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Challenges of remote chemistry teaching for visually impaired people

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Abstract: This research aims to understand the perceptions of visually impaired students about emergency remote teaching during the pandemic. This is a descriptive study, conducted with seven students enrolled in chemistry classes at a support center for visually impaired people in Goiânia through a semi-structured interview. The responses were analyzed and categorized using Bardin's content analysis, which allows us to outline the challenges and opportunities of remote teaching in the context of special education and school inclusion.
Keywords: emergency remote teaching; special education; chemistry teaching

Desafios do ensino remoto de química para pessoas com deficiência visual

Resumo: A presente investigação objetiva compreender as percepções de alunos com deficiência visual acerca do ensino remoto emergencial na pandemia. Trata-se de uma pesquisa descritiva, realizada com sete alunos matriculados nas aulas de Química em um centro de apoio à pessoa com deficiência visual de Goiânia por meio de entrevista semiestruturada. As respostas foram analisadas e categorizadas a partir da análise do conteúdo de Bardin que permite delinear acerca dos desafios e possibilidades do ensino remoto no contexto da educação especial e da inclusão escolar.
Palavras-chave: Ensino remoto emergencial; Educação Especial; Pandemia

Retos de la enseñanza de química a distancia para personas con discapacidad visual

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Resumen: La presente investigación tiene como objetivo comprender las percepciones de los estudiantes con discapacidad visual sobre la enseñanza remota de emergencia en la pandemia. Se trata de una investigación descriptiva, realizada con siete estudiantes matriculados en clases de Química en un centro de apoyo a personas con discapacidad visual en Goiânia, a través de una entrevista semiestructurada. Las respuestas fueron categorizadas con el fin de caracterizar los desafíos y posibilidades de la enseñanza a distancia en el contexto de la educación especial y la inclusión escolar.
Palabras clave: enseñanza remota de emergencia; educación especial; enseñanza de la química

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1 INTRODUCTION

In December 2019, the SARS-CoV-2, or coronavirus emerged in China and quickly spread across the continent, infecting the population with a disease called Covid-19. According to the Ministry of Health, "Covid-19 is a disease caused by the coronavirus, with a clinical spectrum ranging from asymptomatic infections to severe cases" (BRASIL, 2020c, translated bu is). It was declared a pandemic and, under the guidance of the World Health Organization (WHO), social isolation was imposed on both sick and asymptomatic people to prevent the spread of the disease. As a result, only essential services continued to operate and the various social spaces were closed, as were schools.

The removal from the classroom and the possibility of a sudden new teaching format gave educators no opportunity to prepare. Everyone had to adapt to the new teaching configuration, rethink technologies, methodological strategies and, above all, how the learning process would take place. Teaching activity was reconfigured with the emergence of the concept of Emergency Remote Teaching (ERE), which can be defined as:

> Emergency Remote Teaching (ERE) was a temporary and emergency solution, as the name itself indicates, that allowed educational institutions to maintain teaching activities outside the physical space of the school, within the possible circumstances, in the context of the pandemic. These are didactic and pedagogical strategies designed to reduce the impact of social isolation measures on learning (PINTO; MARTINS, 2021, p. 2, translated by us).

The challenges of Emergency Remote Teaching are different when it takes place at different stages, levels, or teaching modalities. When it comes to the education of people with disabilities, the possibilities are different and the demands of ERE are reconfigured when the subject in the process of social integration no longer has access to various services for their rehabilitation and inclusion in society, which directly affects the educational process of these subjects.

The education of people with disabilities has historically faced many challenges, and the Covid-19 pandemic has had immeasurable consequences for both special education and other types of education. Accommodations have been required as a result of isolation and social distancing, and as a result, students with disabilities have made specific demands regarding the accessibility of the new format and materials in distance education. Due to the specific characteristics of special education, this article aims to characterize the experience of visually impaired (VI) students with ERE during the pandemic to understand the possibilities of teaching chemistry in this context. This article is structured as follows: a) the theoretical background of ERE and the specific challenges for special

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education students; b) the methodological approach; c) the results and discussions; d) final considerations.

2 DEVELOPMENT

2.1 2.2 Emergency Remote Teaching in Special Education

The World Health Organization declared a pandemic on March 11, 2020 and because it is an infectious disease, the spread of the new virus took on significant proportions and quickly the five continents had a large number of cases and deaths,

> By the turn of March, the number of cases had already exceeded one hundred in Germany, France, Singapore, and Iran, exceeded one thousand in Italy and South Korea, and reached nearly 80,000 in China. From then on, the disease escalated exponentially, and the increase in cases was accompanied by an unimaginable increase in the number of deaths (MARQUES et al., 2020, p. 231, translated by us).

