Source: Author (2022)

The way in which the didactic game was applied had a very satisfactory and special result, since it was taken from a television program, which was only intended to be a recreational activity.

The low cost of the game caught the attention of the students, as they showed willingness and interest in setting up their own panel to play more than once, having a very satisfactory performance with the subjects covered.

The contents of the second semester were worked on, first, in a theoretical way and then with the help of experiments. According to Silva (2016), experimentation in the Teaching of Chemistry becomes indispensable for the teaching and learning process of scientific content, in the sense that it favors the construction of relationships between theory and practice, as well as the relationships between students' conceptions and new ideas to be worked on.

7.2 APPLICATION OF THE GAME "THE WALL": THE WALL.

The game was applied in four classes of 1st, 2nd and 3rd years of high school. On the day of the application, the rules of the game were made available and explained in a way for better understanding for the students. With the explanation passed on, a test match was carried out so that they understood the functionality of the game in a more objective way.

In fact, as Soares (2013) does, the rules really create order and determine the game, because it was seen with the application of the game that a good understanding of the rules guarantees success in the application of the game. Regarding the rules, no problems were presented during the application of the game. The choice of a well-known style of play also helped a lot for the understanding of the rules, as the basic rules the students already knew and mastered very well.

The space used for the application of the dynamics was the classroom, because, as it is a question and answer game, a large space is not necessarily needed. Before we started the game, there was a conversation with them, so that they didn't make too much noise, because in addition to disturbing themselves when thinking about the answers, they could harm the other classes.

In a very dynamic way, the game really caused a lot of joy for the students or most of them, because there were many games and interaction between the groups of players, at times some students said that they would not play, but with a tone of fun because they were losing. There was no resignation or resistance from them at any time.

After the end of the activity, the students asked to play again at another time and even asked that the game could be used in other subjects, as they observed that it provided a better understanding of the content, making it possible to study and read.

With the application of the game it was possible to observe that a playful activity in the classroom can improve the interaction of students, as it was possible to observe that at all times they sought to interact and talk to make decisions and reach consensus with only one answer, it was also possible to observe that they did not leave any student out of the game. In two of the classes where the

game was applied there were students with disabilities, the students always sought the inclusion of all, asking and instigating all students to participate.

It was possible to observe that playful games bring students closer together, regardless of their physical or mental conditions. It was observed that in a public school without many structures they always try to help each other in a better way, it was observed that some classes even though the team was only a winner they sought to share the prize with everyone in the class, in fact we had classes that the teams that lost were upset because they did not like to lose the game, But in the end the application of it was observed many positive points. Such as their interaction, their group work, their willingness to seek answers to questions.

In various spaces, games and games enable students to construct their own knowledge, as they offer conditions to experience problem-situations, based on the development of planned and free games that allow the student to experience experiences with logic and reasoning and allowing physical and mental activities that favor sociability and stimulate affective reactions. cognitive, social, moral, cultural and linguistic (COTONHOTO; ROSSET; MISSAWA, 2019).

7.3 RESULTS OF DATA COLLECTION

7.3.1 From observation in a traditional classroom

In this way, the themes, colligative properties, atomistics and oxygenated functions of the second bimester of chemistry teaching and their daily practices were addressed. At the end of the cycle, the didactic activity was applied with the classes. Classes took place on Mondays and Tuesdays. The beginning of the two-month period was on May 16, 2022 and the end on June 14, 2022.

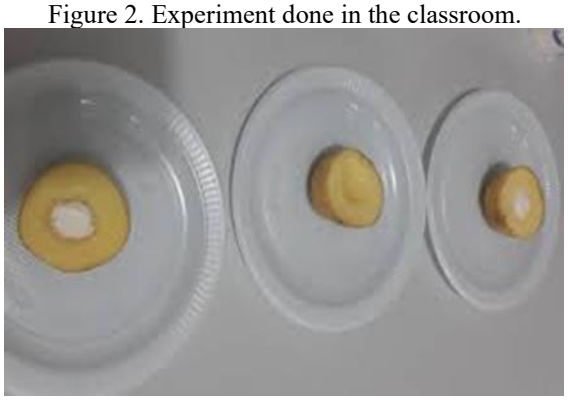
Table 2. Classes start and end time.

