Quiz in learning chemistry subject in high school

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ABSTRACT

The objective of this research is to provide apparatus on ludic methodologies in the classroom, through electronic games, especially the Chemistry Quiz in the classroom, thus emphasizing the need for new means of learning, in this perspective, to assist in the basic learning of individuals. To this end, among the main authors selected were: Costa (2018); Vargas (2018); Bastos (1999); Silva et al (2019); Curricular Parameters of National Education (1997); Souza and Cicuto (2021); De Amorim, Almeida Junior & Simões Neto (2013) and others who are more up-to-date scholars on the subject. The objectives were: To identify and evaluate the importance of the application of digital games, in order to contribute to the teaching of chemistry, through the teaching methodology that involves a Digital Game, with the use of the Quiz platform in the area of chemistry and to discuss the need for an education in Chemistry in a pleasurable way, in the classroom, and its necessity for the effective learning of students belonging to High School. The methodology was based on quantitative and descriptive research, focusing on the method of investigation with the research, as well as analyzing the data with the constant comparative method. For this, a structured questionnaire was applied in this research, consisting of 10 questions – two closed and eight open questions – with the objective of outlining a simple profile of professionals who work in the area of chemistry teaching (16 teachers) and with students (60 students) who have the discipline in their curricular component, more specifically about the use of chemistryof digital games. The results point out how the technique of activities such as the Quiz can contribute to the teaching of chemistry, through the teaching methodology that involves a Digital Game, in their teacher training and with the purpose of understanding how these professionals work the professional practical part of the discipline, and if there is a knowledge and/or interest in tools.

Keywords: Quiz Game, Chemistry Teaching, Teacher Training.

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INTRODUCTION

Basic education in Brazil in the twenty-first century is permeated by problems such as: school dropout, socioeconomic challenges, illiteracy, violence against teachers and school staff, in addition to the lack of government investments in adequate structures and the continuing education of teachers, in order to improve their teaching and learning methodology (SOUZA, CICUTO, 2021).

That is, it is necessary to insert new strategies to improve the learning of schoolchildren, especially when thinking about High School, since children need to understand learning not as an obligation, but as a pleasurable sensation when reading books, for example, or even when playing with electronic games and learning new words, about nature and the chemistry related to it. and thus, pedagogical knowledge related to chemistry (COSTA, 2018; VARGAS, 2018).

Within this context, the so-called Active Methodology emerges, called playfulness, which has a critical and reflective understanding of education, so teaching/learning are built through the student, with the resolution of problems and challenges (FARIAS et al. 2015, (SILVA, SALES, CASTRO, 2019). Therefore, through this method, people are mobilized to always think critically and reflectively, to look for new alternatives to add knowledge, through problems and their resolution.

In this way, such activities as memory games and quizzes, for example, are intended to prepare people for their intellectual and also personal life from basic education, providing them with a unique moment that will be kept in their unconscious, in fact, it should be reflected in their adult life. From this perspective, with these types of exercises, they improve the education about those who know about Chemistry, so that students can feel proactive for knowledge, in this way, they can solve logical questions of the periodic table and nature, through games, the search for new words, acronyms and the search for knowledge as a whole (SOBRAL et al. 2012).

The objective of this research is to provide apparatus on playful methodologies in the classroom, through electronic games, especially the Chemistry Quiz in the classroom, thus emphasizing the need for New Learning Methodologies, thus, it can help in the basic learning of individuals. To this end, among the main authors selected were: Costa (2018); Vargas (2018); Bastos (1999); Silva et al (2019); Curricular Parameters of National Education (1997); Souza and Cicuto (2021); De Amorim, Almeida Junior & Simões Neto (2013) and others who are more up-to-date scholars on the subject.

The specific objectives were: a) To identify and evaluate the importance of the application of digital games, in order to contribute to the teaching of chemistry, through the teaching methodology that involves a Digital Game, with the use of the Mathematical Quiz platform; b) Discuss the need for a pleasurable education in Chemistry, in the classroom, and its necessity for effective learning of students belonging to High School.

From this perspective, the problem of this investigation raises the following question: "how can the new methodologies of playful learning, in particular, the Quiz about the contents in Chemistry be inserted in the high school classroom, in order to assist in the learning of individuals?". Thus, through this research, this can be better understood, based on the evidence of the data collected and analyzed in this investigation.

This question was selected for investigation, since it was perceived as playful tools, such as the Quiz about Chemistry acquaintances, as essential in the effective learning of High School. This is because it is understood how such methodologies are able to help teachers in a categorical way, given that they improve both to carry out socialization among students and to bring bonds between them closer.

In view of this, it was noticeable in the data and at the time of the construction of the theoretical framework, how the scenario of Brazil presents an education that needs better financial support from the municipality, the state and the federal unit, especially from the budgetary point of view. However, in addition, it is also essential that "schools need to be sensitive regarding the relationship between family, school and the community" and studies in Chemistry, so that these students can learn in a pleasant way, as well as feel welcomed by the school (SILVA, SALES, CASTRO, 2019).

In the meantime, this research is justified by the need to understand playfulness, especially when thinking about the moment of learning to study Chemistry at the time of high school. But for this subject to be discussed in an advantageous way, it is necessary that there is a professional improvement of teachers and exchange of knowledge, so that they understand how important it is to work on a digital active methodology in Chemistry studies, so that education in this discipline aims at the interaction between colleagues and the collective.

For this to occur, this research was based on a bibliographic review methodology, with the intention of analyzing about 10 scientific texts found in *the Scielo and Pudmed* database, which deal with this theme, in order to achieve the aforementioned objectives.

Therefore, it is emphasized that it is up to the teachers who work in the classroom to go through the process of continuing education, especially in this context of a global pandemic, and to insert in the classes activities such as: construction of texts in digital format, such as: interactive e-books, *games, quizzes, tweets*, instant messaging, *Gifs, blog*, with hypertexts that can allow *access to links*, videos, images and references of the material, so that they can always resize their knowledge (BRASIL, 2018; SILVA, SALES, CASTRO, 2019).

In this way, students can carry out content productions, such as databases and articles with their productions, their drawings, together with their colleagues. Another elementary alternative is the so-called *Google Docs*, in which students can construct texts and content related to Chemistry studies

collaboratively, in this way, while it is possible for teachers to interact at the same time as students, whether in editing, inserting comments and reinforcing *feedback* on activities and exercises such as the Quiz about Chemistry content (DE AMORIM et al. 2019).

Thus, the results of this research point to the need to provide an effective digital methodology, capable of providing opportunities for adolescent learning based on organized teaching, with well-structured lesson plans and didactic sequences and teachers trained in Chemistry studies.