Faced with a new virus and the lack of specific measures to contain its spread, the global pandemic response was based on the implementation of social isolation, the use of masks and hand sanitizers (MALTA et al., 2020). With the intention of minimizing the impact of the pandemic in the educational context, the Ministry of Education published Regulation No. 343 on March 17, 2020, which allows for the temporary use of digital media to replace presential classes during the pandemic period,

> Art. 1 Authorize, on an exceptional basis, the replacement of presential disciplines, in progress, by classes that use information and communication means and technologies, within the limits established by the legislation in force, by a higher education institution that is part of the Federal Education System, referred to in Art. 2 of Decree No. 9.235, of December 15, 2017 (BRASIL, 2020a, p. 1, translated by us).

Emergency Remote Teaching was the term used to define the "modality" of temporary teaching offered by institutions and includes the different practices used by teachers during periods of social distance that contribute to the learning process. According to Cruz et al. (2020), in this format, the lack of interaction and pedagogical mediation between the teacher and the student hinders the teacher's understanding of the student's prior knowledge, considering the fragility of the learning process in this context, especially when it comes to vulnerable groups or those historically excluded from the educational process, such as students with disabilities. Because of the specific nature of this type of instruction, it is important to understand how ERE for people with disabilities takes place in the context of special education.

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Special education is a type of education that covers the entire Brazilian school system and is aimed at people with disabilities, global developmental disorders, and/or high abilities (BRASIL, 1996). According to data from the 2022 School Census, more than 90% of school-age special education students are enrolled in regular schools, with or without access to specialized educational assistance (AEE).

With the pandemic, people with disabilities have had their routines modified, such as access to rehabilitation, specialized educational care, and social care, in order to comply with the preventive measures imposed by social distancing. We can't deny that the presence of Covid-19 has been detrimental and has negatively interfered with the socio-affective, educational, health, and rehabilitation development processes of people with disabilities (PcD), also affecting their families. The new direction of the work offered to this specific audience had to follow a new flow, as it was necessary to reorder and change the ways of intervening in the context.

The suspension of classes due to the pandemic has highlighted numerous inequalities in access to school, both due to socio-economic factors and the historical exclusion of certain groups. As far as people with disabilities are concerned, social isolation has had a direct impact on them, since "all measures for access to social integration, education, and health care have been interrupted, leaving the socialization and interactions that until then had been provided to them in a personal and effective way" (FABRI, 2021, p. 141, translated by us).

In addition to the classes offered in regular schools, the special education public also has access to specific services in the context of the AEE, in light of which the National Education Council reaffirms the right of access to education for people with special needs in Resolution No. 11/2020, which provides educational guidelines for the realization of classes and pedagogical activities in person and not in person in the context of the pandemic. The document states that "it is up to the education systems, in the provision of schooling and Specialized Educational Assistance (AEE), to promote accessibility in non-presential or remote activities for students from the special education public" (BRASIL, 2020b).

In this context and from this new perspective, AEE is essential for the training of the target group of special education. This service, which must be integrated into the pedagogical-political project of the school, is defined by Decree Nº 6.571/2008 as "the set of activities, accessibility and pedagogical resources organized institutionally, provided in a complementary or supplementary way to the education of students in regular education" (BRASIL, 2008, art. 1, translated by us).

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The policies that regulate special education aim to guarantee democratic access to knowledge. In this sense, the pedagogical work offered to students with special educational needs should favor the plurality of actions that complement each other to promote inclusion with quality in the services offered (BAPTISTA, 2011). There are elements necessary for the provision of special education from an inclusive perspective, such as: teacher training to enable them to meet and include students with specific needs, accessibility, and family and community participation (PIMENTEL, 2012). The aforementioned elements are essential for students to be able to access Emergency Remote Learning, and for this it is necessary to restructure all teaching actions concomitantly, integrating the needs of people with disabilities in an articulated way with ERE.

