Future Trends in Work Remote, Videoconferencing and EaD: Exploring Technological Innovations for Collaboration Virtual

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Abstract. With the increase in remote work and distance education (EaD) and the growing use of video conferencing tools and virtual environments for learning and collaborative work, it is essential to explore existing tools to such tasks - as well as pointing out future trends in this constantly evolving field, whether in teaching activities, academic or market work. We can mention the tools for virtual meetings, web-binars and event transmission, enabling the carrying out of teaching activities, presentations and various works, carried out remotely. or hybrid - breaking geographical barriers, allowing everyone to participate regardless of where they are at the moment. The role of augmented reality (AR) in virtual and hybrid meetings and events also stands out - showing the potential for this technology to transform the user experience by providing more immersive and efficient interactions. There is also the integration of collaboration tools in virtual reality (VR) environments, offering spaces for teaching, working and participating in fully immersive virtual events . This article seeks to provide a comprehensive overview of these technological innovations that shape the future of activities carried out remotely - offering valuable insights for students, teachers, professionals in general, business leaders and researchers interested in maximizing the potential of such digital resources. Furthermore, it is intended to reflect on the implications of these trends, by highlighting the potential benefits (in terms of efficiency, productivity and flexibility), while at the same time recognizing the challenges associated with the adoption of these technologies, such as privacy issues

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1 Introduction

In the last 30 years, there has been a very rapid development of computer technologies and the internet [5]. This, together with other technological advances (mainly telecommunications), played a significant role in the most diverse professional and teaching-learning activities, changing the way people they carry out their activities, communicate and experience reality. However, the intensification of the adoption of computational technological resources for the development of remote activities was significant during the pandemic COVID-19 - which began in March 2020 and forced people to carry out their activities (which until then were carried out in person), so remote and virtual - due to the mandatory social isolation to mitigate the speed of spread and contamination by the disease in the population [14]. Although already there were distance learning and collaborative remote work methodologies previously Due to the pandemic, there was a need for a rapid emergency adaptation from face- to-face work/teaching to virtual, during the time of social isolation collective due to the health emergency. Thus, education at all levels (from basic to postgraduate studies), as well as research activities, university extension, holding of academic events (such as congresses and symposiums), defenses of course comple-

tion work and even graduations (and other events corporate and social) began to be carried out virtually [4]; [18]. This made students, teachers, and workers in general, in the midst of a health crisis, had greater contact with virtual teaching-learning, remote work and holding events, as an alternative to carrying out such activities in a in-person physical space. Faced with this emergency change in the teaching-learning dynamics, as well as well as remote work in the corporate environment, which occurred during the pandemic, it is believed that this has motivated several legacies for the post-pandemic [4]. Obviously, remote activities would not be a substitute total of the respective face-to-face modalities (even more than many people have greater motivation for face-to-face mode, due to the greater human connection in these situations). However, this greater familiarity with digital telecommunications resources, opens paths for a greater presence of digital resources in activities diverse academic and work activities, enabling remote/hybrid activities to be carried out on a larger scale. According to Cardoso [4], Siqueira [19], some questions and hypotheses can be formulated such as:

- Will remote and/or hybrid teaching and work be part of academic/corporate culture in an increasingly intense way?

- Possibility of international conferences, symposiums, congresses, may will also be in web mode via videoconference, in parallel with the realization face-to-face (i.e., hybrid), thus eliminating the obligation for a researcher who wants to present their work to travel to present them - which saves financial resources for travel, accommodation, food, even optimizing this professional's time in relation to their work;

- It would open up opportunities for flexibility for masterâs students and doctorate, could during the vacation months of their classes (but with ongoing research) carry out their activities remotely instead of to attend university during this time (enabling them, for example, spend more time with their families in the months without classes);

- Enables greater availability of sandwich masters and doctorates in which part was made outside the institution of origin - national or international - could be subjects taken remotely - eliminating travel expenses, living in another country, distance from family, difficulties in adaptation to another culture, greater facilities for students with disabilities who so wish (since many of them have difficulty adapting and/or need a companion), among other advantages;

- Possibility for undergraduate students, graduate students and researchers to participate in various congresses via videoconference if they prefer - therefore, travel expenses, hotels, time spent and, in many cases, documentation. This mainly benefits academics with limited financial conditions who need to participate in the congress, but who are unable to obtain institutional financial aid - or who have mobility difficulties for reasons several;

- Reduces or eliminates the constant need to travel for work in the middle corporate, reducing costs with travel, displacement, time, and even possible accidents that may occur along the way (and which the company would have to offer financial support to the employee or their family members).