Classes	Start of classes	End of classes
Year 1	8:30 p.m.	9:30 p.m.
2nd year	7:30 p.m.	8:30 p.m.
3rd year A	8:30 p.m.	9:30 p.m.
3rd year B	9:30 p.m.	10:30 p.m.

Source: author (2022)

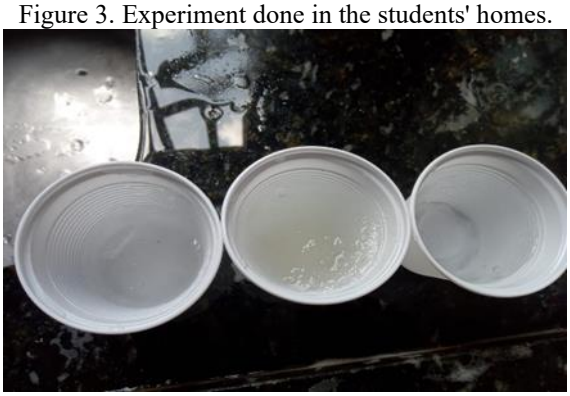
With different schedules, the regency of the second two months began. The 1-year high school class had "atomistics" as its content. The 2nd grade class content was "colligative properties". For the 3rd year high school class, it was "oxygenated functions". The conducting took place with the exposition of all the contents in the painting. Throughout the classes, activities were applied with exercises related to the content, experiments were carried out in the classroom and at home. The experiment in Figure 2 shown below was carried out with students of the 2nd year of high school where they observed one of the colligative properties, osmoscopy. Under the regency of the teacher in training Marcos Francisco Ozorio dos Santos.

Figure 2. Experiment done in the classroom.



Source: Author (2022) Source: Author (2022)

Figure 3. Experiment done in the students' homes.



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7.3.2 From the application of the game

The game was applied in the classes with the aim of expanding their knowledge. It was possible to observe that the didactic game had a great acceptance by the students involved and, as a result, a complementation in their knowledge.

The use of didactic games is an important tool in the teaching-learning process, in view of its collaborative and motivating aspect, which drives the student to have an active role, fostering critical thinking and the ability to (re)construct knowledge (BARROS; MIRANDA; COSTA, 2019).

After the contents taught in the classes, two questionnaires were applied, one to evaluate the knowledge and commitment of the students, and the other of the chemistry discipline, containing questions regarding their knowledge and the discipline, in order to predict how the students' knowledge was before the application of the didactic activity. With the result of the questionnaires, the game was applied and at the end of the stages of application of the game, a questionnaire was given to the students to evaluate the didactic game containing questions related to the activity developed. There were a total of 60 students in the classroom, adding up to the 4 classes that participated in the activity.

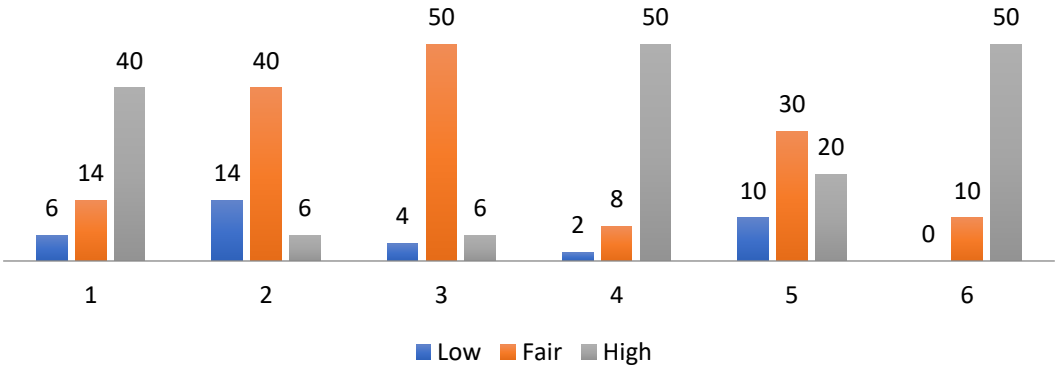
The purpose of the analysis is to dialogue with the data obtained through the questionnaires and bibliographic research, that is, the agreement or discrepancy of the data obtained with the result.