Inclusive teachers must ensure accessibility in their classes, know how to make the curriculum more flexible following specific learning needs and know how to evaluate the learning process. Ruling No. 11/2020 deals with linguistic accessibility and states that education systems must provide instruction and assistance that takes into account the specific needs of each special education group and ensures that,

> a. Translation/interpretation in Brazilian Sign Language (Libras) and in written Portuguese for deaf and hearing-impaired students; b. Accessible and appropriate instructional materials and, where appropriate, captioning for deaf and hearing-impaired students; c. Accessibility of communication and information for students with visual impairments and deafblindness, in the use of specific codes and languages, including audio materials and audio description; and d. Resources to ensure curricular accessibility for students with visual impairments and deafblindness. Resources to ensure curricular accessibility for students with visual impairments and deafblindness. c. Accessibility of communication and information for students with visual impairments and deafblindness, in the use of specific codes and languages, including audio materials and audio description; and d. Resources to ensure curricular accessibility for students with impairments in the areas of communication and interaction (BRASIL, 2020b, translated by us).

In the face of social segregation, visually impaired students have been deprived of access to educational resources and activities adapted to their specific needs. As a result, special education has found itself in a situation where it is limited to existing Digital Information and Communication Technology (TDIC) resources, creating new demands. When it comes to teaching chemistry in the context of Emergency Remote Teaching (ERE), the resources for carrying out experiments are limited to alternative technological materials, methodologies, and pedagogical strategies for inclusion.

Thus, in order for students with VI to be able to learn chemistry in remote classes, it is necessary to rethink strategies so that they can participate autonomously in virtual classes under equal

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conditions, highlighting the need to study the main challenges faced by students in this period to enable decision-making aimed at meeting the specific demands of chemistry teaching.

3 METHODOLOGICAL PATH

Initially, this research was carried out at the LPEQUI (Chemistry Teaching and Inclusion Research Laboratory) linked to the Chemistry Institute of the Federal University of Goiás (UFG), which has a partnership with the institution that supports visually impaired people, where the chemistry classes studied in this research take place. The teachers in initial training (PFI) and continuing training (PFC) are UFG students and work at the Pedagogical Support Centre/Brazilian Centre for Rehabilitation and Support for the Visually Impaired (Support Institution) in Specialized Educational Assistance (AEE), teaching Experimental Chemistry classes on a weekly basis.

The partnership between the University and the Support Center was signed in 2009, and since then, the classes offered by the teachers in training at the institution have been carried out with the use of different cultural tools created and adapted by the members of the research group, as well as accessible materials and resources specifically designed for the teaching of chemistry, considering the theoretical-practical nature of this science for this specific audience, that is, the classes included experimental activities (BENITE et al., 2017).

Presentially, the challenges and limitations of teaching Chemistry to people with visual impairments were already diverse, since vision is the sense most used to collect experimental data in conventional experiments. Given the social distance and the uncertainty of returning to the classroom, the Ministry of Education provides the possibility of distance education during the period of social isolation, triggering the offer of Emergency Remote Teaching (BRASIL, 2020a). The regular schools in the State of Goiás began to organize themselves for the return of classes in a distance format, however there was no specific direction from the supporting institution guiding how the experimental chemistry classes with visually impaired people would be maintained at a distance since all the instruments and experiments used were designed for presential teaching.

Data were collected through a virtual meeting in which the visually impaired students answered a semi-structured questionnaire (Chart 1), which was audio and video recorded, transcribed, and analyzed. We investigated the challenges and requirements of the new format and how it would be possible to teach chemistry to this specific group, as well as the socio-economic and technological factors that would have a direct impact on Internet access and consequently on the learning process.

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We also aimed to analyze the context of those involved in order to differentiate the needs and demands, as well as the (re)elaboration of pedagogical interventions in a new format to minimize the impact of the geographical distance imposed by the pandemic.

Chart 1 -Questionnaire

N.	Question
1	Are you participating in distance learning? If so, which ones?
2	What is the structure of the classes you are taking? Are they remote classes via zoom or google meet, video classes via YouTube, WhatsApp, just receiving material?
3	What difficulties are you having with distance teaching?
4	Are the lessons more dialogical, conceptual or do you have any proposals for practical activities?
5	Do you think it would be feasible to return Chemistry classes to Fridays at the same time and duration?
6	What would be the best format or platform for chemistry lessons?
7	Would it be possible to hold experimental classes in remote education, using substances you have at home?
8	How are you feeling at the moment, with the pandemic, not being able to leave the house, what's it like?

Source: Elaborated by the authors.

