


CHAPTER 41

Experimental Disciplines: Challenges Faced by Teachers and Students of the Licenciature Course at the Federal Institute of Education, Science and Technology of Piauí

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ABSTRACT

Chemistry is the science that studies the transformations that involve matter and energy, based on experimental practices of the concepts that are addressed in the classroom. With the COVID-19

pandemic, education took new directions towards technologies, due to the need to continue with classes even in extreme periods, educational didactics involving the use of technologies had to be adapted both to the educator and the student, making them both adhere to remote teaching. In the classes referring to the experimental chemistry practices, the chemical experiments were carried out through remote classes, which caused an effect of astonishment on the teachers and students, who had to adapt these activities to the imposed and necessary contents of the curriculum of the chemistry course. to the virtual world, so numerous challenges arose during this process. Therefore, this article will address, through the verification of data analysis of a questionnaire aimed at teachers and students, the main challenges faced in practical chemistry classes during this period of pandemic, making a comparison with practical classroom classes, concluding that there were advantages and disadvantages in this process.

Keywords: Experimental discipline of chemistry, remote classes, covid-19, challenges- teacher/student.

1 INTRODUCTION

On December 31, 2019, the World Health Organization (WHO) was alerted to several cases of pneumonia in Wuhan City, Hubei Province, People's Republic of China. It was a new strain (type) of Coronavirus that had not been identified before in humans. People around the world were forced to isolate themselves in their homes in search of protection against the Coronavirus, thus starting a global pandemic. With social isolation, teaching units were closed, and the process of distance education began in public and private schools. At the Federal Institute of Piauí- Campus Picos, the distance education process had a great impact on teaching-learning; in the higher education course of Chemistry, for example, some of the disciplines in which this impact was felt by both professors and students was especially in the experimental disciplines of chemistry, with a great process of changes and adaptations on their part.

One of the adaptations experienced by teachers and students was related to the use of electronic devices such as the cell phone or notebook as the main means of interaction to watch the classes and the complementary videos available on the youtube platform, which contained in them some experiments on

the subjects passed on during the classes. classes and also the realization of practices elaborated at home with simple materials. This was one of the main methods used by teachers to alleviate the lack of face-to-face classes. However, not all students had access to the use of these devices, and not even teachers and students were so familiar with the technologies, resulting in a great challenge for everyone.

According to the author, also Fernandes, (2021. apud CARVALHO. 2022 P.14) in this way, an even greater degree of difficulty in the teaching and learning process was attributed to the pandemic, mainly due to obstacles related to the access and use of technologies , as well as adapting to a new teaching scenario. This adhesion was seen as the only alternative for the continuity of teaching, so that even more time was not lost in the skill in relation to learning.

Since then, the percentage of student performance in these remote chemistry laboratory experimental classes, in which teachers observed changes in school performance, compared to face-to-face classes, this performance was unsatisfactory. There was also a certain difficulty for the students in relation to having direct contact with the teaching professors of the experimental classes in the chemistry laboratory, such as clearing up doubts about elaborating experiments at home that were previously carried out as a team in the laboratory with the guidance of the responsible professor, the communication was limited by the lack of device, internet and knowledge of the use of these technologies.

Thus, the main objective of this study is to identify the main challenges faced in the teaching-learning process of experimental subjects in a chemistry laboratory, by students and teachers in the Degree in Chemistry at IFPI Campus Picos, before and during the pandemic. As well as verifying what factors can stimulate students' interest in experimental subjects during the pandemic and what is the learning performance in relation to experimental subjects, during the pandemic.

2 METHOD

At first, a bibliographic research was applied to collect data and a better theoretical basis than According to Macedo (1994 apud Sousa, Oliveira, Alves 2021, p.67) “it is the first step in any type of scientific research, for the purpose of reviewing the existing literature and not redounding the subject of study or experimentation.”

For the analysis of the research, two types of approach were applied, one being qualitative and the other quantitative, emphasizing the remote teaching-learning process of the experimental subjects in the laboratory of Chemistry, having as target audience the professors and students of the Instituto Federal do Piauí-IFPI, Picos campus, active in this teaching area.

