

Investigating Remote Teaching: How Google Meet and Zoom Affect Teachers and Students' Experience

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Abstract: Due to the suspension of in-person classes caused by the COVID-19 pandemic, educational institutions had to adapt to remote teaching. Thus, videoconferencing tools were adopted to make it possible. However, using these tools can impact the remote teaching experience. In this paper, we present an investigation about the Google Meet and Zoom. We considered teacher and students profiles concerning Usability, a quality attribute that allows assessing the ease of use of user interfaces, and the User Experience (UX), which provides a holistic view focusing on subjective aspects such as affect and emotions. The purpose of Usability and UX is to understand the impacts of the tools on the quality of the remote teaching experience. Our results indicate that besides the tools, the interaction between teacher and student, in the context of synchronous classes, impacts the remote teaching experience, being an essential aspect of discussion and enabling further investigations within the technology-supported education community.

1 INTRODUCTION

Due to the context of the COVID-19 virus pandemic, the World Health Organization (WHO) started to recommend a series of measures to reduce the spread of the virus, one of which was social isolation (OMS, 2019). As a result, countries that adopted the practice of social isolation had to stop several face-to-face activities, seeking to encourage the population to stay at home. One activity that was heavily affected was face-to-face teaching.

The suspension of face-to-face teaching activities in several countries created the need for teachers and students to reassess the support services for online teaching to face the challenges in the educational environment. For instance, face-to-face teach-

ing methodologies and practices had to be adapted to emergency remote teaching (ERT) (Lin et al., 2021). In Brazil, the Ministry of Education advised that face-to-face classes would have to be replaced by classes through digital media. Thus, many educational institutions have adopted ERT, using technological tools to continue activities. In this context, videoconferencing tools have become essential to allow interaction between teachers and students.

However, with the sudden adoption of ERT, teachers and students had to adapt themselves to use these tools. In this process, some difficulties may arise, such as the lack of training to master a new tool and the negative attitude towards the concept of remote teaching (Kalimullina et al., 2021). Thus, the purpose of this paper is to present an investigation about two videoconferencing tools, Google Meet and Zoom, using two quality perspectives: usability and user experience (UX). For this, we carried out a study involving a usability test to capture aspects of use related to the tools and a UX evaluation to capture the user experience when using them, considering the teacher and student profiles. This investigation aims to understand how these tools can impact the remote teaching experience, considering this impact as an important aspect to be investigated in education supported by technolo-

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gies. The following sections present the steps we did in this investigation.

2 BACKGROUND

This section presents the concepts of usability and UX, which are fundamental for understanding the research reported in this paper. In addition, we present works related to this research to contextualize it.

2.1 Usability

According to the software quality standard ISO 9241-11, usability is “the measure that a system, product or service can be used by specific users to achieve specific goals with effectiveness, efficiency and satisfaction in a given context of use” (ISO, 2018). Nielsen et al. (2012) say that usability is “a quality attribute that assesses how easy user interfaces are to use”. They say that if a system hypothetically manages to do what the user wants, but the interface is difficult to interact with, it is likely to be soon replaced by another system that meets this user’s needs (Nielsen et al., 2012). Therefore, usability is a quality attribute that allows us to assess the ease of use of user interfaces.

Usability is defined by five components that qualify how well a person can interact with a system: learnability, efficiency, memorability, error tolerance, and satisfaction (Nielsen, 1994). It is possible to assess usability through usability tests, which employ techniques to collect empirical data, where the user performs a series of tasks elaborated by an evaluator. Usability tests aim to show usability problems under the users’ perspective (Rubin and Chisnell, 2008).

2.2 User Experience (UX)

By focusing on ease of use, usability is related to the objective aspects of use, on how to use a feature. The concept of User Experience (UX) provides a more holistic view, focusing on subjective aspects, such as affection, sensations, emotions, and value of user interaction (Law et al., 2009). According to Hassenzahl (2018), UX can be characterized in two qualities: hedonic and pragmatic. Pragmatic qualities provide effective and efficient means to handle a product, while hedonic qualities emphasize users’ psychological well-being. (Hassenzahl, 2018).

There are different techniques for evaluating UX. Rivero and Conte (2017) carried out a systematic mapping study where 227 techniques that assess UX were identified between the years 2010 and 2015.