The data was analyzed using the methodology developed by Bardin (2011), in which a collective floating reading is carried out. The statements are then cut into extracts that meet the research objectives. It is essential to consider the needs of all the subjects involved and to do this it is important to listen to the contributions of each of the participants in order to plan viable interventions in the specific context in which the students are inserted. It is therefore understood that planning must take into account the information obtained from dialog with the community so that adaptations can be made to meet the demands of the group being investigated. The participants in this meeting/interview were: 7 teachers in initial and continuing training and 7 visually impaired student.

4. RESULTS AND DISCUSSION

Chart 2 shows the three categories established for analyzing the participants' responses and the subjects covered in each of them.

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Chart 2 - Categories of analysis and subjects covered

Categories of Analysis	Issues dealt with in each category
1. Organization and functioning of education for people with disabilities during the pandemic: diagnosis	Assistance Format Technological resources
2. Students' perceptions of the challenges of teaching in the pandemic	Digital accessibility Lack of teaching support
3. Students' perceptions of psychological impacts in the context of the pandemic	Student demotivation Mental health

Source: Elaborated by the authors.

As far as the students are concerned, all the participants of the meeting were already in chemistry classes at the SUPPORT INSTITUTION, three of them blind and four with low vision. In chemistry classes, the diversity of the classroom must be taken into account, even within the specificity, in addition to the different characteristics of the disability and the school grade, the students also have different socio-economic conditions, since for some of them the access to the Internet is limited.

4.1 Organization and functioning of education for people with disabilities during the pandemic: diagnosis

Before the pandemic, the members of the study group attended both inclusive schools and the support center to access special education services. Thus, the first question asked was whether they participated in distance learning in other subjects, and almost half of the students still did not have access to classes or services, either at school or at the Special Education Service (A1, A2: Me!; A7: Me, only Physics!).

In Brazil, there were no national guidelines for the use of the methodologies adopted during the ERE, highlighting the challenges of providing this service, as there was also a lack of technological resources in educational institutions, as well as teachers with adequate training for distance learning (SILVA; AZEVEDO, 2022). Thus, the institutions had the autonomy to define the format of the services offered. In the speech of A1, we can see the use of synchronous and asynchronous classes using a variety of technological resources, such as WhatsApp, the audio and video platform (zoom),

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YouTube, as well as the application/platform developed by the State Education Network to send activities and materials to students.

> I'm also taking online classes, both on Zoom and through the app at the military school. They have an app for teachers to post assignments for students, which students copy into their notebooks and keep for their teachers to see when everything returns to normal after the pandemic. The military school has created an app just for military schools, where teachers post activities and we respond to them. There's no need to copy in a notebook, we can answer everything there. There are also video lessons on Zoom, the teachers send the link in the group, we go in and have the lesson, it's really cool. There are also lessons on YouTube. Some teachers also put videos on YouTube, so if you prefer that, there are different ways to learn. I'm participating in different models... There are also online exams. I'm still in exam week (STUDENT A1 - SUPPORTING INSTITUTION, translated by us).

As for the modality, A1 was attending both the Support Institution (special education) and the regular school (inclusive high school), while A2, A6 and A7 reported that they were only attending classes at the SUPPORTING INSTITUTION, with 3 different subjects, as shown in the chart below:

Chart 3 - Subjects, technology resources and teaching modality accessed by the students interviewed

Participant	Modality	Subject	Resources/strategies
A1, A2	Special Education	AVAS	YouTube videos and WhatsApp audios
A6	Special Education	Computing	Activities via WhatsApp
A6	Special Education	Sociology	Remote classes via zoom
A1	Inclusive high school	All subjects	WhatsApp, Zoom, School app.
A7	Special Education	Physics	*Zoom*

Source: Elaborated by the authors.

In the AEE offered by the Supporting Institution, visually impaired students have access to complementary and/or supplementary services to mainstream education. AVAS is a subject offered by the SUPPORTING INSTITUTION and the abbreviation used by the student refers to Autonomous Living Activities, where students are encouraged to develop autonomy by carrying out daily tasks. Physically, the SUPPORTING INSTITUTION has a special space that simulates a home where presential classes used to take place. During the pandemic, the teacher started working with the students, giving them activities to do at home, filming them, and sending them via WhatsApp. Despite the feasibility of the tasks suggested by the teacher, A2 claims not to have done them for three weeks.