Table 3. Questionnaire to assess students' self-knowledge.

Questions
1 - How is your attendance in classes of the discipline?
2 - How often do you look for the teacher to ask questions?
3 - Your degree of understanding in the discipline?
4 - During the discipline was your effort?
5 - After taking the course, did your interest in the subject increase how much?
6 - How important is discipline to your daily life?

Source: Author, (2022)

Graph 1. Assessment of students' self-knowledge



Source: Author, (2022)

With the answers obtained, it was possible to observe that the students show an interest in the discipline, but end up having doubts and do not have the initiative to seek help from the teacher, making the discipline boring and difficult for themselves.

According to Lima and Gomes (2014), it should be understood that seeking new methodologies for the teaching-learning process should be present and part of the daily life of teachers in search of a better education. Often in the classroom, the teacher, fatigued and discouraged due to lack of resources, exposes the subject in a very theoretical way without relating it to the daily life of the students, and in addition, in a very simplistic way, they ask if they understood the content, the students at most make a gesture stating that they did.

Chart 4: Questionnaire of the Theoretical and Experimental discipline.

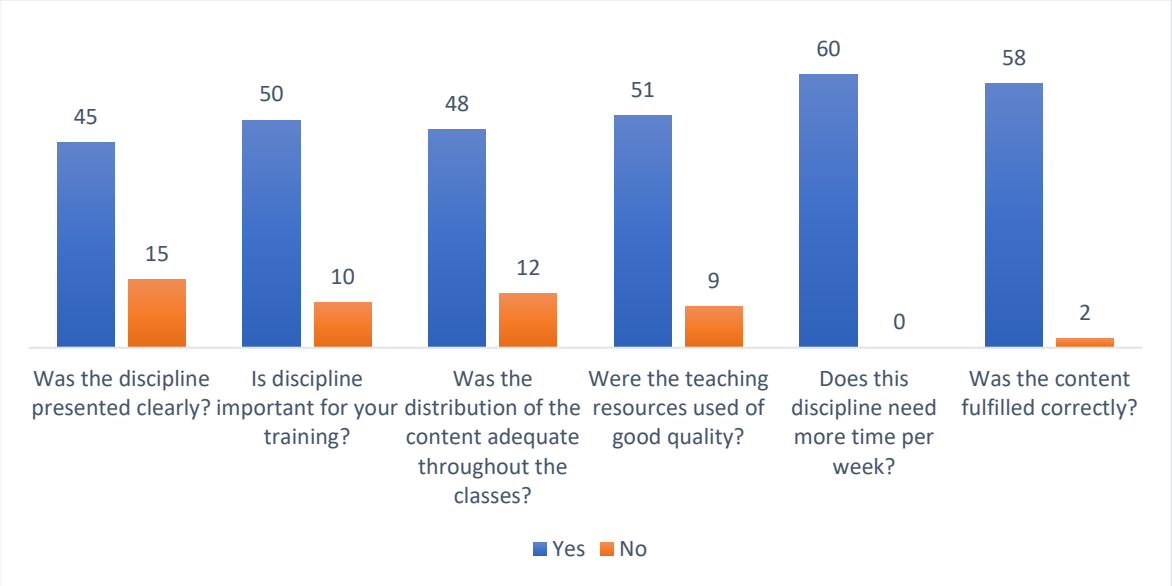
Questions
1 - Was the discipline clearly presented?
2 - Is discipline important for your training?
3 - Was the distribution of the content adequate throughout the classes?
4 - Were the didactic resources used of good quality?
5 - Does this discipline need more time in the week?
6 - Was the content fulfilled correctly?

. Source: Author (2022)

With the analysis obtained through the questionnaires, it was possible to observe that more than 50% of the students understood the subject, also answered the importance of the discipline for their training and if the content was appropriate for the activity developed. 100% of the students answered

that the discipline should have more class time, because the contents thus passed would be better understood and would have more moments with experimental classes.

Graph 2. Questionnaire of the discipline Theoretical and experimental.