The techniques are interviews, scales, forms, checklists, exploration with acquaintance, probes, experience sampling, and controlled user monitoring methods. Finally, the UX evaluation captures the user’s experience about the tool.

2.3 Related Work

In the educational setting, technological tools are among the resources most used by teachers to facilitate student learning (Eady and Lockyer, 2013). Digital devices, software, and learning platforms offer a range of options to give support to teaching (Herold, 2016). Kuss et al. (2019) sought to identify applications for mobile devices that might be suitable to support the teaching-learning process. The results show mobile applications that describe some specific use in the classroom, including support activities for the teacher, such as dictionaries, schedules, and applications aimed at specific subjects.

Among the technological tools used for teaching, there are videoconferencing tools. Kumar et al. (2015) showed that videoconferencing tools in remote teaching provide real-time interaction, enabling feedback and promoting student-centered engagement. Considering teaching in times of pandemic, the videoconferencing tools adopted in the ERT become even more relevant since these tools are widely used to carry out synchronous and remote classes (Singh and Awasthi, 2020). Singh and Awasthi (2020) carried out a comparative study of several videoconferencing platforms to highlight their advantages and disadvantages. These tools have features that increase users’ control and security regarding the advantages. For example, Zoom can disable the participant’s screen sharing, and Google Meet maintains control over the user’s data.

The adoption of videoconferencing tools that support teaching is not trivial. As pointed out by Knapp (2018), one of the difficulties of online teaching is the lack of interactivity between teacher and students and the lack of face-to-face contact. She also mentioned that the feeling of isolation and lack of motivation that students usually experience due to the lack of interactions they are used to, such as social interaction, is one cause for the evasion of students from online courses.

Vandenberg and Magnuson (2021) compared attitudes towards the use of Zoom for remote teaching of bachelor’s degree nursing, considering students and professors. The data, collected through a Likert scale survey, indicate that students’ attitudes towards the remote classroom experience were immensely negative, mentioning psychological barriers such as stress and anxiety. The data also indicate divergence between

professors and students regarding the receptivity in using Zoom. However, both groups prefer traditional classrooms to the tool.

However, there are positive effects regarding videoconferencing tools in remote teaching. Al-Marroof et al. (2020) state that the online classes application's effectiveness is highly dependent on the adoption of technology as means of remote teaching. The study investigates the impact of Google Meet in the context of the COVID-19 pandemic and the importance of choosing an effective and appropriate technology that reduces the fear factor (uncertainties and anxieties that the pandemic caused in students) during remote educational processes. Their results found that students' usefulness and ease of use significantly affect the acceptance of the chosen tool, reducing the fear factor and encouraging students to attend scheduled classes.

While illustrating the use of videoconferencing tools, Maher (2020) shows two projects that can successfully support online teaching and learning. In the first project, videoconferencing tools (Skype and Zoom) were used to support classes for hospitalized K-12 students. The second project used these tools with students at a university adopting the remote teaching model due to COVID-19 restrictions. The results indicated that videoconferencing allowed informal group interactions, such as games and conversations during class breaks, helping teachers and students establish social relationships.

All these studies focus on the tools' functionalities and remote teaching itself. However, few studies address the remote teaching quality experience and the interaction between teachers and students in this context. In addition, none of them consider quality criteria related to tools and their experiences of using them, such as Usability and User Experience (UX).

Therefore, we report in this paper the usability and UX analysis of the Google Meet and Zoom tools, aiming to investigate how such videoconferencing tools impact the quality of the remote teaching experience. We used the usability test to verify functionality aspects that can affect the interaction between teachers and students. We also used the UX evaluation to check whether the experience of this interaction is pleasant or not from the subjects' perspective.

3 METHOD

As the investigation consisted of evaluating the impact of the tools from the student and teachers' point of view, the most appropriate way to assess usability would be through user testing. We decided to use

the usability test with teachers and students to investigate their perceptions using videoconferencing tools. To investigate the experience of teachers and students with videoconferencing tools, we decided to use interviewing techniques, such as a UX interview and the Audio Narrative technique, and a scaling technique, the Affect Grid.

Due to the limitations of pages, the artifacts used in the usability tests and UX evaluation can be found in the Technical Report (TR) (Aguiar et al., 2022). The study had five researchers who acted as evaluators and applied the usability test and UX evaluation to 15 subjects. This section shows how we conducted the usability test and UX evaluation.