Data collection took place from two online questionnaires, one for the 4 teachers of the experimental chemistry discipline, anonymously being identified, from number 1 to 4, questionnaire was prepared in Google Form, composed of 7 questions and was sent via WhatsApp and the one of the students participated 40 students of the Chemistry course through Google Forms is available on the WhatsApp platform, containing 8 questions. Students were identified from 1 to 40, preserving their anonymity. The questions

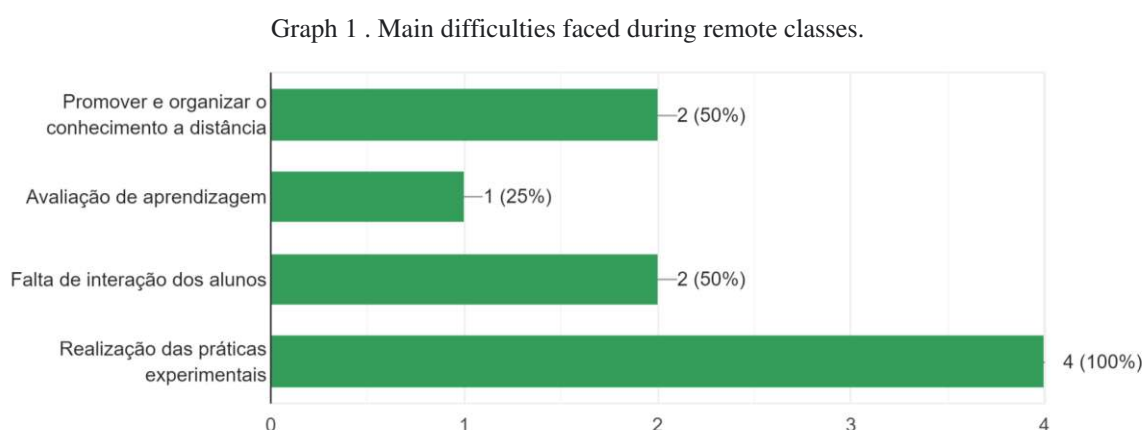
were objective and open, answered according to the individual experiences of the interviewees in relation to the remote experimental teaching of chemistry, the technologies used during this process, knowledge acquired and their perspectives for teaching. The results obtained were posted in graphs and tables to be discussed

3 RESULTS AND DISCUSSION

To verify the main challenges faced in the teaching-learning process of experimental subjects by students and teachers in the Degree in Chemistry, in the midst of the pandemic, two questionnaires were carried out (found in the appendix of this work). One for teachers and one for students. Therefore, in this part of the work, we will approach the data obtained in the application of this questionnaire intended for teachers and soon after, the data obtained in the students' questionnaire.

3.1 DATA OBTAINED IN THE TEACHERS QUESTIONNAIRE

The questionnaire seeks to understand the main difficulties faced during remote classes, the process of adapting these classes and learning from it, compared to face-to-face classes. Look at graph 1:



Source: Survey data, 2022.

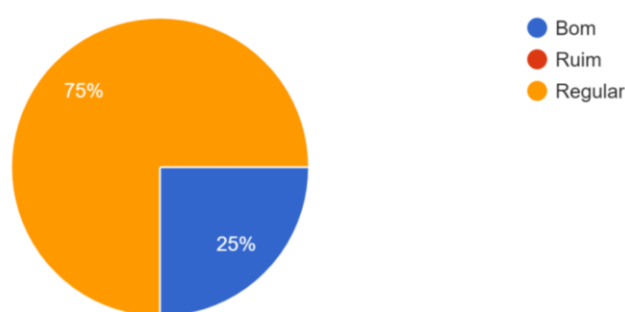
In Graph 1, we can identify that teachers had difficulty in developing more accessible practices for students, this result was to be expected, as the laboratory discipline works on the basis of practical classes with the help of the teacher inside the laboratory with all the materials needed to carry out the experiments.