This is fundamental, considering that education in Brazil has been the target of many discussions, mainly focused on the issues of learning difficulties and low level of proficiency that children demonstrate in this course of teaching this research. This reinforces the idea that teachers of Chemistry and other areas should take into account the combination of other teaching strategies for the construction of knowledge about Chemistry studies in knowledge spaces.

Such developments can help to reduce the school failure of these students' later years, especially by using playful tools and transversality in teaching, with regard to the teaching/learning of Chemistry. For better organization of this text, it has been subdivided as follows:1) Introduction; 2) Theoretical Framework; 3) Methodology; 4) Discussion and Results; 5) Final Thoughts.

THEORETICAL FRAMEWORK

NEW DIGITAL TECHNOLOGIES

In the context of modernity, it is known that the proximity of Information and Communication Technologies (ICT) and the educational world have become essential in this pandemic context. This is due to external pressures to the phenomenon of the consumer society and also its excessive modifications - ways of thinking and acting - as well as in commonly educational and didactic approaches, such as the continuing education of teachers (PARANÁ, 2019).

Thus, although technological integration is only understood as the existence of what is known as technology, in reality, the main problem should be to understand how this inclusion of technology occurs in the learning and teaching processes, as well as in the curriculum and learning experiences in knowledge spaces (APPLE, 2019).

It is believed that digital technologies are conceptualized as a set of technologies in which they allow, especially, the transformation of any language or data into numbers, that is, they modify processes in order to perform tasks, such as educational data. Its importance is given within the globalized society, given that it provides benefits, both to students and teachers, in terms of their commitment and learning (APPLE, 2019).

When we think about education, for example, as a sense of learning, what we perceive is how it has undergone transformations over the centuries, whether in terms of space, as well as new

learning methodologies, materials, objectives, and for this reason, the teacher and the school community need to follow such prerogatives (LAVADO, 2020).

When thinking about the pandemic context, this became more necessary and evidenced, since all educational institutions sought new ways so that learning did not decrease and in this context, digital resources took on an essential role (VYNCK, BERGEN, 2020).

This is because, by using technologies, distances can be reduced. Bearing in mind that with COVID-19, the new reality has expanded the process of implementing digital resources, both in teaching and in teaching work, the latter being quite challenging, and it is necessary to look for alternatives to reinvent oneself (VYNCK, BERGEN, 2020).

From this point of view, the continuing education of teachers is a process that needs to be constantly guided in the daily lives of these professionals, aiming at the improvement of pedagogical practice, thus expanding knowledge.

As a result of the changes in social paradigms in recent years, continuing education ends up being a need to re-signify teaching-learning, especially aimed at technological generations. For this, education must be born from the realities of the school's daily life, as well as valuing their knowledge, their experience and thus mixing both theory and practice and thus adding to the teacher knowledge that is significant: being in itself very valuable (VYNCK, BERGEN, 2020).

When it is reflected in the training of professionals in an effective way, it is also essential to glimpse three dimensions of teacher training, namely: 1) the scientific dimension; 2) the pedagogical dimension; 3) the personal dimension (DUARTE, 2017).

The first concerns the development and updating of the contents that need to be taught and the way in which human beings learn. The second refers to teaching methods, resources, and techniques, while the last reflects the personal dimension, in which it regulates the intention and intensity of teachers' attitudes, in order to promote multiple learning (DUARTE, 2017).

In this sense, in order to be able to meet these criteria, the so-called continuing education needs to follow a logical understanding, capable of effectively promoting a significant exchange of knowledge, in which theory and practice are combined (KOEHLER, MISHRA, 2009).

Thus, in the context of the pandemic, active learning can be incorporated at the same time, such as the e-learning modality, or even called *flipped classroom*, in which it can be understood as an inversion of the common (VYNCK, BERGEN, 2022).

That is, at first, the student internalizes the essential contents and concepts, either before the training, or later with the class, in addition, he can discuss the knowledge acquired and thus there is the alternative of solving doubts on the subject with the help and guidance of his facilitator. So, when you look at the issue of learning, you see how it can be more engaging, practical, and also meaningful.

From this perspective, educators and students can leave their passive role and receiver of information, which is currently more common in traditional education, and can take an active role as protagonists of their own exchange of knowledge and meaningful learning through new digital technologies (VYNCK, BERGEN, 2022).

And although this strategy has been evidenced in the pandemic, it is not so recent, given that it was initially proposed by theorists such as Lage, Platt and Treglia (2000), and was still called the "*Inverted Classroom*", at which time it was first presented by the curricular component called Microeconomics in 1996, more precisely at Miami University, in the United States.

However, the main reference would be the *Flipped Classroom* methodology through chemistry teachers, such as Aaron Sams and Jonathan Bergman, at *Woodland Park High School*, Colorado, in which they researched and disseminated the active methodology. In fact, this would be another possibility of applying the active methodology in education, in order to serve both basic education and higher education (MORAN, 2020).

In the meantime, what can be seen is that, despite the spread of COVID-19, and consequently, the social isolation of children and adolescents ended up generating consequences not only educational, but also in their interpersonal sphere.

As a result, these digital platforms provided the opportunity for classes not to stop and for knowledge to be transmitted, that is, the development of learning was maintained. Thus, teacher training, with regard to remote teaching, was evidenced, being a necessity not only at a time of global pandemic, but also at the end of it (PARANÁ, 2019).

With this, it is possible to stimulate the adaptation and optimal acceptance of young people to new ways of learning, making it possible to preserve intellectual progress, in addition to maintaining proximity between students and teachers.

In addition, it is still essential to remember the role of the family in this context, considering that they can contribute to the process of ensuring better results for their children, through direction, support and welcoming. Being then a necessary motivation for children not only in the pandemic, but throughout their lives, in addition, it may be able to provide educators with another alternative to contribute to the success of their students (GORDON et al. 2020).

In view of this, when thinking about educational innovation, provided by digital resources, it is necessary to understand that these are not based on the indiscriminate use of new technologies, but on the development of pedagogical practices, while their use is aimed at multiple and dynamic learning in the classroom.

In the meantime, what can be seen is that educational technology does not need to be observed as a phenomenon that occurs in isolation, but should be considered an instrument of the

puzzle, of how teachers can teach students to learn, through playfulness and with pleasure for what is being studied (WENGLINSKI, 2005).

According to the report Educators, Technology and Skills of the XXI Century, published by Walden University, the process of teacher improvement in this bias allows us to affirm that the new digital technologies end up positively affecting the profile of teachers, while demanding more and more from them in relation to their training to use them, as well as provoking an attitude that is both open and flexible, as well as the continuous changes that occur in society (APPLE, 2019).