Source: Author (2022)

Chemistry present in everyday life is of paramount importance to bridge the gap between the student's previous knowledge and scientific knowledge, remembering that the latter must be built collectively, through discussions, observations, among other means, also enabling greater interaction among students, motivating them to seek reasons and explanations for the phenomena that happen around them (SILVA, 2016).

The practical activities make the classes more enjoyable and fascinating, making the students feel motivated to participate in the activity, learn in a group, not be afraid to make mistakes and seek self-learning. For students, it is important to include games that are popularly known, that they can make inferences from the environment outside the classroom and that the application of what was studied in class is noticeable in extra activities (ALENCAR et al, 2019).

The difficulties of inserting experimentation in the teaching of chemistry may be associated with something more complex, that is, the workload of the discipline and the lack of laboratories in public schools, even the teacher trying to include experiments with more accessible materials, end up investing their own resources in the acquisition of them, because many institutions do not have the materials and do not even provide them.

Table 5. Game quiz.

Questions
1. About the game we used today, did you have a good experience?
2. Was the game easy to play?
3. What did you think of the game's visuals, was it looking good?
4. How much did the activity help in understanding the content?
5. Did you learn anything new from this activity?
6. Does the use of different activities in Chemistry classes increase your interest in studying more of this subject?
7. Would you like to use more activities like this during your lessons?
8. Would you like this activity to be carried out in another subject?

Source: Author (2022)

It was observed that 92% of the students had a good experience with the game, also showing that many of them did not come into contact with another game or playful activity at school. It was also possible to observe that 8% of the students did not find it a good experience, because for them the dynamics could disturb other classes.

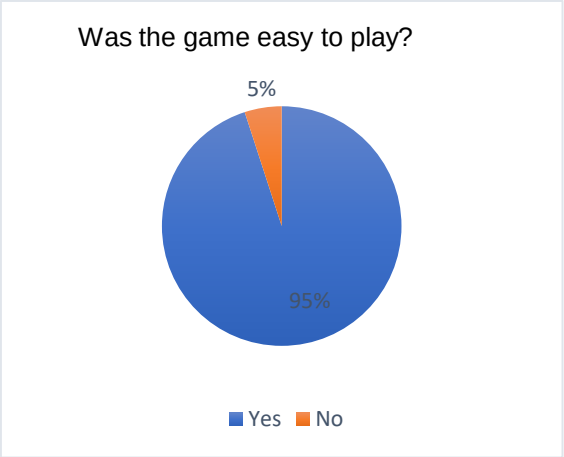
Graph 3. Students' response to question 1.

Source: Author (2022)

From this point of view, it is possible to highlight that education and fun are completely linked, as education can be easily acquired through pleasurable activities. Playing and playing are pleasurable exercises of reality and through them it is possible to acquire and establish basic rules of coexistence, improving educators, students and society. The teacher must enrich any playful activity developed, making new characters and situations, where the interest increases in the child and adolescents thus being able to create the possibility of an interesting learning (SHMEREGA, 2014).

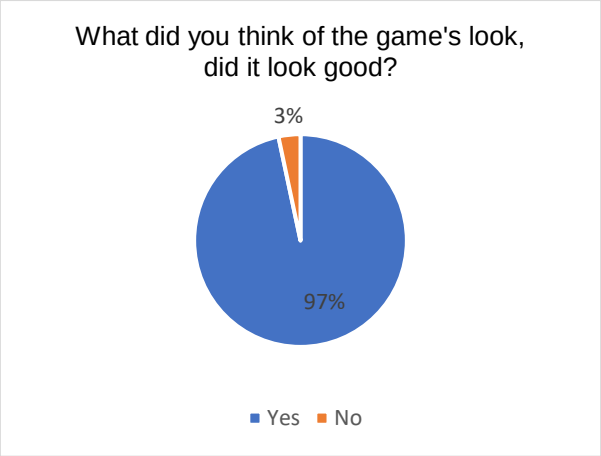
Analyzing graphs 4 and 5, it was possible to observe the importance of an easy-to-understand game and a pleasant look, as more than 90% liked the game's visuals and found the game easy to understand.