3.1 Selection of Subjects

Among the subjects, five are teachers: one at elementary and high school, one at technical education, and three professors. Four teachers teach languages (two in higher education, one in technical education, and one at elementary and high school) and one agronomy professor. As for the ten students, one student was from elementary school, one from technical education, and eight from higher education. We selected different education levels for teachers and students to check if their impressions would be the same about the tools considering different contexts.

Three teachers have training in videoconferencing tools (Meet and Zoom) provided by their educational institutions, while two professors did not. Regarding students, three had never used Zoom, one had never used Meet, and six had used both. All subjects gave their consent to use their data in this study through a consent form.

Although there was hardship in recruiting subjects during the pandemic caused by COVID-19, it was still possible to gather 15 participants. Despite the differences in subjects' education levels, we did not assess skill issues with technologies and maturity, but their experiences using these tools in remote teaching.

3.2 Study Objects

Videoconferencing tools make it possible to connect on a global level. Whether in meetings, classes, or other non-face-to-face interactions, it is possible to transmit them in real-time. During the COVID-19 virus pandemic, such technologies have been widely explored, as they are closer to traditional classrooms of face-to-face teaching. It is possible to interact with other users through audio and video simultaneously. In recent years, several tools have emerged that allow this connection between people. Among these video-

conferencing tools are Google Meet¹ and Zoom².

Google Meet (which we will call Meet) is a video-conferencing service developed by Google, enabling real-time meetings. This tool is widely used, especially for its simplicity, as it is possible to join a meeting through a link provided by the host. Zoom is a program that allows videoconferencing calls. Zoom Video Communications developed it, and it has different plans to use the extra features offered by the tool. We used Google Meet (prior to the May 24, 2021 UI Update) on its web version while using the app for Zoom (version 5.6.6).

3.3 Usability Tests

3.3.1 Tasks Script

We used a task script for the usability tests, containing activities to be performed by the subjects on Meet and Zoom, together with the interview technique. The script considers standard features, aiming to perform similar tasks. All these features were made for both teachers and students. The task script contains the activities that can be most commonly performed during remote teachings, such as starting a presentation or using the drawing board.

For the metrics we used for the test, we considered the following: the number of errors made by users, their opinions regarding the task, and the evaluator's observation while the users performed the tasks on both tools. The task script and the metrics table used can be found in the Technical Report (TR).

3.3.2 Interview of Usability Stage

We carried out one interview with each subject separately to understand the subjects' perceptions about videoconferencing tools. For the interview, we designed questions to understand the users' perceptions about the tools' interface and how they interacted with them (whether they had any difficulties or not). The questions asked in the interview can be found on TR.

We explained the meaning of each question to the subjects to avoid ambiguities in the interpretations of these questions. For example, in question 1 ("Which interface did you find most inviting? Which had the most user-friendly or intuitive interface?"), the concept of "inviting" used was the following: if the tool is attractive or captivating, which makes the subject want to use it.

¹<https://meet.google.com/>

²<https://zoom.us/en-us/meetings.html>

3.4 UX Evaluation

3.4.1 Interview of UX Stage

We designed the interview to collect data of interest to the investigation in the context of UX. For teachers, we sought to understand how these tools interfere with the motivation to teach synchronous remote classes (QT1), specific resources for teachers provided by the tool (QT2), its interference in their classes (QT3), and how the tool can make them more efficient (QT4).

For students, we sought to find out whether these tools influence their attention (QS1), how the student perceives the teacher transmits the content (QS2), whether the timespan of classes interferes to their attention (QS3), and how these tools could make the synchronous remote classes more beneficial (QS4).

3.4.2 Audio Narrative

Audio Narrative is a qualitative technique that allows users to verbally retell their experiences in a free story format. Stories about the product are recorded in audio and may include topics to support user-reported issues (AllAboutUX, 2021).

We chose this technique to capture more information about the experiences of teachers and students using Meet and Zoom in the ERT. Besides that, the users would feel more comfortable reporting their experiences, which might not have been possible to collect during the interview.

3.4.3 Affect Grid

Affect Grid is a quantitative technique in scale format, designed as a quick way to assess the dimensions of pleasure-displeasure and arousal-sleepiness (Russell et al., 1989). In this technique, the user marks their emotional state concerning a product on a 9x9 grid, where excitement forms the y axis and pleasantness the x axis. We chose this technique for its simplicity and for quickly obtaining information within the scope of pleasure and arousal.