Therefore, educators need to know the technology in order to understand its dimensions, analyze them critically, make an adequate selection as well as information in which they are transmitted, in effect providing greater curricular integration within the classroom.

With this in mind, several educational researchers, such as Burns (2006), understand the integration of technology in the classroom environment as advantageous, not only for teachers, but also for students. For him, this is due to the fact that technology has the power to motivate and help students, providing them with opportunities to learn in a more playful way, work on cognitive and imaginary skills and thus reinforce their learning (BURNS, 2006).

From this perspective, it is understood how educational innovation, when thinking about Information and Communication Technologies (ICT), permeates knowledge in practice of the possibilities and limits in which children's protagonism can be effective. In other words, when there is an interaction between ICTs and knowledge construction processes, teachers can: in the foreground, plan and provide opportunities for experiences and knowledge exchange environments supported by ICTs (GEORGE, MALLERY, 2022; **HAŞLAMAN et al. 2007**).

The second point would be to create adequate learning opportunities in order to apply new teaching strategies, which can be enriched by ICT, and thereby address the peculiar needs of each student; 3) develop and implement teaching plans that have strategies and methods necessary for the relevant technologies (**HAŞLAMAN et al. 2007**).

ADOPTION OF DIGITAL/PLAYFUL METHODOLOGIES IN CHEMISTRY CLASSES: USE OF THE QUIZ TOOL

As is well known, education in Brazil is permeated by social problems, investment and teacher appreciation. In this context, it is necessary for teachers to be able to innovate at the time of teaching and learning (APPLE, 2022).

Therefore, the activities carried out in the classroom should be based on active learning methodologies, which in turn deal with the autonomy of individuals, the games about the contents, which can be explored through gamification, can be an important way to increase the creativity of

students, while respecting their way of seeing the world around them and in society as a whole (LINHARES, IORLETE, REIS, 2021).

It is known that the National Common Curriculum Base (BNCC) is a federal documentation responsible for guiding the learning of students throughout Brazil. That is, they concern the quality of the competencies and skills acquired by students from kindergarten to high school. As a result, this document represents the promotion of equal rights and opportunities, both in private schools and in public schools, thinking about the idea of new active teaching methodologies as something innovative and that should be adopted from the perspective of the classroom (BRASIL, 2019).

Thinking about complying with this legal apparatus, Active Methodologies can be a very interesting alternative in this context, since they can provide the student with the opportunity to become capable of being an agent if they have learned themselves, whether from a procedural, conceptual or attitudinal point of view, either with motivating actions, or with projects that aim at the formation of children, even though they are in early childhood education, create the perspective of a citizen who seeks his or her ideals (GEORGE, MALLERY, 2022).

This is because constructive activities can be inserted in this context, such as hybrid activities, in which teachers can be present at the time of learning, or students can learn remotely (MORIN, 2021).

An example of this are the activities carried out in Google classroom, in which the student is present in virtual meetings, the teacher can pass quizzes and games with the gamification strategy and still the student continues learning. Another way would be the formation of case studies in which students would solve challenges and problems, such as painting drawings of the *World Map*, or even mathematical games that propose challenges, goals, and virtual prizes (INFORCHANNEL, 2022).

Thus, Active Methodologies, added to the new digital technologies, can be peculiar instruments in learning, both to explore new knowledge and to improve knowledge about mathematical formulas.

This was evident, considering that, with the internet, people can travel around the world, get to know plays, theaters. Another form of work is that of peers or teams, whose students can come together to achieve a goal or a challenge, with the sharing of ideas they can learn together, as they learn and teach at the same time (INFORCHANNEL, 2022).

Through this alternative, they can resize their critical thinking, in addition, learn to deal with opinions different from their own, while improving their condition of otherness and autonomy in their choices and desires; They begin to understand learning as something that is light and peaceful. In addition, they can become capable of defending ideals and problems in their daily lives (MORIN, 2021).

Therefore, with activities that involve hybrid teaching, playfulness, and Gamification in the classroom, whether virtual and face-to-face, can help students stay learning, when you think about the area of chemistry it is no different. This is because they will feel more satisfaction with the activities and the exchange of knowledge. This is because it is not enough to invest in content, it is necessary that students feel comfortable and welcomed in classrooms (INFORCHANNEL, 2022).

These methodologies provide ideals of autonomy to select the themes and work on them through projects of action plans, class plans and insert them in the Pedagogical Political Projects and in the School Regulations of educational institutions. In this way, it is possible to think of an education that is integrative and democratic.

This occurs precisely because, through participatory education, the pedagogical team can, therefore, guide teachers to offer children the possibility of approaching reading and writing, becoming subjects capable of understanding their social function and thus seeing reading-writing, knowledge of geography and mathematics, as an innovative instrument of their lives. capable of changing their success inside and outside of school (FRANCO, FERREIRA, BATISTA, 2015).

From this perspective, logical comprehensions, the act of learning to read and write are goals of most people who go to school, and, therefore, must be worked on significantly, so that the student understands that each one reads and writes in his own way, endowed with the ability to become a proficient reader and writer (MORIN, 2020).

In the meantime, it is up to the teachers in question to rethink their work in the classroom, in the sense of perhaps modifying and innovating their lesson plans, with activities that are both attractive and diverse. In this way, it will be possible for students to feel more proactive to new knowledge (MORIN, 2021).

It is believed that with the insertion of active methodologies being inserted in the chemistry classroom, new methods can be designed in order to install in the classroom a curriculum that is at the same time more focused on the student and that also meets their needs and expectations (APPLE, 2022).

This is because, through such actions, schools can believe in a learning capable of experimenting with more flexible curricula, where students learn to integrate knowledge in a broad way, values and the life project through themes that are at the same time real, with relevant challenges and with stimulating activities such as games, of collective, face-to-face and digital activities inside and outside the school (MORIN, 2021).

So, for this to be effective, the training of teachers, principals and the entire school body must be treated as a continuous process, and this implies developing an initial training that is not committed to making the future teacher to solve problems in the classroom, but preparing him to solve solutions and follow possible paths. Through this, they can think and reflect on the updating of

pedagogical political projects, regiments, and school action plans (LINHARES, FERREIRA, REIS, 2021).

In this way, by using chemistry teaching methodologies, educators can become capable of admitting, accepting and respecting the diversity manifested by their students, from the social, cultural and physical aspects, being someone who diagnoses and combats all forms of discrimination, critically observing the educational practices existing in school and non-school spaces (LAVADO, 2022).