Experimental activities carried out in the laboratory or in the classroom are relevant when characterized by their investigative role and their pedagogical role in helping the student to understand phenomena. (SCHNETZLER and MARTINS 2018 apud Ferreira, SOUTO , SILVA, RAULINO E SANTOS, 2019, P. 1)

In graph 2, we identified that the adaptation process in these remote classes was 75%. In these remote classes, the teachers noticed that the students missed the interaction with them, that is, a classroom discussion in which everyone puts their opinion. Another issue with the same result as before was the

discussion of organizing these online classes so that students could understand the content, which more than half also answered that it was not so organized, despite the teachers making an effort to plan the classes. In Graph 2, we identified that the adaptation process in these remote classes was 75%, they managed to adapt to the technology in a certain way since the students have a mastery with digital devices, being able to familiarize themselves with the new resources, but on the other hand 25% thought the whole process of change in their daily routines was bad, which is normal, because not everyone can follow these classes, as they are sometimes very tiring, being on the computer or cell phone screen watching it.

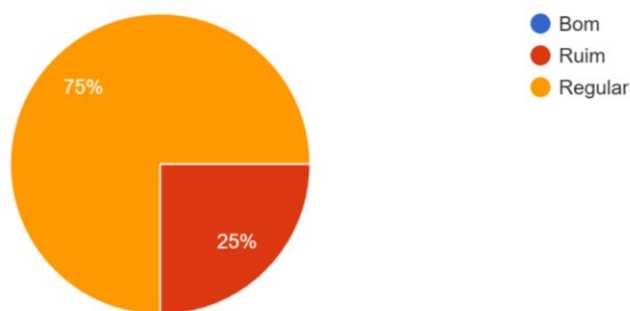
Graph 2. The process of adapting remote experimental classes.



Source: Survey data, 2022.

In graph 3, we have the comparison of remote classes with face-to-face classes, which reaches 75% again, if we observe the great majority found regular education, but it did not reach 100%, because in face-to-face classes the degree of learning is extremely high, it is in In a classroom we share knowledge, and those 25% of people who did not agree with remote learning is an answer to continue with face-to-face and online classes just in case of another worldwide problem that could replace it.

Graph 3: Student learning during remote classes compared to face-to-face classes.

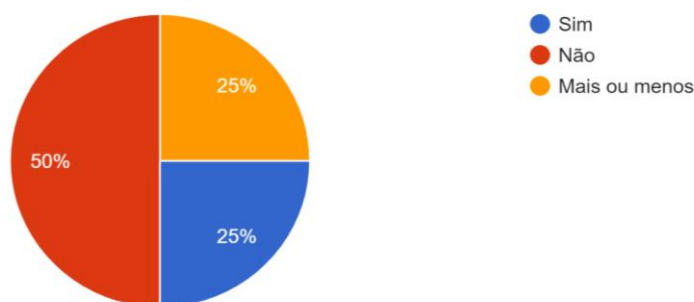


Source: Survey data, 2022.

In graph 4, the representation of the image shows the expected results of the students in relation to learning reached 50%, they answered that they did not learn as much and the other half of 25% concluded that they were not successful, that is, there is a gap in this remote learning that is says innovative and is not bringing as many benefits.

Integrating a new instrument [digital technology] in the classroom implies pedagogical changes, changes from the point of view of the teaching vision, which must be studied and considered by teachers. (BITTAR, 2010 apud COSTA E PRADO, 2010 p. 220).

Graph 4 : Expected results in the subjects of Experimental Chemistry were achieved in the pandemic.



Source: Survey data, 2022.

In all the results on learning, we soon imagine what were the methods cited by teachers to be able to bring some knowledge to their students? So we had some answers that prove that the methods were the most technological possible to be developed in a short time, in that chaotic moment that was all this pandemic and they sent their respective answers that are just below:

Table 1: Methods developed by Teachers to teach their remote classes

TEACHERS	ANSWERS
1	Lab practice videos
two	To carry out the experiments according to the course syllabus, the practices were adapted so that the students could perform them at home.
3	Practical classes with alternative materials and videos from virtual platforms or youtube.
4	Youtube videos with practices developed in the laboratory.

Source: Survey data, 2022.