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> The course I'm taking online is AVAS at the SUPPORTING INSTITUTION. They give us the content and then we have a week to do it. There are two or three weeks where I don't do it, but (laughs) it's okay. There's the group (on WhatsApp) where she sends out the activities. For example, this week it's canjica, which we have to make. She explains to us how to make canjica. She sends everything through audio. She looks for a video on the Internet that explains it step by step, a very simple video, so that we can understand everything, the amount, the measure of the things to put in, and we do it. We have to make a video of ourselves doing things and send it to her, for example: washing a pair of sneakers or making rice pudding. (STUDENT A2 - SUPPORTING INSTITUTION, translated by us)

Another complementary activity mentioned in Extract 1 is the computer class. A6 doesn't describe exactly how the classes took place, but she is dissatisfied with the strategy adopted by the subject teacher for the period of social distancing when she compares it with the remote classes offered by another teacher in the SUPPORTING INSTITUTION.

> A6: The sociology teacher at the SUPPORTING INSTITUTION who started this business of classes, all live, cute, that kind of thing. (...) I'm having a computer class, the teacher sends us an activity, we do it and send it to her. It's that kind of service, but it's not an online class). In addition to computer science, A6 was enrolled in sociology, a supplementary course to regular education, as well as the physics classes that A7 was accessing, both offered remotely through the Zoom application. (STUDENT A6 - SUPPORTING INSTITUTION, translated by us)

Each teacher at the support center had the autonomy to define the format of the distance activities during the period and the participant felt included because the resources used were accessible, however, according to Grzebieluka et al. (2022, p. 39, translated by us) "using communication platforms does not mean guaranteeing educational development and adaptation to technologies". Thus, for students to be able to learn school content using technological platforms, teaching practices, and teacher mediation must be adapted to the new format, providing not only access but also learning.

4.2 Students' perceptions of the challenges of teaching in the pandemic

The indicators of quality of learning and teaching show that in Brazil, the marked inequality puts vulnerable groups at a disadvantage when it comes to access to different levels of education, as is the case with people with visual impairments, because "when it comes to people with disabilities, this inequality increases the vulnerability of this population contingent, since they were already in a risk group, in social inequality and with denial" (SILVA et al., 2021, p. 2, translated by us).

Teachers need to be aware of the reality of students' digital access in order not to increase

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educational inequalities in remote education (PETRUS et al., 2021). For this reason, to better understand the student's relationship with the available technologies, as well as access to the Internet, we identified some of these elements, such as: a) lack of access to the Internet, b) instability of the Internet (A6: *...there are times when even the Internet of the boys in our group, of the teacher herself, fails*; A7: *My problem is more with the Internet only, because the Internet here is bad*), c) mastery of the tool (A6: *I thought I would never be able to get into the application*).

It's important to note that only students who had access to the Internet (stable) and electronic devices participated in the preliminary research, since it was conducted online, via Zoom, and not all students enrolled in the face-to-face chemistry subject had access to the WhatsApp group or the Internet, which characterizes our first contradiction of emergency remote teaching as exclusion of subjects that are not digitally included. Petrus et al. (2021) state that while alternatives such as remote teaching aim to reduce the impact of the pandemic on student learning, the use of standardized strategies tends to deepen existing inequalities in access to national education,

> Adopting a standard solution for remote teaching, especially those related to the use of computers and the Internet, without sufficient information about its students, tends to increase pre-existing inequalities since it does not take into account the differences between groups, especially in terms of access to this education. On the other hand, not taking measures to return to school or to strengthen the relationship between the student and the school can increase the dropout and truancy rates on their return, not to mention reducing overall learning (PETRUS et al., 2021, p. 14, translated by us).

Of the 18 students who participated in the WhatsApp group, only 7 were able to access the first meeting, and during the two years of the study, other students accessed the classes and participated in the remote activities from different cities and states. Given this data, it can be said that although remote teaching contributes to accelerating the insertion of TDIC in education, the lack of digital accessibility for many Brazilians has increased educational inequality in Brazil (SILVA et al., 2021).

Communication accessibility is a right for people with visual impairments, and in the context of the group studied, more than half of the students enrolled in the AEE Chemistry subject didn't even have access to the discussions because they didn't have access to the Internet. In this context, we can consider that the students in the group studied face different technological barriers, which, according to the Brazilian Inclusion Law (LBI), "are those that hinder or prevent people with disabilities from accessing technologies" (BRASIL, 2015, art. 3, translated by us).

> For the time being, classes are running smoothly. My problem is only with the internet, because the internet here is bad. Yes, the teacher is explaining well, I can

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> understand everything. (STUDENT A7 - SUPPORTING INSTITUTION, translated by us)

With regard to the instability of the Internet cited by A6 and A7, according to a study conducted by the Regional Center for Studies for the Development of the Information Society (CETIC, 2018), a significant portion of public school students find it difficult or impossible to access the Internet, and there is also a difference between those who use broadband and those who use 3G, which has a direct impact on the format of teaching and the type of content that can be accessed.