In addition, they can cooperate in the management of institutions, in teamwork; acquire a team attitude in the various segments of society, family and community; to be a modifying agent, whether in professional, social or political contexts in school and non-school areas.

The results of the current research point out how these technological resources in the chemistry classroom are essential, so that teachers can have knowledge, skills and pertinent attitudes, developing them, routinely, in order to include technological resources in the students' daily tasks.

According to Van Nuland et al (2014) and Costa (2018), the quiz method, when used in the teaching of chemistry, is an enormous quality of learning in the classroom, being an essential method for the effective learning of students, since they can learn in a more playful and pleasurable way.

METHODOLOGY

In this research, a structured questionnaire was applied, consisting of 10 questions - two closed and eight multiple choice - with the objective of outlining a simple profile of professionals who work in the area of chemistry teaching and with students who have the discipline in their curricular component, more specifically about the use ofof digital games, in order to contribute to the teaching of chemistry, through the teaching methodology that involves a Digital Game, with the use of the Quiz platform in their teacher training and with the purpose of understanding how these professionals work the professional practical part of the discipline, and if there is a knowledge and/or interest in tools.

It is believed that in this way, chemistry, which is a discipline that requires theoretical teachings, accompanied by practice, can be better understood in the teaching environment and reproduced in the student environment. However, due to the structural inability of many schools to offer laboratories for practical classes, so that students can learn with platforms such as Quiz, unfortunately it is still common for teachers to be limited to developing their activities in a purely theoretical way.

Thus, this research arises with the aim of settling questions about the importance or not of this tool as an aid in the teaching of the discipline, and having proven its importance, to understand

how professionals suggest to overcome the deficiency caused by the lack of physical spaces and more pleasurable activities for students.

The methodology of this research is descriptive in nature, with the intention of carrying out a survey of data about the profiles, knowledge and opinions of teachers active in the area of chemistry (HOLTON, 2010). According to Gil (2008), the main objective of descriptive research is to specify characteristics of an established population and to have standards of techniques for data collection.

However, for this to occur, quantitative research was supported, turning to the method of investigation with the research, as well as analyzing the data with the constant comparative method. The descriptive nature was selected precisely because of the possibility of describing reality, based on the naturalness of the problem (CANZONIERI, 2010).

It is known that quantitative research has a lot of scientific recognition, given that, through a systemic investigation of the phenomena observed in data collection, it is possible to analyze the data in a statistical and computational way (DYNIEWICZ, 2009).

According to Deslandes and Gomes (2010), quantitative research is usually selected when there is an analysis of the percentage of data, since it works with a representative sample and with statistical samples. Similarly, the model suggested by Pressman (2002, p.409) suggests that quantitative research can be carried out:

> [...] If quantitative data is desired, a form of time study analysis can be conducted. Users are observed during the interaction and data – such as number of tasks correctly completed during a standard time period, frequency of actions, sequence of actions, time spent "looking" at the video monitor, number of errors, error recovery time, etc.

As was the case of this research, which was based on the collection of information in structured questionnaires (with a free program called *Google Forms*) to perform a data analysis and also quantify them, with percentage, being presented the results both in 8 subtopics with high school students from a public school and the second part with written questions about the performance of professionals who work in the area of chemistry. It is important to emphasize that this program was chosen mainly for its speed of results and also security, since the questionnaires and results cannot be manipulated.

Thus, the students and teachers answered the questions through a link generated by the author of the research. The answers to the forms could be answered not only by the computer, but also by the mobile devices of the respondents.

Therefore, the use of the constant comparison method is evident, since it is possible to compare the profile and teaching data in the classroom (virtual and face-to-face) of the interviewees in a fast, dynamic and safe way. This is precisely because in this methodology, the data are coded and

then assigned to each relevant subject category (CANZONIERI, 2010). And in this case, the focus was on the use of the Quiz platform and the experience of Chemistry teachers with them.

In other words, in the case of this research, a comparison between the levels of training of the teachers, their experience with the Quiz on chemistry were pointed out, for example, and the results appeared in graphs with percentages and the discursive responses of the students and teachers. Then, the results appear in a very conclusive way to the survey questions, for the entire target audience.

The interviewees were a total of seventy-six participants, sixty of whom were high school students, aged between 15 and 19 years, sixty students who have the discipline of Chemistry in their curricular component.

The other portion consisted of sixteen teachers in the area of Chemistry, aged between 25 and 45 years old, who work in public schools located in the urban region of the city of Jequié, and have more than five years of experience in the area with the curricular component of Chemistry.

RESULTS AND DISCUSSION

According to the Bahia State Department of Education, through the Curricular Matrix proposed for the "new" high school (BAHIA, 2020), the 1st and 2nd grades of high school have a workload of 40 hours per year allocated in a weekly schedule, while the 3rd grade of high school has 80 hours divided into two weekly schedules. over the course of the regulations, 200 school days. However, this document does not specify the number of hours/classes for the realization of practices of the discipline, from which it can be deduced that this distribution between theory and practice must be made by the teacher himself, considering his autonomy, planning and availability of infrastructure.

A notorious and, to a certain extent, justifiable fact is the complaint of many teachers about the lack of time and digital resources in public schools in Brazil, to work on the subjects provided for in the curricular structure of the discipline itself, and this is one of the factors pointed out by the teachers. As stated by Borges (2002, p.294), the "lack of time of the teacher to plan the performance of activities as part of his teaching program" is one of the reasons for not carrying out practices in laboratories.

Still, Brown (2005, p.2) shows us that "Chemistry provides important explanations about our world and how it works. It's an extremely practical science that has a big impact on everyday life." That is why we should not neglect the practical part of this discipline, because once this is done, we will be transmitting incomplete knowledge to the students.

Chemistry practice classes with games such as Quiz - such as Rachacuca, Quizur, Wordwall and others - deserve relevance, because one of their purposes is to show how natural phenomena common to our daily lives happen, and what is their importance in the cycle of life. Revealing,

testing, investigating, proposing experiments, are actions that should be part of the reality of the teaching process of this discipline, without seeming something distant from the reality of the majority of students.

For this to happen effectively, the use of games such as Quiz, as well as virtual laboratories emerge as a solution, proven to be effective, as is the case of the project *Physics Educacional Technology* (*PhET*) created in 2002 by Nobel laureate Carl Wieman. It is a website where students and teachers can take science and math simulations for free. Thus, with just a few clicks and in a short period of time, it is possible to simulate practices that would previously only be possible with the use of appropriate physical structures, trained personnel, glassware, reagents, and so many other utensils, expensive and difficult to acquire (QUÍMICA, 2017; CREATIVE COMMONS, 2021).