3.5 Execution

First, we performed the usability tests in Meet. After executing the task script, we performed the UX evaluation. For the Audio Narrative, we asked the user to tell (if they wanted to share) any interesting happening using the tool in moments that were not part of the test execution. As for the Affect Grid, we asked the user to select a row and a column that best represented their experience with the tool, considering all

the times they used it until the moment of evaluation.

Then, we carried out the same procedures on Zoom and, at the end of execution, we carried out both interviews with a focus on usability and UX. The Usability Test and UX Evaluation took an average of 40 minutes to complete the entire assessment process.

4 RESULTS

We divided this section into two parts: usability tests results and UX evaluation results. The Subsections 4.1 and 4.2 report the results obtained with the techniques used in each evaluation.

4.1 Usability Tests Results

4.1.1 Results of Test using the Tasks Script

For a better understanding of the usability tests results, we grouped all the difficulties encountered by students and teachers. The difficulties found between these two groups were derived from similar tasks (Figure 1). The total of 15 subjects, we found that nine had difficulty in “presenting content with audio” on Meet, while seven had the same problem on Zoom.

The task “open drawing board” proved problematic in both tools, where five users found the activity complicated on Meet and six users on Zoom. Regarding the “change background” task, four users had problems with Zoom, and two users had problems with Meet. Among those who had any difficulties, even teachers who had received training in the tools were included. Finally, some users had no difficulties running the tasks, three on Meet and five on Zoom.

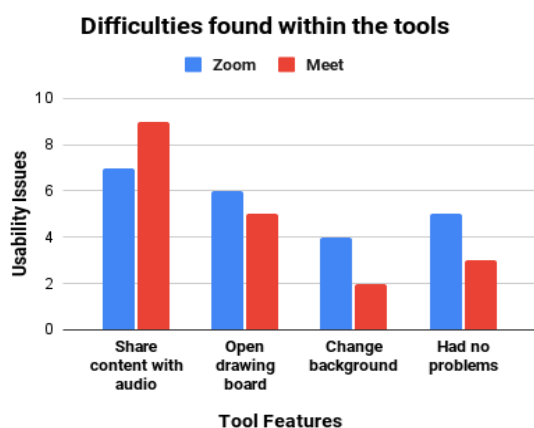


Figure 1: Difficulties found by subjects while running the tasks within the Usability Test.

4.1.2 Results of Interview about Usability

During the interviews, users indicated which interfaces they considered the most attractive. Regarding teachers, three answered that they prefer Zoom, according to them, because it has more interesting features than Meet, and because they believe that Zoom performs better on their computer. The two teachers who prefer Meet believe that this tool is easier and simpler. For students, the preference was balanced. Five students prefer Meet because they consider it simple and more agile to use. Meanwhile, the other five students prefer Zoom because they believe its features are more interesting and present better performance on their computers.

We extracted other general questions to be considered about these tools from both the interview and the “user’s opinion” usability metrics. Among them are the paid plans these tools offer, the need to install one of them (Zoom), and the difficulty of people of a certain age to fully understand how these tools work.

4.2 UX Evaluation Results

4.2.1 Results of Interview about UX

Interview results were divided between teachers and students, as the questions addressed to each audience were different. Three of the five teachers interviewed reported that videoconferencing tools discourage them from giving their synchronous remote classes. Their comments alternate between these tools have a hard time running on their computer, difficulties using these tools, and the limited dynamics of remote teaching. The latter is related to interaction limitations that would not occur in face-to-face teaching, and thus, is not related to videoconferencing tools.

When asked about their beliefs on these tools interfering with students’ participation, four teachers believe that they do not, reporting various justifications as to what could interfere. For instance, we highlight the internet connection problems, the student’s interest in that class, and the teacher’s responsibility to present content in a stimulating way. The teachers who believe these tools interfere responded to their experience in these classes, despite the question being related to the students. They reported that these tools could provide more features that collaborate with their meeting room control. For example, teachers can lower a student’s hand, as reportedly students forget to disable the “raise hand” feature, which can disrupt the class flow.