Graph 4. Students' response to question 2



Source: Author (2022) Source: Author (2022)

Graph 5. Students' response to question 3

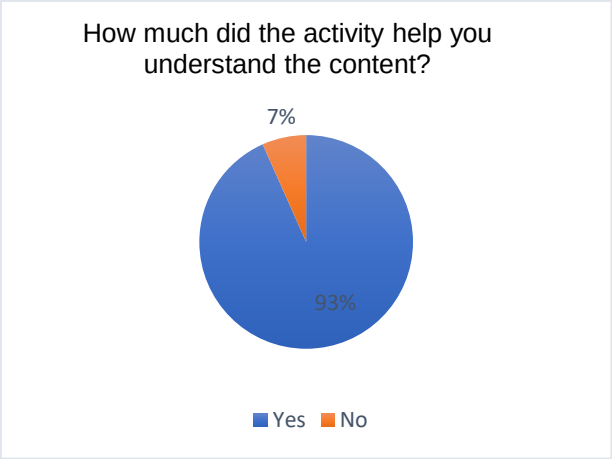


Source: Author (2022) Source: Author (2022)

When well applied and understood, playful education can contribute to the improvement of teaching, both in the qualification or critical training of the learner, and to redefine values and improve the relationship of people in society (ZANATA, 2016).

The use of playful activity shows that it is of great relevance in teaching, since it helps the student to better understand the content. It is possible to observe that 93% of the students said that the activity used helped them to better understand the content applied in the classroom and 97% highlighted having learned something new.

Graph 6. Students' response to question 4



Source: Author (2022) Source: Author (2022)

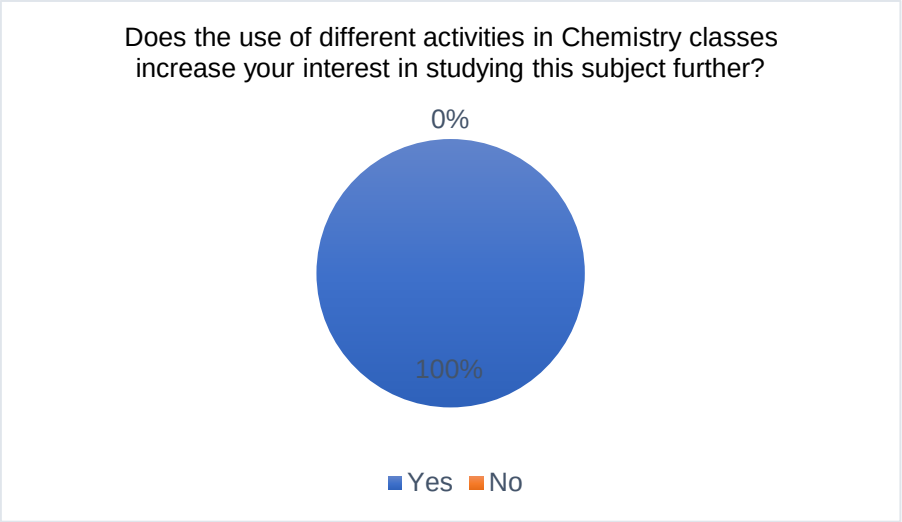
Graph 7. Students' Response to Question 5

Source: Author (2022) Source: Author (2022)

In this aspect, the development of educational games can enable a greater approximation between teacher and students, necessary for the conceptual discussion of a series of chemical/scientific concepts in the classroom, which can have therefore an increase in interest in this type of content. (Miranda, 2020).

The observations denote that teaching shows us that there is a great need for diversified introductions of modalities of playful activities in classrooms, so that there is a motivation and socialization among students, where it will also have a great contribution to their learning. When asked about the use of playful activities in chemistry classes, the result obtained shows that 100% of the students say that their interest in chemistry classes increases with the use of playful activities.

Graph 8. Students' response to question 6.