Evidently, the academic experience of academic activities and work post-pandemic does not bring the negative association of social isolation forced as in the pandemic [4]; but rather a new way of teach, learn, and work - overcoming the limits of geographical barriers and availability of time for those involved, as well as an interesting way of reduction of expenses for holding/participating in classes and academic events [15], research and corporate, and thus enable an increase in participants due to such advantages. In the next section, several computational technologies will be shown that enable work and teaching in a remote, virtual way, to carry out activities mentioned above. Several of these applications have versions free (which offer several features) and premium (paid, which offer a even greater number of features), but in this article we will emphasize the free versions of the tools in question.

2 RELATED WORKS

According to Marinho [11], there are several technologies that serve remote teaching, Many of these tools are free - available for both computers and mobile devices. In this way, they can be used as if they were a "virtual classroom/auditorium/office". As examples, video conferencing tools for meetings, virtual classes or lecture, mentioned below in this article. There are also tools for transmitting lectures, events, round tables and similar events, which will also be exemplified in this article - as well as virtual environments that enable virtual interaction group chat, functioning as virtual discussion rooms - also widely used in virtual "coffee-breaks" of events that are held virtually/remotely.

2.1 Videoconferencing Tools

Among the most used video conferencing tools, we can mention Google Meet, Skype, Zoom and Microsoft Teams as examples. Google Meet is a tool from the company Google, which allows video calling, voice and group screen sharing [2] [11]. There is a free version and a premium version, which is paid. The free version serves a few users and videoconferences have a time limit. Google Meet can be accessed via the web (to do this, the user must click on a link generated when creating the video conference) or via the application (which can be installed for free on several smartphones or tablets). Anyone who is part of the same institution as the creator of the videoconference (host) does not need permission to join the call (it is enough to be connected via the institutional email account and have access to the link or access code). Users who are not part of the same institution need to have their entry request approved by the host - which, in turn, provides additional permissions, such as the possibility of disable guests' microphones and remove participants who are disrupting the event [11]. Skype is a video, audio and text communication application available for various platforms. It is free to download and use (although some optional elements are paid), and it is considered a good tool for working remotely with other people [13]. Currently, Skype is owned and developed by Microsoft. Among its various features are video calls (which can be for a single person or several people at the same time on the platform, and which may or may not be recorded at the choice of whoever makes the call) and sending instant messages to other users via chat. It also allows the user to share their screen during a video call, in video classes, virtual event presentation or company meeting. Thus, it makes it possible to display various documents to other call participants in real time, sharing what is on their desktops without having to send links to do so [13]. Other Skype features include end-to-end encryption (a security measure that prevents the call from being intercepted by people outside the meeting); live subtitles (useful for people with hearing impairment or when there are elements that make it difficult to hear what is being said, such as noise in the environment, and which display a transcript of the content screen everything said). Another feature that deserves to be highlighted is the translation feature, which allows two people to talk in different languages, since hat the application translates each side of the conversation in real time [13]. In this way, they can be useful in educational, congress and work spaces (all carried out virtually or in a hybrid way), in which have an international scope, with participants from different countries and different native languages. Zoom is another video conferencing tool that works in a similar way to Google Meet, in terms of how to join and participate in the meeting, as well as the specific settings that the host has in the video call. A user can have a free account to organize video calls - for example, a freelance professional who sometimes needs to meet virtually with clients, patients, students, etc. [8]. In the free version, calls can be made with up to 100 participants, with a time limit per video call with more than 2 people. If participants want to continue the meeting, they will have to access Zoom again and create a new session, which will also have the same time limit. Just like Google Meet, during a virtual meeting, users can "share their device screen with other participants, communicate via chat, use a whiteboard to take notes, send files such as photos or documents and record the video call" [8]. Microsoft Teams, which also has a free version, makes it possible, like the applications mentioned previously, to "chat with other people, share files online and collaborate with anyone, from virtually anywhere, all in a 'single application' " [12]. It also allows you to send links to documents, upload files or share photos with up to 5 GB of cloud storage. One of the features of Microsoft Teams that deserves to be highlighted is Communities, which consist of a safe virtual space for virtual group activities, where people interact and share information for different purposes (for example, manage meetings for an association, plan a friends' soccer game, or get tips from the local dog breeders group); thus, the user can easily invite other people to their community. Management tools "allow a community creator to adjust and manage settings for a community, including membership roles, community name, description, and guidelines " [12].