We will show below the result of the research carried out with high school students and chemistry teachers from public schools in the municipality of Jequié, in order to understand more about the theme, the importance of games in the classroom was highlighted, with the intention of exploring them as a resource in the demonstration of phenomena, whenever a physical chemistry laboratory is not available and thus students can maintain themselves more and more interested in the theme.

QUESTIONNAIRE APPLIED TO STUDENTS

1- You prefer to learn chemistry through:

a) Textbook

b) research activity (as a concept of chemistry, chemistry in our daily lives)

c) all methods

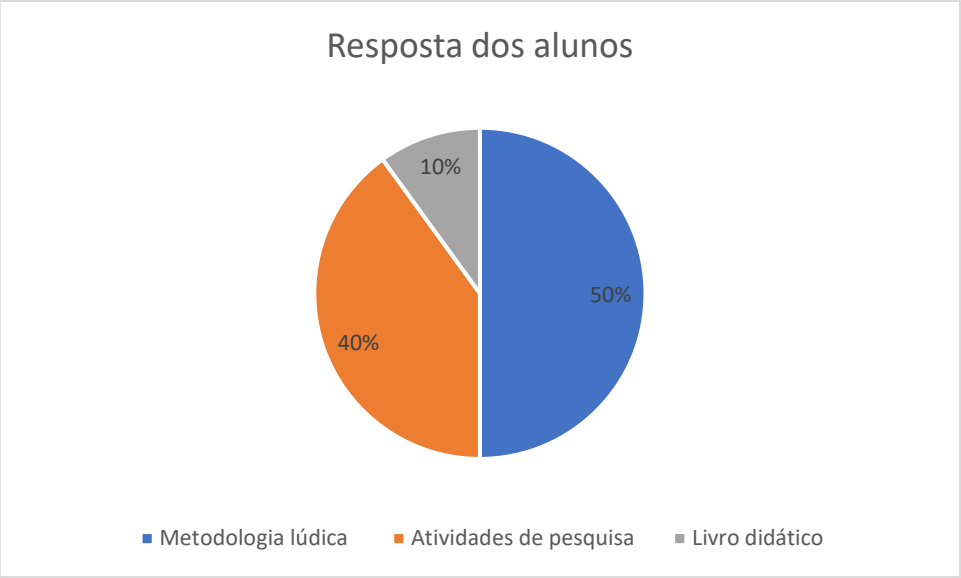
2 - Has your teacher used the new methodologies active in the classroom - such as quizzes, acronym games, and others - to learn more? If so, comment on your learning.

3 - To learn chemistry, do you students just need to "memorize" the contents covered or do you believe that using games is more motivating? Justify.

4 - Do you think new learning technologies can help you learn more effectively? Why?

5- If it is of interest to you, leave your e-mail here so that you can receive the completed survey.

Graph 1 – Do you prefer to learn Chemistry through:



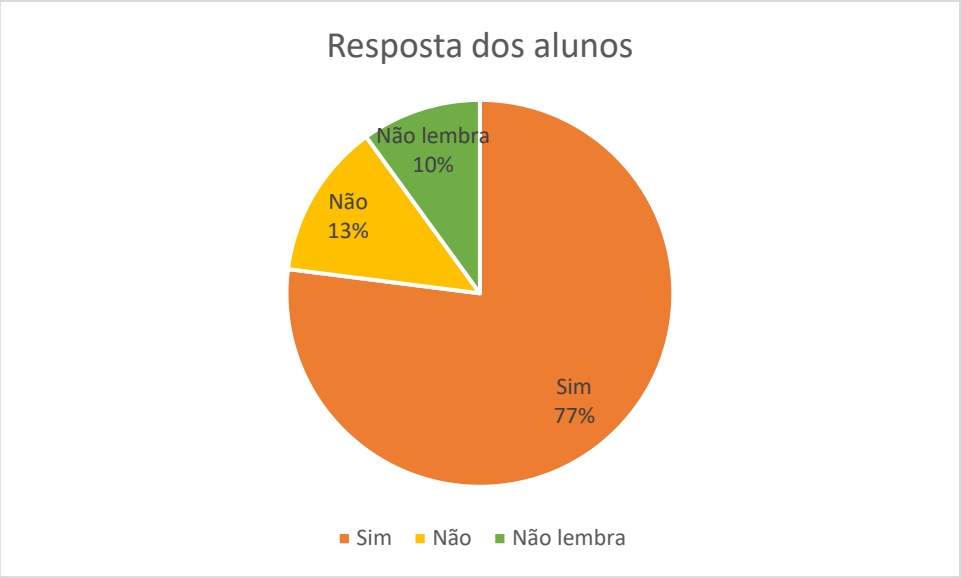
Source: Researcher, 2023

According to Graph 1, referring to question 1, the largest portion of the students (50%) believe that it is interesting to learn chemistry based on a playful methodology, on research activities, on the textbook in a mixed way. While 40% of the students believed that research activities are better ways to learn and only 10% think that they learn only from textbooks.

In this way, it is inferred how the activities need to be aligned with the activities of the students, where not only the teacher is the protagonist and passes on the knowledge, but also as a stimulator. This Quiz tool proves to be efficient, as it has a range of different practice titles, which allows the teacher to use it in different classes, such as: chemical kinetics, chemical solutions, organic functions, among others. As it is a very simple application where the user is invited to be the protagonist of their own experiments, the teacher is free to create different types of scripts, practical classes, dynamics and continuous modifications.

In question 2, as shown in Graph 2, when asked if their teacher had already used the new methodologies active in the classroom - such as quizzes, acronym games, and others - to learn more, 77% of the students said no, 13% said yes and 10% did not remember.

Graph 2 - Has your teacher used the new active methodologies in the classroom to learn more?



Source: Researcher, 2023

With the *quiz* application called Rachacuca, for example, the teacher can work with students on subjects such as acid and base and neutralization reactions, as well as question why certain reactants do not react, introduce the concept of *Gibbs*' free energy, octet theory and noble gases.

With the protagonism provided by the application, the student can be free to do the experiments he wants, without having the fear of explosion, inhalation of harmful gases, and the best: being able to repeat as much as he wants, as there is no limit on the amount of reagents to be used. This makes the learning process more pleasurable and fun, which encourages the student to become more and more interested in the study of chemistry.

It is noted that, based on these virtual practices, the student improves his knowledge, his autonomy and his protagonism in chemistry classes, and the teacher should encourage this potential in his students. In this sense, it would be interesting for the teacher to start with the theory and explain the practical script to be worked on in this laboratory, and from there, act in order to give all the necessary support, observing and correcting possible errors.