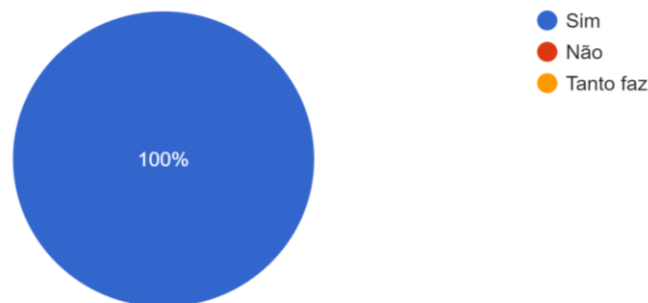
In Graph 5, the percentage difference between face-to-face and remote classes is revealed, and we obtained the following conclusion: of such. According to GIRAFFA (2012, p.17) “Currently, the method of teaching and learning requires an increase in research and communication techniques, since technology has made the classroom communicate more and become closer. the information. Emphasizing, still, that it is necessary for the professor to be careful with the sources of research and in how to prepare his classes so that both, students and professors, do not just stop at something superficial.”

Graph 5 : The difference noted between in-person and remote classes.



Source: Survey data, 2022.

Graph 6: Return of face-to-face classes.

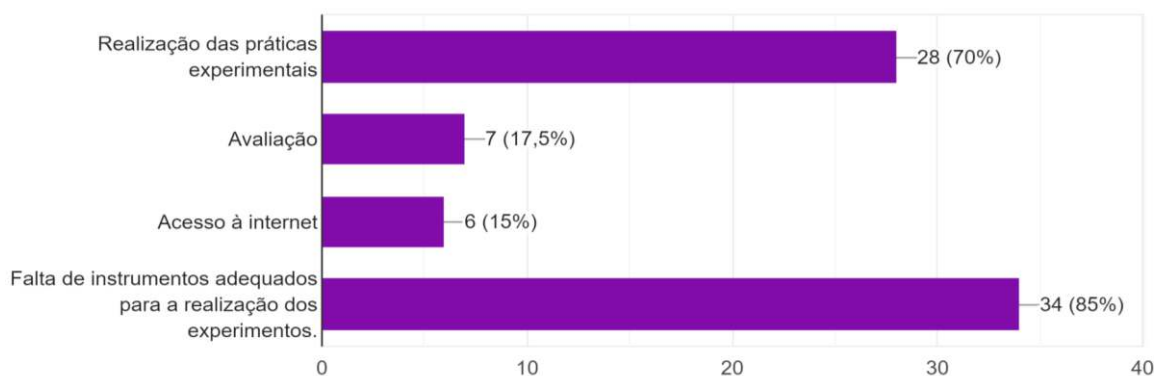


Source: Survey data, 2022.

3.2 DATA OBTAINED IN THE STUDENT QUESTIONNAIRE

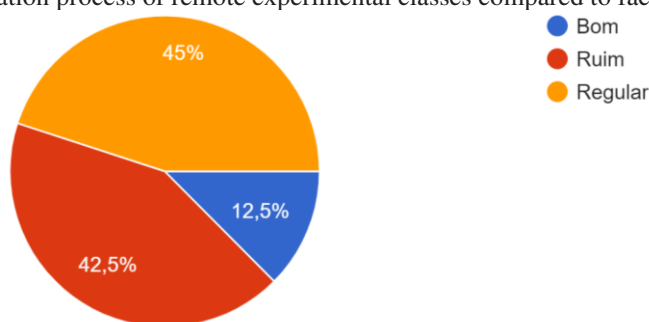
In the questionnaire applied to students being identified as: 1 to 40, preserving their anonymity. Starting the answer to the first question we can analyze in image 7, about 85% answered that they did not have adequate equipment to carry out the experiments carried out at home, the only way the students had was to adapt domestic equipment to perform the same, sometimes they had to pick up with a neighbor, buy. The student had to redouble himself to be able to carry out the practices at home, thus having a lot of difficulty, each student had his doubts and questions about the experiments. In carrying out the practice, many had to repeat the experiment because they did not reach the expected result. Therefore, there are several gaps when it comes to carrying out an experiment and having to adapt it is necessary for the student to redouble his attention and see what are the best possibilities to reach a result close to the laboratory with the appropriate equipment. About 75% say they had some difficulty in carrying out these adapted practices, the persistent difficulty when doing something in another environment that will be adapted and without adequate materials. Graph 7 shows the following detailed results:

Graph 7: Main Difficulties Faced by Students during Remote Classes



Source: Survey data, 2022.