> In the online class, I'm following the content well, although there are times when even the Internet of the kids in our group, even the teacher, fails. The only problem I've had is when I wanted to install Zoom, I had to ask for help because there were a lot of things to write down to install it, so I had to ask for help. I thought I'd never get into the app, but then I did. I got into the sociology teacher's class. Now I can access it because the other students post the links there (in the group). All I have to do is click and I'm in. This business of not having access is a Brazilian problem. There are people who are worse off than us, who live in the corners of Judas, where you have to walk miles to get a line. It's a very complex problem (STUDENT A6 - SUPPORTING INSTITUTION, translated by us).

Regarding the mastery of the tool, if we consider that digital accessibility is a mechanism to reach any content on the Web that all people should have without the help of others, regardless of their needs (SILVA et al., 2021), we can see in A6's response that the student is not yet digitally included, despite having broadband Internet access, the student faces technological barriers when she needs support to use the Zoom Meetings software to access remote classes. Even after downloading and accessing the software for the first time, the student can only access the virtual classroom with the assistance of her classmates, who convert the call ID to a link so that the student can simply click to enter the virtual classroom.

Another challenge presented in the students' responses and highlighted in this category was the lack of support from the teachers (A1: *send an assignment and that's it, do it, no explanation, it's up to you... apart from the math teacher who is very present, the rest of the exact subjects are the same*), as evidenced in A1's speech.

> So, teacher, chemistry is a little more complicated for everyone because the chemistry teacher isn't very present. She leaves a lot to be desired when it comes to online classes, you know? (...) So, teacher, she's one of those teachers who sends you an assignment and that's it, you do it, no explanation, you get on with it. She just sends it, you know? She doesn't have online classes, she doesn't go out of her way to help us with a lot of things. Not that she's a bad teacher, she's a great chemistry teacher, but in online classes, in distance classes, she falls short. The physics teacher too, in fact, except for the math teacher who is very present, the rest of the subjects are the same. The physics teacher, at first the same as the chemistry teacher, is now teaching online (zoom) every Friday morning, sometimes even twice a week, so he's doing very well, we're learning a lot from him. He starts activities, he starts videos on YouTube, there's Zoom... (STUDENT A1 - SUPPORT INSTITUTION, translated

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by us).

The challenges associated with lack of support are not limited to the student-teacher relationship during the pandemic. According to Silva et al. (20-23), many teachers felt abandoned during the period of social distancing and had to deal with several problems to maintain teaching, such as increased workload, lack of direction in planning appropriate teaching activities for the distance format, and lack of resources and technical support.

Costa (2013) points out that teacher training practices for the use of TDIC have favored the acquisition of technical knowledge, and have not trained teachers with adequate digital skills for the incorporation of technologies in the educational context. The resources used during the pandemic were developed before the need for social distancing, but teachers had to appropriate and use digital tools in a compulsory and emergency way, and the educational scenario that emerges from this need triggers a context of uncertainty not only for students but also for teachers and school management.

The teacher mentioned by A1 faced the same challenges as countless other teachers to adapt and offer educational activities to hundreds of students. There was no lack of participation, as the teacher regularly posted activities on the application developed by the school. However, because she didn't offer lessons in the format that the students wanted to learn in the virtual format, the characterization was that although she was a good teacher, she fell short in the distance format (A1: *she's a great chemistry teacher, but in online classes, she falls short in distance classes*).

For example, A1 points out that another teacher has moved beyond using the app to other platforms and formats, thereby increasing the support for teaching (A1: *The physics teacher, in the beginning, was the same as the chemistry teacher, now he teaches online (zoom) every Friday morning, sometimes even twice a week, he's very good, we learn a lot from him. He starts activities, he starts videos on YouTube, there's zoom*...).

Given the students' responses, the format that best meets their learning needs in the above context is remote (synchronous) teaching using the Zoom app with WhatsApp support. As far as the specificities of chemistry teaching are concerned, the challenges are to develop didactic-methodological strategies that allow the teaching process to be based on language and the use of alternative materials, both for carrying out experimental activities at home and for representing the symbols inherent to chemistry, which in the AEE use resources that have already been adapted.