Thus, it is necessary to have strategies in the spheres of schools and educational scientists, with regard to coping with these difficulties of knowledge exchange in the classroom and outside of it. With this in mind, the Connected Education Innovation Program, a government project instituted through Decree-Law 9,204, which has as one of its objectives to encourage the use of technologies in schools as a pedagogical tool (BRASIL, 2017).

To this end, according to this document, there needs to be a commitment from agencies and entities at the federal, state, district and municipal levels with the support of the interested schools themselves, the private sector and civil society.

Graph 3 - To learn chemistry, do you students just need to "memorize" the content covered or do you believe that using games is more motivating?

Source: Researcher, 2023

In question 3, it is observed that, in graph 3, when asked if to learn chemistry, you students only need to "memorize" the contents covered or do you believe that using games is more motivating? Justify. 93% of students said that the quiz game can be important since:

Student to: it makes learning easier.

Student B: I believe that with quiz games we can learn instead of having the obligation to memorize.

It was noted that 93% of the students pointed out that they prefer to learn chemistry with games, instead of memorizing the contents to be addressed. Only 7% preferred to study only with the textbook and memorize. This result demonstrates how chemistry is a dynamic and essentially practical discipline and, therefore, the lack of a laboratory infrastructure in schools can end up hindering its understanding and compromising its learning. That is, theoretical classes should be associated with practical activities, to resize the students' knowledge.

In addition, thinking about these aspects makes it essential to envision a chemistry teaching that is dynamic, participatory and capable of solving social problems, in a certain way, such as the lack of physical structure of laboratories. As a result, to combine the theory and pedagogical practice of the Chemistry syllabus.

Considering that the teaching of Chemistry demands not only theoretical classes, but also practical teaching of the discipline, the aforementioned project of the federal government meets this perspective, as it has as one of its principles, the greater access to computerized pedagogical mechanisms, hence the possibility of inserting virtual laboratories as aids in the teaching of chemistry.

According to the Connected Education Innovation Program, a government project instituted through Decree-Law 9,204, the premise is to foster the importance of encouraging the development of teaching professionals and managers, through continuing education. In this way, the agents involved in the teaching process would be prepared to put into practice the use of technologies. In other words, it is not enough for the educational institution to have equipment capable of facilitating teaching, it is crucial that teachers are also trained in the use of these tools, ensuring that the results of improvement in education are satisfactory.

Thus, we can infer that the use of technologies in teaching, such as virtual laboratories, should not only be a concern of teachers, but also a concern of the government, because, in order to correctly implement technological innovations in the educational process, all those involved must actively participate. After all, education should not only keep up with technological development, but should also be part of it.

Graph 4 - Do you think new learning technologies can help you learn more effectively?

Source: Researcher, 2023

In question 4, as shown in graph 4, when asked if "can new learning technologies help you learn more effectively?" Why?" Unanimously, 97% of students said that learning based on new technologies is the most effective and 3% said that it is not. Thus, it is notorious that the practice of playful games such as the Quiz should not be neglected, given its fundamental role in the construction of knowledge. After the experiment, it is possible for the teacher to instigate the student to research the experiment carried out through a report, for example.

Thus, it is observed how essential it is to understand and use active methodologies based on Quiz games, with different learning contexts: within educational institutions, whether in face-to-face or remote teaching or even schools that have laboratories, computer rooms or not.

From the discussions presented, it is clear in the opinion of the students interviewed that the teaching of chemistry is outdated when the student is deprived of participating in practical observations and games such as the Quiz, of what has already been worked on in theory.

In this context, as already mentioned, Quiz is an excellent alternative to the problem pointed out, since many applications that play this role for free and on devices that are quite widespread today, such as *smartphones* and computers. All of this contributes positively to the implementation of this project in schools.

QUESTIONNAIRE APPLIED TO TEACHERS

1-How many years have you been teaching chemistry?

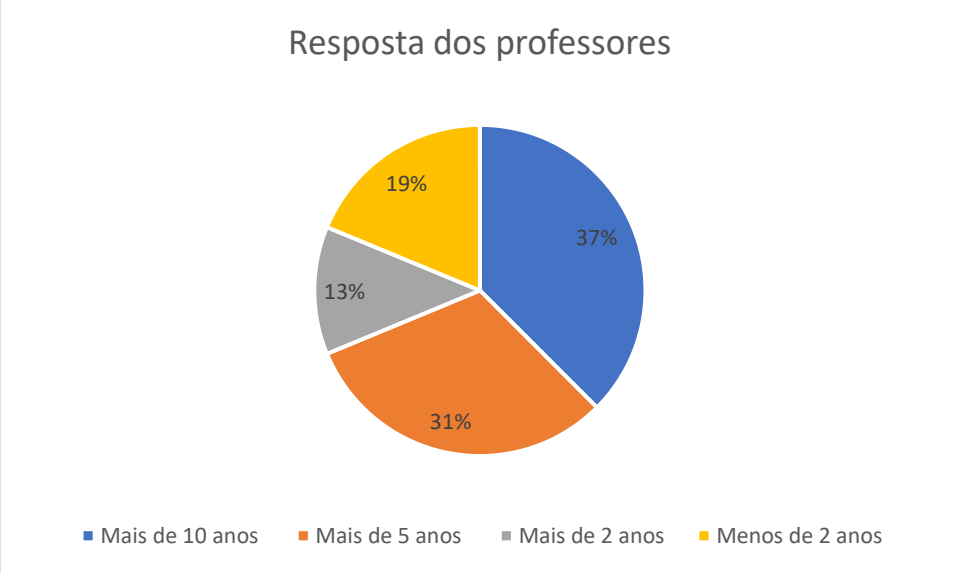
2-Have you ever applied games or playful methodologies – such as quizzes in the classroom? If so, share this experience in relation to the learning in the class.

3-Do you believe that a classroom focused on teaching and learning in a playful way is fundamental or do you prefer traditional teaching? Justify.

4-Name alternatives that can be used in the classroom and that result in better learning of the contents covered.

5- If it is of interest to you, leave your e-mail here so that you can receive the completed survey.