Five of the ten students interviewed believe that these tools influence the synchronous remote classes’ attention and/or absorption. For example, when the

tool is difficult to use, the teacher may have problems in ministering their classes, hindering the experience of both. In addition, these students reported that the class being by videoconference is another factor influencing the attention and/or absorption of the class content. The other half of the students believe that these tools do not influence them, reporting that the responsibility is of the various distractions of their environment. For instance, they mentioned actions such as accessing content on the internet unrelated to their class and performing other tasks during class time.

When asked about the tools' interference on teachers' transmission of content, seven students believe that these tools do interfere, reporting that teachers' lack of knowledge about these tools' resources can harm them, leading them to explain the content in an unusual way of their didactics. A reported example is when a teacher cannot present slides or use the drawing board to improvise the content demonstration to continue the lesson.

Regarding the timespan of synchronous remote classes, one student reported dissatisfaction with Zoom for the time limit imposed in meetings for non-subscribers to its paid plans. Eight students also reported that the timespan of the synchronous remote classes affects attention, stating that a too long class is not ideal for remote teaching, making it tiring and prone to distractions. Although this result is not the tools' responsibility, it substantially impacts the remote teaching experience.

4.2.2 Audio Narrative Results

Regarding the Audio Narrative technique results, it was possible to observe similarities between the total reports from the 15 subjects (not distinguishing between teachers and students) grouped into three categories. The first, which we called "Inconsistencies", refers to reports where the tools presented unexpected behaviors, for example, resources that disappeared and reappeared eventually. It was not possible to discover the reason. There were reports of six subjects directed at Meet in this category, related to changing the background and recording the meeting, and none directed at Zoom.

The second category, which we called "Usability Problems", reports the difficulties in interacting with the tools. Three subjects reported problems presenting content with audio on Meet, and three reported dissatisfaction with being removed, without warning, from the meeting when they reached the 40-minute timeout on Zoom.

The third category, which we called "Remote Interaction Experiences", consists of general experiences related to the context of remote teaching. Four

subjects told about experiences related to Meet, reporting discomfort with the low interaction levels and presence of people in the meeting, as they kept cameras and microphones turned off. Meanwhile, three subjects reported contentment with Zoom for features that provided a good experience, such as the Break-out Rooms function, which allows splitting a meeting into up to 50 sessions.

4.2.3 Affect Grid Results

Regarding the Affect Grid, in Figure 2, it can be seen that, concerning the students' perception of Meet, most results are concentrated in the upper right portion. These results show neutral feelings tending to pleasant feelings.

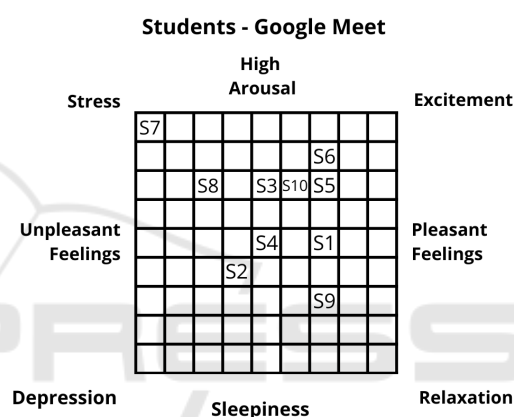


Figure 2: Students' Affect Grid regarding Meet.

Teachers, regarding Zoom, are more dispersed in the grid. However, most teachers tend towards pleasant feelings (see in Figure 3). In Zoom, the pleasant feelings may be due to the fact that three teachers prefer to use this tool. For comparison, the equivalents results of each grid can be found in the TR.

5 DISCUSSION

Analyzing the results to investigate the quality of the remote teaching experience through videoconferencing tools, we obtained some relevant points. Most students showed the impact when the teacher did not have the appropriate knowledge of using these tools. Most teachers reported a lack of motivation regarding using these tools, and one of the reasons given was the difficulty in handling them, despite the majority being trained in at least one of the tools. We observed these results through both the UX evaluation questions (questions P1 and A2 from Table Questions UX (Aguiar et al., 2022)) and the reports of Audio

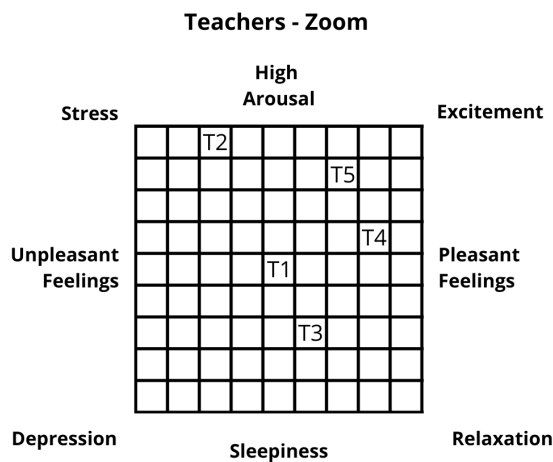


Figure 3: Teachers' Affect Grid regarding Zoom.