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4.3 Students' perceptions of the psychological impacts of the pandemic

Among the challenges mentioned by visually impaired students, one of them refers to their lack of motivation concerning distance learning (A2: *courage to do it... laziness*). Santana et al. (2023), in their study of the challenges of emergency remote teaching, showed that student demotivation is one of the factors and that this is due to shaken mental health as well as the difficulty of learning through video classes. In Extract 4, the students present some problems related to inattention due to social networks, lack of resources to develop the lessons, and also lack of access to the resources provided by the school due to some technical problem (A1: *The biggest difficulty is when the app goes down*).

> The courage to do it. I don't find it difficult because the teacher explains to us how to do things, so it's not complicated, so far everything is going smoothly. I can keep up with the content, but the problem is that I haven't done it for three weeks, three weeks including this one that's coming to an end, because... because I'm too lazy, because whatsapp doesn't let me, and... that's it. And the other one is because my mom's tank at home is broken, so I can't use it. (STUDENT A2- SPONSORING INSTITUTION, translated by us).

A2's statements support the idea that learning is not only ensured by access to technology, resources and diversified methodologies (A2: *I haven't done it for 3 weeks, 3 weeks including the one that's running out now*), but the attention of the family and teachers is essential in terms of learning strategies and student involvement, especially for the special education target group (A1: *The teachers are always on call, we have a WhatsApp group with all the teachers*).

> So, teacher, I'm not having so many difficulties because everything is very accessible. The biggest difficulty is when the app goes down. I end up missing an activity or something. The school app is very accessible. I'm not going to say 100%, nothing's perfect. And the teachers are always on call, we have a whatsapp group with all the teachers (STUDENT A1 - SUPPORTING INSTITUTION, translated by us).

Leontiev (1978) presents a need in the structure of (human) activity, which materializes in a motive that links it to the goal. If students don't have learning motives, they are unlikely to find the need to learn the content or carry out the proposed teaching activities. From this perspective, the teacher plays a crucial role in guiding the teaching to generate the student's need to appropriate this concept so that the school fulfills its social purpose (ROSA, et al., 2010).

The meaning that the subject attaches to its objectification can change the motives of the activity. They are considered or become effective motives when they coincide with objectification, or they may not coincide, resulting in motives that are only

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comprehensible and incapable of producing an activity (LEONTIEV, 1978). Given the above, another contradiction of emergency distance education has emerged: teachers have to stimulate students and develop teaching strategies that motivate students to learn, even without adequate resources, without guidance, without professional recognition, with difficulties in contacting students, excessive working hours, and an increase in psychological stress (SILVA et al., 2023).

The teacher-student relationship is a critical factor in both the students' commitment to the proposed activities and their emotional well-being. However, during the pandemic, teachers showed higher levels of stress, anxiety, depression and fear of Covid-19, exacerbated by the responsibility of teaching (CALDAS; SILVA; SANTOS, 2022). Even before the pandemic, mental health was a public health concern, particularly among adolescents. During the pandemic, there was an increase in depressive and anxiety symptoms in young people, which is a cause for concern, particularly about vulnerable groups who need interventions to reduce emotional distress. Vasquez et al. (2022, p. 313, translated by us) emphasize the importance of face-to-face activities for maintaining the mental health of adolescents, given that "school is a space that represents not only a place of study but also a place of agglomeration and coexistence with other people of their age," as evidenced by A2's statement:

> So at the moment, I find it very complicated because we feel very trapped and whether we like it or not, at some moments in our life we feel a little bit alone, I don't know, because as we were used to walking around with a lot of people, going to the SUPPORTING INSTITUTE every day, seeing this mess, seeing PG1 telling us to be quiet (laughs), it's complicated, you know? And whether we want to or not, there are times when we forget our masks, forget to put alcohol on them, forget things, and we even get a little afraid to leave the house because of these things, because of these things that we have to use to prevent it. I avoid going out as much as possible, I only go out with my parents or my sister or someone I know who will always remind me of things, and when I do go out, it's from my house to my aunt's house, you know? Like my dad says, "Keep your hands up, don't touch anything. It's very complicated, it's terrible people, terrible, terrible. If we're not careful, we'll get depressed (STUDENT A2 - SUPPORTING INSTITUTE, translated by us).

Student A2's statement confirms Vasquez et al.'s (2022) assertion that school routine would mitigate the impact on students' mental health, but students show concern about Covid-19 cases (A2: *afraid to leave the house; A3: using alcohol gel all the time; A6: on the one hand, it's good that we protect ourselves*). School-age visually impaired people, when they use special education and AEE services, socialize daily with their regular school classmates in one shift, and in the other shift they participate in classes aimed at the specific public, where they also socialize with other visually impaired classmates so that the school routine of the students interviewed represents a large part of the social interaction of this public.