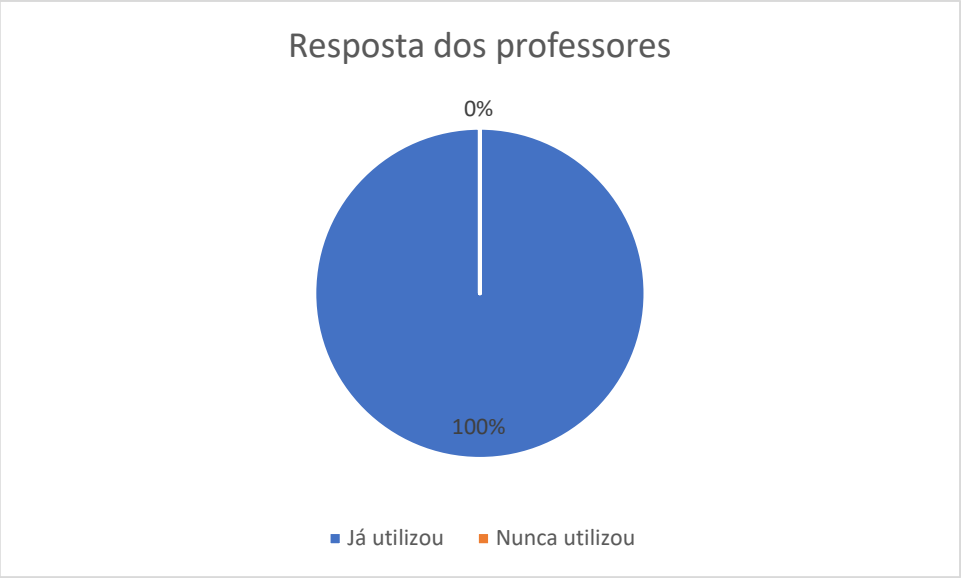
Graph 5 - How many years have you been teaching chemistry?



Source: Researcher, 2023

According to graph 5 above, in question 1 the largest share of chemistry professionals in the public network, 37%, have been working in the area for more than 10 years, thus indicating a vast experience in the area of expertise.

Graph 6 - Have you ever applied games or playful methodologies – such as the quiz in the classroom-?



Source: Researcher, 2023

According to question 2 directed to teachers, Graph 6 shows that 100% of teachers said that they have already used games and playful methodologies such as quizzes in the classroom. In addition, most of them ended up telling positive experiences about its use. In fact, one of the teachers makes it clear that he has always worked with this type of tool, being a recurring practice since his internship at the university and that he has passed on such habits to the regular classroom of the high school in which he is the conductor.

> Teacher A: Yes. Improvement in student teaching and learning
> Teacher B: Yes. I've used animations, and simulation site. I've never used quizzes, but it would be a good approach as well. The animations contributed a lot to a better elucidation of the phenomena and helped a lot to facilitate the students' understanding.
>
> Teacher c: Since my first conducting internship I have always liked to take a quiz as a form of revision before the mock exam. In high school, I did a quiz with 30 questions on the subject and divided the room into groups and distributed signs with the alternatives from A to E. The students liked it a lot and, in addition, it was worth a grade. I go through the questions on the slide and give them some time to think. Tomorrow, 03.05. 23, my penultimate day of internship in elementary school, I will also take a quiz as a day rlde review of all the content already seen. There will be 10 questions about chapter 6 and 7 of the 9th grade. I hope they like it. The class likes it when I apply the quiz because they like to compete and when it's worth a grade, then they like it even more.

In this sense, it can be seen how essential it is to discuss within the academy and in the school community about teacher training that is continuous and participatory. An example of this occurs at the State University of Southwest Bahia, Jequié campus, where there is an extension project for chemistry professors called Computational Chemistry, registered in the Information and Project Management System (SIGPROJ), under the number 277645.1326.289293.10102017, which was approved by the committee according to CI process No. 351/2017, whose objective is toaddress topics related to the use of computational chemistry in its most diverse objectives, including the use

of software to support the teaching of Chemistry (UESB, 2021). The course is continuous and is offered whenever demand arises for teachers and students.

Expanding this idea, thinking about the importance of this tool for the teaching of chemistry, it is interesting to include this theme in the academic curriculum of chemistry degree courses, since it is possible that future teachers will still face the problems occurred by the lack of physical structures of laboratories in the schools in which they will work.

Added to this, university projects must work, during the graduation of professionals in this area, with problems and possible solutions for what they will face in the future, such as the absence of modern equipment and physical laboratories and the insertion of students and the school community to virtual simulators.

Graph 7 - Do you believe that a classroom focused on teaching and learning in a playful way is fundamental or do you prefer traditional teaching?

Source: Researcher, 2023

Based on the answers to question 3: does the teacher believe that a classroom focused on teaching and learning in a playful way is fundamental or does he prefer traditional teaching? Justify.

According to Graph 7, it was noted that 94% of the interviewees indicated that they believe in a learning teaching focused on learning in a playful way, and only 6% of the interviewees said that they prefer traditional teaching.

For a generation that was born immersed in technology, making use of the available resources can be more productive and efficient, since, by producing media, these can be easily shared in the virtual environment. Because, although inappropriate use - with games and movies, throughout the day and night - can harm students' performance, these equipments, when used with specific and well-defined objectives, are capable of promoting interaction and assisting in the teaching-learning process (SANTOS and ROSA, undated).

According to Correia Marly (2010, p.3, *apud* VEIGA 2001, p.2) "it is necessary to evolve in order to progress" and informatics is capable of introducing certain subjects - such as the syllabus of chemistry classes - in an alternative way, which can help in the teaching process. Educators, then, would cease to be mere transmitters of knowledge, and would become adjuncts in the construction of knowledge. In this way, technologies such as "computers" and *smartphones* would become allies of the teacher in the teaching process.

For this, the courses in this area should enable projects that focus on the handling of virtual tools to assist the teaching of Chemistry, since all teachers need to be trained to use tools such as the quiz in the High School classroom.

And this needs to be debated in all social spaces, as we know that many schools still do not have support for practical classes, either for structural reasons, or for lack of reagent, equipment and glassware.