2.2 Live Streaming Tools

Among several tools for live transmission of events, lectures, classes - both online events and hybrid events (which take place in person at a location, but are broadcast for those who want to participate remotely), we can mention Instagram Live and You Tube Live. Instagram Live is a broadcast tool on the social network Instagram, created in 2016 as a feature of Instagram Stories - which also comes free of charge, gaining space as one of the main means of creating content on the network, due to the high popularity of live streaming on other platforms and on Instagram itself [16]. ' It is a tool that can be used to transmit lectures, round tables, and various academic events, carried out in a hybrid or remote mode. To use this resource, the user creating the event simply needs to have a cell phone/tablet with the Instagram app downloaded and an account created.

In the app, just click on the new publication icon and scroll to the right until live. As for the camera, if the live is being done with just one person, they will need to control the application, using the front camera for transmission. If there is another person helping with the transmission, the rear camera can be used without problems. Regarding transmission performance, so that there are no crashes: "a device with a good processor, large amount of RAM and storage is recommended. The minimum RAM required by Instagram is 2GB, but 4GB and 6GB are more suitable for lives" [16]. You can use the built-in microphones of the mobile device itself, or an external microphone, such as a lapel microphone, for example. In fact, an external microphone can provide better sound quality to be captured in the environment and transmitted to other internet users - who, connected to Instagram through their own devices, will be able to watch and interact in real time via chat . You Tube Live, like Instagram Live, allows you to broadcast a live event, teaching a class or presenting a workshop. YouTube has the tools to help manage live streams and interact with viewers in real time. Live broadcasts on YouTube can be done with a webcam, a mobile device (simple options for beginners) or a broadcast encoder. "The encoder for live broadcasts is ideal for more advanced events, such as those that broadcast the content creator's screen or a game, that use external audio and video hardware and that require management of a complex production - for example, several cameras and microphone" [22].

2.3 Webinar Platforms

Although video calling apps (such as those mentioned previously in this article) are used to hold small meetings, webinar solutions have the difference of making it possible to bring together a much larger number of people online. Among the platforms developed specifically for holding total events, virtual, we can mention GoToWebinar and Remo, among others existing on the market. GoToWebinar is an online meeting platform that features applications free for web, Android and iOS. Just like other platforms previously, it allows you to create and participate in online conferences, but with the difference to offer advanced interactivity features - including chat, polls, sending questions from the audience and screen sharing. Although the download is free, use itself requires a monthly subscription [20]. There is even a version of the application in Brazilian Portuguese. It has a desktop application that can be used without the need for installation, and allows the transmission of images and presentations in real time for an audience [20]. In this application, it is possible to gather up to 100 people at an event, with the right to admin control to control participants' microphones, avoiding unwanted interference. To use it, enter a code to gain access to the virtual room. Once there, the presenter can control the audio and content displayed on everyone's devices. And all operations performed on the desktop are displayed to participants. There are also features such as allowing questions from the audience, polls and sending of general questions from the presenter â reproducing the interactivity that exists in a face-to-face presentation. It also allows the recording of meetings and presentations, as exists in other similar applications, enabling the lecture to be watched as many times as possible. times as necessary by the participants - in addition to enabling the speaker, if he wishes, to later disseminate the material to those who prefer watch on demand [20]. Remo is a platform that stands out for offering an event experience virtual environment that simulates a physical environment, promoting more natural and spontaneous meetings between participants [17]. Among its features, one can highlight the interactive table environment - which consists of the representation of participants through avatars that can move between different virtual tables. Each of these tables can host a conversation or presentation, allowing networking and interactions similar to those of a physical event [17]. Furthermore, there is a resource that provides structured networking, by allowing participants to move freely between tables, interact with other participants and exchange contact information intuitively [17]. Furthermore, it provides video and audio integration, supporting video conferences and audio conversations at each virtual table, providing closer and more effective communication among the participants [17]. In addition to networking, Remo offers tools such as virtual whiteboards for group brainstorming, document sharing and support interactive presentations. Remo is designed to be intuitive and easy to use. use, for both organizers and participants, with an interface which simulates a physical environment in a virtual way. Among some features of Remo that differentiate it from GoToWebinar, mentioned previously, we can highlight, for example, the event format: the Remo replicates the experience of physical events with tables and interactive networking, while GoToWebinar is more traditional, offering structured webinars for presentations, workshops and online training. As for the focus on networking, Remo is specially designed to facilitate networking and social interaction between participants, which can be more limited on platforms like GoToWebinar, which are more focused on formal presentations and specific interactions during webinars. Furthermore, the Remo allows