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> This pandemic sucks for me, because as everyone here knows, I used to spend the whole day on the street, walking around, and with this pandemic, I can't even go out on the street, practically, but I still sneak out because no one deserves it either, more than three months. Just yesterday I went out, you know, but like this, taking care all the time by applying alcohol gel, the others stopped to help me, grabbed my arm, grabbed my shoulder, then where people grabbed me, I applied alcohol. There were even some people laughing at me inside the axis because I was applying alcohol where people were picking it up (STUDENT A3 - SUPPORTING INSTITUTION, translated by us).

Considering that social relationships have a direct influence on the subject's development, the challenges posed by social distance can modify the potentialities and limitations of those involved in the teaching-learning process, since for Vygotski (1997) the psychological development of people with or without disabilities is the result of a dialectical intrapsychic process that is intrinsically related to what happens in the intrapsychic sphere. From this perspective, both the relationship with other students (mentioned by A2) and with the teacher (A6: *she kept on top of me so that I could get better every day*) in a face-to-face format can contribute to the subjects' learning and development.

> On the one hand, it's good because we're protecting ourselves, but on the other hand, I miss presential classes, there's nothing like face-to-face classes. I used to have face-to-face computer classes, it was really good because I'd ask questions in class, together with the teacher, and she was on top of things so I could get better every day. When I came to the SUPPORTING INSTITUTION, I didn't know anything about computers, I didn't even know how to type properly, I knew the very basics, but I miss that thing when the teacher was by my side telling me "look, you're getting this wrong or that wrong", "you're getting this right", I miss that, it's not the same as me sending her the content, her evaluating it and saying "oh, that's ok, she's here with me, that's cool". I think human warmth is much better (STUDENT A6 - SUPPORTING INSTITUTION, translated by us).

Teaching people with visual impairments requires the use of accessible tactile or technological resources and also requires mediation as a fundamental element for the use of instruments and signs in learning school concepts (VYGOTSKI, 2007). In the AEE cited by A6, in addition to accessible computers, students with VI participate in classes that take into account the specificities and learning moments of each student to stimulate development as much as possible (A6: When I arrived at the SUPPORTING INSTITUTION, I didn't know anything about computers, I couldn't even type properly), thus highlighting the importance of developing the necessary skills beforehand so that they can participate in virtual classes through AEE. In light of the above, in order to ensure equity in the provision of education for the small proportion of the special education target population who have digital access and the skills to use the proposed tools, different strategies must be adopted to reduce educational inequalities and the harm caused by ERE.

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5 CONSIDERATIONS

This research was based on the concept of education as a right, which involves organizing the education system to take into account the specific needs of students who are the target of special education, with a focus on visually impaired students. Our findings show that the school plays an important social role in the lives of students and has different roles beyond teaching school content.

Based on the dialogue between seven visually impaired students and teachers in initial and in-service training who shared their experiences during the ERE, the analysis of these students' perceptions revealed three main categories: 1) the organization and functioning of the education of people with disabilities during the pandemic; 2) students' perceptions of the challenges of teaching during the pandemic; 3) students' perceptions of the psychological impact related to the pandemic.

Concerning the first category, it was possible to characterize the predominant format of teaching activities as well as the TDICs selected by mainstream and special education teachers and accessed by students. In category 2, regarding the challenges perceived by the students, there was evidence of digital exclusion of some visually impaired students due to: lack of access or limited access to the Internet and difficulty in using the selected digital tools. There were also reports of a lack of instructional support. In terms of students' perceptions of the psychological impact, category 3 highlighted the importance of face-to-face teaching for students' mental health and showed that students were demotivated to carry out and participate in the proposed activities.

Based on the categories analyzed, we concluded that the main impact of distance education for visually impaired students was due to educational inequality, which was accentuated during the period of social distancing, as well as the lack of specialized attention for the public. On the other hand, we understand that visually impaired students who have been rehabilitated and have the autonomy to use accessible TDIC resources have excelled and managed to learn with greater quality.

Reflecting on these perceptions, we conclude that it is essential for teachers to use methodologies that encourage student participation, taking into account the technological space and the student-technology relationship, in order to minimize learning losses, sparking the need for new research aimed at the intersection of distance education and special education modalities.

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