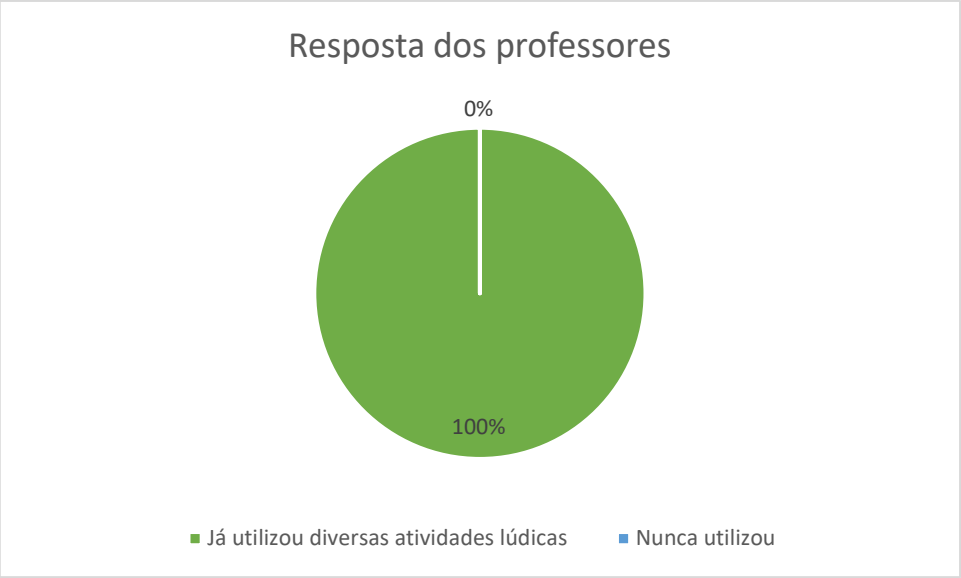
Thus, the use of new technologies can provide more participatory and dynamic classes, but for this to occur, it is necessary that there are continuing education actions and projects within the higher education centers that aim to understand the virtual simulators in their entirety, so that the contents can be explored and inserted in the students' curricula.

As a result, it is a fact that Chemistry classes should not be taught only in a theoretical way, because, in this way, the student would be deprived of an essential part of chemistry, which is experimentation and investigation.

However, many schools still do not have laboratory structures, or have a limited number of reagents, equipment and glassware to carry out practical classes. Thus, it is feasible to use alternatives to overcome these difficulties.

Thus, students from schools devoid of this laboratory apparatus end up having a distorted view of what chemistry really is, because they are limited only to seeing formulas and equations inherent to the discipline, without having the essential contact of the practical part, being deprived of contemplating what was said in theory to be applied in practice.

Graph 8 - Cite alternatives that can be used in the classroom and that result in better learning of the contents covered.



Source: Researcher, 2023

According to question 4, which discusses the alternatives in which they can be used in the classroom and that result in a better learning of the contents covered, Graph 8 shows that 100% of the teachers said they use several activities since the application of the Quiz, such as work groups, simulator site, animations, in which there may be links between people's daily lives and the content. So much so that some describe:

> Teacher a: Quiz application and games helps a lot, I have been doing this and the learning has improved. Not to mention the experiments that can be done in the classroom.
>
> Teacher b: Small experiments, group work, short videos, technical visits.
>
> Teacher c: Simulator website, animations, well-designed slides with images and topics, short videos, orientations of work and research that stimulate the development of students' autonomy, etc.
>
> Teacher d: Quiz as I've said before, experiments, building models, mini seminars, etc.

From this perspective, it is understood how practical classes play an important role in the formation of students, since they become protagonists in the teaching process by handling what was studied in books, seeing how chemical transformations are processed. That said, it is necessary for the student to be inserted in the teaching process as an agent, that is, it is necessary for him to leave the field of ideas and theoretical contents and start to act actively.

Although the institutions lack a punctual investment from the government in laboratories, especially for Chemistry, Physics and Biology classes, the teacher needs to be able to use the resources already made available by the school and the students' digital media – students' own cell phones.

A great example of this was the reform that occurred with the Program for the Improvement and Expansion of Secondary Education, made available by the Inter-American Development Bank. Through this action, there was a curricular reform of these subjects and the construction of laboratories supported by the Ministry of Education (MEC). With greater incentives for actions such as these in the interior of the states, it is possible to envision an education that is at the same time diversified, with pedagogical proposals specific to the educational institution and with a common basis (QUADROS et al. 2011).

In view of this, it is necessary for schools to be open to the use of technologies that help in the role of making up for the lack of a physical laboratory. It is essential that educational institutions, especially those of basic education, follow the development of technologies, so that they become "partners" in the process of teaching and learning chemistry, aided by virtual laboratories. If this process does not occur, the transmission of knowledge will be irreversibly outdated, due to the archaic and uninnovative way of teaching.

The use of technological innovations in the classroom can be an ally, with regard to the student's focus on subjects that require a little more concentration, such as chemical phenomena. In addition, it is essential that teachers are aware of the importance of these tools for the new generations. In this way, in addition to implying a better use of the content, the use of virtual laboratories can make the class more dynamic and, consequently, more pleasurable, which would weaken old archetypals around chemistry classes.

FINAL THOUGHTS

Throughout the work, we sought to understand if the teaching of Chemistry was impaired, when it was not possible to teach practical classes due to lack of structure in the school for this purpose, since unfortunately it is common for all schools to have tools such as the Chemistry Quiz. With a positive answer, we then sought to outline ways to circumvent this problem with the help of devices available in our daily lives. In this way, the Chemistry Quiz stands out as a possibility to contribute to the process of teaching Chemistry in schools that do not have physical laboratory structures or even for distance learning so common both in the old pandemic context, as well as in this post-pandemic moment.

Through the analysis of the questionnaire together with the testimonies of students and teachers, it can be concluded that the use of the Quiz in the classroom is an alternative to be considered, as it allows the practice of the discipline with technological resources common to most students, the *smartphone*. And that, from this contact between theory and practice, it would be possible to make the teaching of chemistry more playful for the student and, consequently, obtain more results in the exchange of knowledge between teacher and school community.

In addition, it cannot be overlooked that new active learning methodologies, such as the simulations of programs such as Labvirt and *Beaker* , can be of great relevance to students, since they can provide the possibility of approaching a range of Chemistry contents, while helping in the improvement and learning of students in relation to digital inclusion both within, as well as outside of school environments.

In this way, it is hoped that teachers, more and more in Brazil, can use virtual simulators to strengthen students' understanding of the concepts of Chemistry worked in collegiate environments, especially abstract concepts where it is common for students to feel more difficulty. Added to this, it is suggested the increase of research on this theme, in addition to the need for teacher training based on continuing education where the construction of practical classes in the areas of informatics and laboratories is reinforced, especially when combined with citizenship, general and technical training, both of teachers and students in Brazil.

In addition, to contribute to scientific studies within the classrooms, so that these tools are inserted in the curricula of schools, while the school, as a whole, can value research and extension projects in the area.

So, based on the results, it is evident how these virtual tools resize syllabus, as well as diversify the methodology within Chemistry classes. That is, how digital platforms such as Quiz are excellent resources capable of promoting the interaction between theory and practice, as well as allowing the analysis, visualization and understanding of chemical phenomena, whether at their macroscopic level, as well as submicroscopic and also at the level of symbols. Thus, the adequate perception to understand playful activities such as quiz games is expanded, their applicability in chemistry curricula in all schools in Brazil.

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