Graph 8: Adaptation process of remote experimental classes compared to face-to-face classes



Source: Survey data, 2022.

When we talk about the process of adapting these classes, we identified that almost everyone had some difficulty, if we analyze graph 8 we will see that about 45 % found it regular, little by little they were adapting to this new learning style, but there is another percentage of 42.5% did not like to leave the usual teaching to enter a totally unknown world without proper preparation. In this way, we can take into account that there was difficulty in adapting.

In an emergency and with little time for planning and discussion (which would take months in a normal situation, teachers and school managers, public and private, from basic to higher education, had to adapt in real time (in real time) the curriculum, activities , contents and classes as a whole, which were designed for a personal and face-to-face experience (even if semi-present), and transform them into a fully experimental Emergency Remote Teaching. . It was the fastest digital transformation that is known in an entire sector and at the same time (ENSINO..., 2020, n. apud COSTA E NASCIMENTO, 2020 P. 2).

Regarding the tools and methods used by the most successful teachers, see the following student responses in the table below:

CHART 2: Main tools used by teachers according to students.

STUDENTS	ANSWERS
1	Videos of experiments on youtube, for the creation of the report.
two	Videos with the experiments already done.

3	The practice of the experiment at home.
4	Use everyday materials to make experiments possible.
5	It was the experiments where I had everything at home and they were simple.
7	To tell the truth, I was not successful in almost any, why I don't know, because I followed all the steps described by the teacher .
8	Theoretical classes, using the Google Classroom and Google Meet tool.
9	Experiment with tools you have at home.
10	Videos with the experiments already done.
11	Encourage the realization of practices at home, bring the results in the form of a report and seminar.
12	Encourage the realization of practices at home, bring the results in the form of a report and seminar
13	The script created by the teacher, in my opinion, was successful because it was charged with four different forms of activities, which made it absorb as much content as possible.
14	The use of videos with demonstration of experiments and from there make the reports.
15	The adaptation of experiments to the students' daily lives, thus bringing the option of using things from our home and learning chemistry.
16	I found it useful to observe a professional doing it in a video, as well as to do it with homemade materials, although doing the experiments in the laboratory is more fruitful.
17	There were no methods on the part of the Professor who have exodus.

Source: Survey data, 2022.

Analyzing all these answers, we noticed that most students answered that one of the main tools used was youtube with experiment videos that could be done at home. There was clearly the observation of these videos where the teacher could propose to the students to repeat the same experiment at home with the same materials, prepare a practice report or even the presentation of a seminar on that practice, it depends a lot on the teacher he had these possibilities to try to reach satisfactory learning results, and other responses from students were meetings through meet and others were that these classes were not successful.

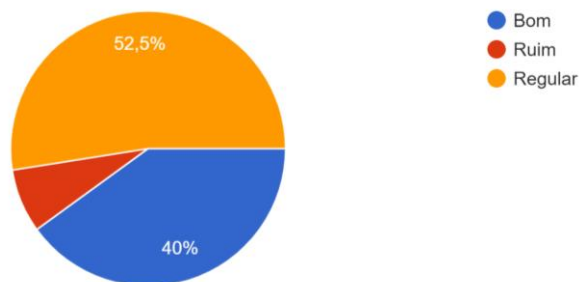
In this sense, experiments can enrich teaching planning and practice and thus create points of articulation with themes and concepts present in curricular guidelines (SANTOS; NAGASHIMA, 2017 apud FERREIRA , SOUTO, SILVA, RAULINO E SANTOS, 2019 P.4).

If you stop to think about it, the little knowledge that was obtained during this pandemic was enough to take advantage of, just imagine that without the technology we have today, we wouldn't have done anything. According to the Author Almeida (2007 . apud GARCIA. 2013 P.32)), the use of technologies in the educational process provides new teaching and learning environments different from traditional environments, and the real contributions of technologies to education arise as they are used as mediators

for the construction of knowledge. With the advancement of technology that has been taking science along, more lives can be saved and education can not stop completely until everything is stabilized, which took 2 years and we still suffer all that happened, but not all was lost, it remains only to continue.