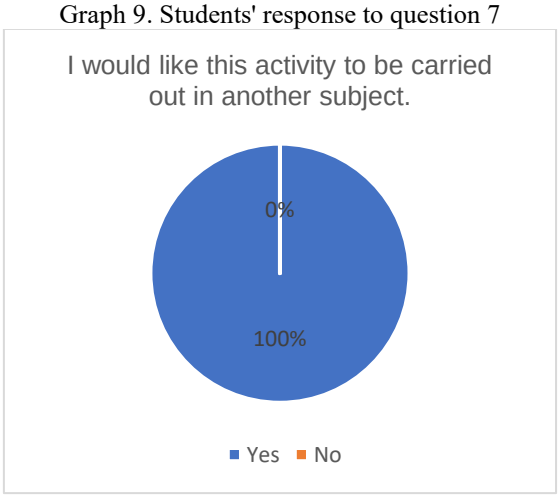
Source: Author (2022)

Based on the results obtained, it is evident that the use of didactic games, after theoretical classes, improves students' motivation and involvement in the educational process, since it acts as a moment of relaxation, reinforcement of content and synthesis of knowledge (ALENCAR et al, 2019).

Gamification allows the student to form concepts, relationships and logical constructions, expressing themselves with the body and mind. By playing, he develops curiosity, initiative, self-confidence, in order to experience and use language, concentration, thought and attention. The school environment can favor the spontaneous character, as the act of playing and learning at school goes hand in hand with the elaboration of new concepts and the integral development of the student (THUROW et al, 2021).

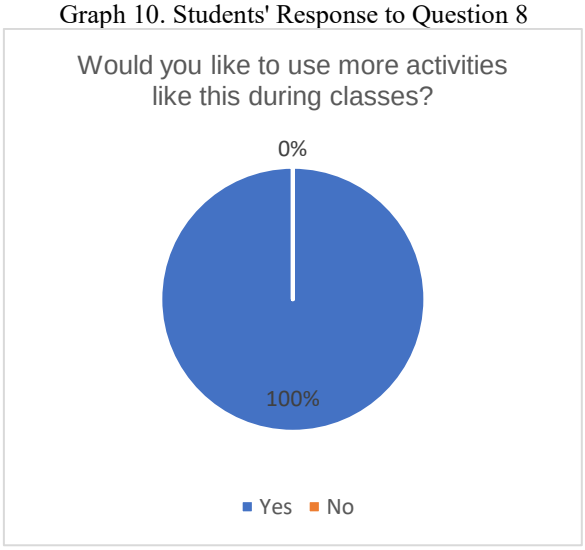
Analyzing the results, it was observed that 100% of the students would like to have playful activities carried out more often in the classroom, so it is also possible to observe that they would like to have them in other subjects, where it shows the importance of the game in the school routine.

Graph 9. Students' response to question 7



Source: Author (2022) Source: Author (2022)

Graph 10. Students' Response to Question 8



Source: Author (2022) Source: Author (2022)

Play is about learning. To play is to learn; In gamification, lies the basis of what will later allow the student to learn more elaborately. Thus, the ludic becomes an educational proposal to cope with the difficulties in the teaching-learning process (CARLOS, 2010).

The game can be applied in education, not as a single means of learning, but as a strategy to facilitate learning, develop in the student the desire to learn, making learning pleasurable, especially in topics that are difficult to understand (BREDA, PICANÇO, 2011).

8 CONCLUSION

The objective of this work was to observe and reflect on how the use of gamification can help in the process of teaching and learning general chemistry in high school chemistry contents. The students' opinion regarding the activity was obtained and analyzed. Thus, it was observed that gamification can present important contributions to the teaching and learning process, from the realization of the activity, significant results were obtained, such as better student participation and a better understanding of the content.

Gamification, in addition to reinforcing the content, helps to strengthen the relationship between teacher and student, from the application of the didactic game, it was possible to observe that there was a contribution to achieving quality education. Through the playful moment, it was possible to associate learning with the satisfaction of playing, taking with it the desire to learn. Thus, it was possible to show the students who participated in the activity that it is possible to learn in a more dynamic way.

The readaptation of the television game was built to address the general chemistry content, however, the same game can be adapted to several other subjects, changing only the questions and the

content covered in the chosen subject. This game is easy to understand, with simple construction and rules, the choice for this game is due to the affinity with the way it is developed and played.

Finally, bringing the content in a fun way can be effective in some moments of daily life at school, but we know the difficulty that the teacher has in preparing certain playful activities, in addition to expenses, the uncertainty that it will be really beneficial for the students and if they will be interested in participating, because we know how frustrating it is to prepare something different and not have feedback from the students.

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