Narrative.

These results show that usability issues seem to harm the experience of both students and teachers in remote teaching, so these tools must be easy to use. This can be seen mainly in the features most used during classes, such as presenting content and opening the drawing board (tasks in which both Meet and Zoom have shown usability issues for students and teachers). The users' preference regarding the interface was another important point that impacted the experience. Even though the tools encompass good features, some students do not like the interface because it seems confusing (regarding Zoom). On the other hand, those teachers still prefer Zoom because of its features and forget about the confusing and unattractive interface. Therefore, these tools must have good features, thus making lessons more interesting, but this is not enough. It is necessary to be concerned with usability issues because if a tool is difficult to interact with, it is likely that another will replace it.

Teachers who prefer Meet reported that the interface is simpler than Zoom, thus also more accessible to students due to its ease of access, i.e., it does not need installation as Zoom does. This preference may point that the simplicity of a videoconferencing tool contributes to a less convoluted remote teaching experience for both teachers and students. This was also demonstrated in Al-Marroof's (2020) study, which states that applying online classes is highly dependent on the technology adopted.

The results reported in the UX evaluation (Section 4.2) indicate that videoconferencing tools work as a bridge between students and teachers and that, for the remote teaching experience to be pleasant, mutual collaboration is necessary. This can be seen clearly as more than half of the teachers agree that conditions extrinsic to the tools also interfere with student par-

ticipation, such as the way the class is taught and the student's dedication.

It is possible, observing the results of the Affect Grid, to relate the divergent results between teachers and students in Zoom reception with the findings of Vandenberg and Magnuson (2021), which also indicate divergence between teachers and students regarding receptivity in the use of Zoom. Regarding the students, their study indicates that the experiences of remote classes using Zoom seem to be negative for psychological reasons. However, in our usability results, some students indicated a negative experience regarding using Zoom because they found the interface confusing. At the same time, three teachers still prefer Zoom because of its features.

In addition to the factors we presented above, which are related to the tools themselves, in the Audio Narrative reports, subjects pointed that issues related to the remote class itself can also affect the experience. For example, classes that cause discomfort or inattention if there is no mutual engagement and participation, such as in classes where students' cameras are kept off, as reported by one of the subjects "My online classes are always with the teacher talking and us with the camera off. Sometimes I just sleep. When I wake up I see that I am alone in the meeting room". Also, as the reports indicate, students can be easily distracted by factors unrelated to the remote class, making cooperation evident and necessary.

The videoconferencing tools we investigated in this study can interfere with the quality of remote classes experience. One of the reasons is that these tools were not created to conduct remote classes but were used even so, as they allowed for an interaction closer to the face-to-face classroom.

Lastly, considering that it is impossible to train all teachers regarding these tools and that even those who have training have difficulties, these tools need to have good usability. We state this because teachers who have not received training will need to handle these tools independently. As mentioned in the students' interview, not knowing how to handle a tool's resources may harm teachers' performance when teaching their classes, leading them to improvise in the content presentation. This improvisation can hinder students from absorbing the content.

6 CONCLUSION AND FUTURE WORK

This paper presents an investigation seeking to understand whether the videoconferencing tools used in remote teaching influence the remote classes' expe-

rience quality. We executed a study involving the videoconference tools Google Meet and Zoom, performing the usability test and UX evaluation with 15 subjects, including teachers and students. The results indicate that these tools can interfere with the quality of the remote teaching experience and that teachers and students need to cooperate for a positive remote classroom experience.

It is relevant to evaluate other tools used in this context for future work. For example, tools focused on other types of interaction, such as game-based learning platforms. These assessments are necessary for a more holistic understanding of remote teaching and the solutions designed for this context.

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