Let's see in graph 9, another demonstration that the methods used by the methodology developed by the teachers contributes to some parts of teaching, such as using the cell phone to watch classes posted in the classroom or youtube videos, absorbing some parts of the content and thus taking the classes to the face-to-face return.

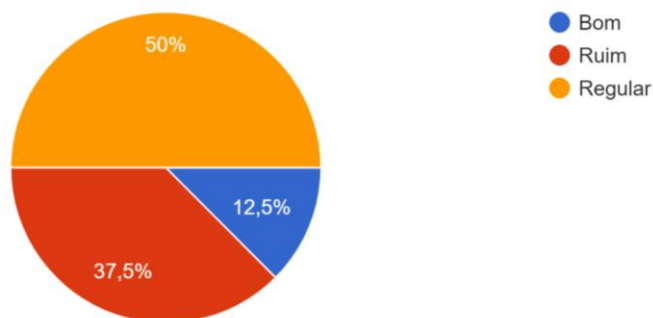
Graph 9: Methods used by teachers to pass on the subject.



Source: Survey data, 2022.

Teachers were regular, reaching 52.5%, this shows that the methods were the most appropriate at that time when there were not so many alternatives, complete methods were not possible, according to the students, 40% did not reach the desired goal.

Graph 10: The learning performance during the remote experimental classes being compared with the face-to-face ones.

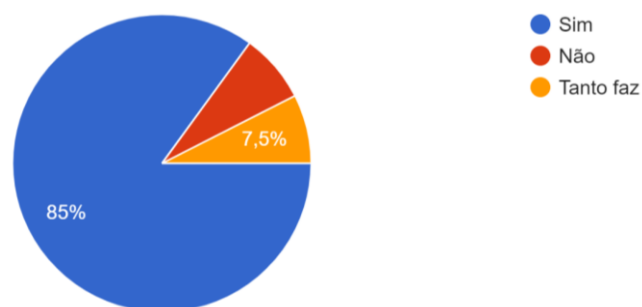


Source: Survey data, 2022.

Regarding the learning performance, it was considerable, about 50% answered that it was regular and another part 37.6% was bad, they got almost nothing and only 12.5% thought it was good, so the majority thought it was regular, perhaps due to the ease of access to the internet at available time.

The main function of education does not change because we live in a pandemic. Student learning is still the focus of classes and the teacher has a fundamental role in this process. Despite being a huge challenge, the teacher has at hand a path of possibilities to lead the appropriation of knowledge and the development of the proposed actions, strengthening the bonds between family and school, key pieces for the success of remote teaching. (MARCON E VALLE 2020 apud COSTA E NASCIMENTO, 2020 P.3)

Graph 11: Return of face-to-face classes



Source: Survey data, 2022.

In graph 11, we notice that about 85% of the students answered that they did want to return to face-to-face classes and only 7.5% did not want to return. So we can prove that face-to-face classes have more resources to work with and several forms of methodology that we can use within a classroom to pass on content, thus undoubtedly better and profitable than the same.

The students' answers about the biggest difficulties faced by the students when carrying out the practices in their homes with improvised materials that served as substitutes for the appropriate ones. Most of them answered the lack of adequate material, this allows the experiment without due care, to go wrong, when the material is improvised it is necessary to have a lot of attention and another answer of the students was the lack of the teacher to guide at the time of the experiment, because there is It is customary for students to enter the laboratory and have the teacher answer any questions that arise during practice, sometimes a phenomenon never seen before. It is notable that the students lacked the face-to-face teacher at the time of the experiment. According to CORDEIRO, educators had to reinvent themselves to be able to teach at a distance through remote teaching and for students to experience new ways of learning, without the face-to-face and warm contact of the teacher. Here are the main opinions of the students:

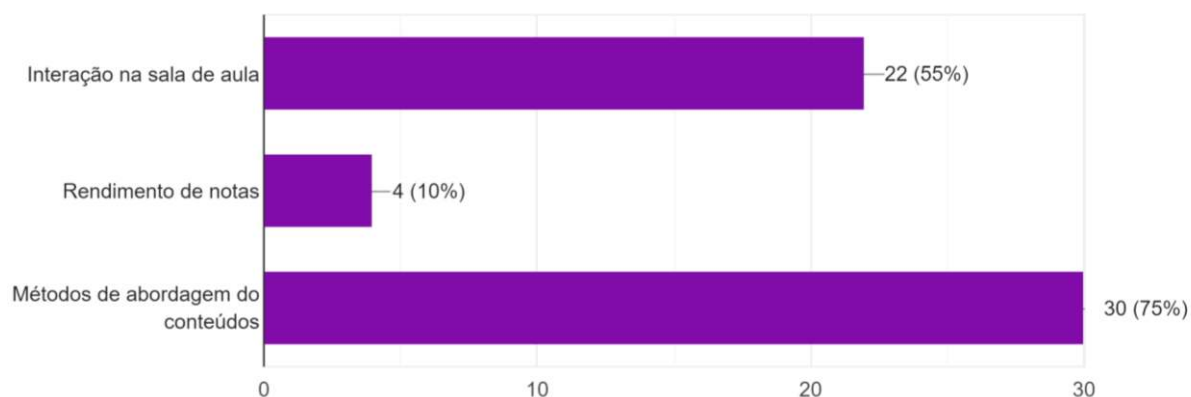
CHART 3: Main difficulties during remote chemistry laboratory classes.

STUDENTS	OPINIONS
1	Lack of suitable material.
two	During the experiments, several doubts arose, which there was no way to discuss. And the mistakes of this attempt became stressful
3	Not having the help of a teacher when doing the experiment.
4	The lack of adequate materials/reagents to carry out the practices. Because of this, sometimes the result of practice does not turn out as expected.
5	Difficulty in finding materials to carry out the experiments.
6	Lack of reagents and glassware

7	The lack of instruments to carry out the experiments, lack of space and lack of access to books to use in research.
8	The understanding of the content.
9	The materials, and the practice itself, because if I'm not mistaken, I only obtained a satisfactory result in one experiment.
10	The shortage and cost of materials.
11	Lack of necessary equipment.

Source: Survey data, 2022.

Graph 12: Greater difference noticed comparing with the experimental face-to-face classes with the remote ones .



Source: Survey data, 2022.

Finally, Graph 12 shows that the biggest difference according to the students noticed in the online classes were the methods that the educators used to teach their classes, which reached 75%, using technology in their favor to then get on the learning path. . However, we have another answer that the students marked, which was the lack of interaction in the classes that they felt with about 55%, we can see that these two answers are flaws that are a risk to be taken in relation to a new teaching system created quickly. , but that can meet some needs that was to continue to have access to education, because without it there is no way the world can function.

4 FINAL CONSIDERATIONS

This research was started from the difficulties in remote classes experienced by students of the Chemistry course, in the discipline of experimental chemistry, this new way of teaching ended up changing the routine of students and teachers who were forced to adapt, many challenges were faced when throughout these classes they had technology in their favor.

Great points were observed during this research and one of them was with the teachers who had to be quick and plan their classes and identifying what would be best for the students, but we know that during the results when listening to the opinion of teachers and students there were flaws despite that we would know from the beginning that quality teaching is that experienced in a classroom with direct contact with the educator.

Another point draws a lot of attention and in the communication between students and students to remove doubts and questions, in the matter of the teacher passing a practice and the student had any doubts about the material or reagent or that the experiment did not work and the students answered who often had no feedback regarding their doubts, they felt they lacked adequate guidance from the teacher and this was one of the flaws. the good side is that teaching is more difficult to practice because of doubts that may arise and at that moment it is not possible to be answered. And the educator with so many jobs cannot respond to all students.

Despite the existence of many obstacles we still have to overcome, remote teaching brought a positive point, which was to bring education to thousands of students being broadcast live or recorded for students to continue studying, even with different resources that can bring a little of the classroom for the screen of Smartphone, tablet or cell phone the lessons. Finally, the student discovered that there were bad and good parts at the same time. Although face-to-face teaching is indispensable for quality education.

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