for greater personalization of the participantâs experience, with freedom of movement and interaction in a 3D virtual environment, while GoToWebinar is more focused on presenting content in a direct and efficient.

2.4 Augmented Reality Tools for integration at virtual events

Augmented reality (AR) can be integrated in several ways to improve the experience in videoconferences and online events, making them more attractive to participants who are often geographically dispersed. These augmented reality applications not only make events online more engaging and interactive, but also offer new ways to communicate complex information and improve the overall experience of participants [1]. Among the examples of applications integrating augmented reality into platforms that enable online events and presentations, we can mention, for example, example, Blippar - which is an augmented reality platform that offers several solutions for integration into online events and presentations [3]. There is also Spatial, which since 2020 has been offering a social augmented reality workspace on mobile devices - enabling let people log into their 3D experience by making the workplace virtual space more accessible, and which in 2021 started to provide a 3D collaborative space through web browsers. as well as galleries where you can, for For example, displaying art with non-fungible tokens, or NFTs [10].

2.5 Integration of Collaboration Tools with Am- Virtual Reality environments

The integration of collaboration tools with virtual reality environments (VR) allows teams to work together more immersively and efficiently [1]. Among these tools, it is worth highlighting the virtual whiteboards, present in tools such as Conceptboard - where Participants can collaborate, take notes and sketch ideas using gestures and drawing tools in VR environments [6]. There is also applications that enable collaborative design, such as Gravity Sketch for example - which allow design teams to create 3D models in real time, where can work together to iterate and visualize concepts directly in virtual reality environments [9]. They also deserve to be highlighted platforms like EngageVR for example, which are used for training corporate and simulations, where participants can interact with simulated scenarios, carry out practical training and practice collaborative skills in a virtual environment, involving spatial computing, AI and metaversion services [7]. There are also virtual interaction tools such as VR-Chat, which allow teams to hold brainstorming sessions, workshops creative and networking events in virtual environments, using avatars to interact and collaborate [21]. These VR integrations with environments virtual collaboratives, therefore, increase efficiency and collaboration between geographically dispersed teams, in addition to offering new possibilities for collaborative work in more engaging and immersive environments provided by virtual reality.

3 CRITICISM AND SUGGESTIONS

3.1 Advantages and Challenges

The growing advancement of virtual/remote modalities of work, teaching-learning and holding of events, brings a transformation in their dynamics - in addition of redefining traditional work and education paradigms, also opens up doors to significant innovations with the integration of emerging technologies such as virtual reality (VR) and augmented reality (AR), providing a more immersive and motivating experience in the virtual environment. Among the potential benefits of improving tools for activities virtual services, one can mention, for example, the increase in efficiency and productivity, since videoconferencing tools allow collaboration in real time between globally distributed teams, reducing the need for travel and optimizing working time. In addition, there is a gain in flexibility and accessibility in relation to education remotely and holding events online - as it provides access to educational content and academic presentations from anywhere in the world, allowing students, teachers and researchers to overcome barriers geographical and temporal. Other important points to be highlighted are the immersive experiences and interactive (provided by the integration of VR and AR in learning and work by facilitating the simulation of complex environments and the visualization of abstract concepts in a more tangible way). and innovation collaboration in virtual collaborative environments, since they they encourage creativity and innovation, allowing teams to work on complex projects together, regardless of the physical location of members. However, there are some associated challenges that need to be mitigated so that the growing use of such virtual resources is successful. Among them, issues of privacy and security can be mentioned, since the growing dependence on digital platforms requires increasing attention to the privacy of user data and security cybernetics, requiring strict measures to protect sensitive information. Another important factor to be mentioned are possible technological and accessibility barriers: since, due to various social inequalities, not

everyone has adequate access to the technologies necessary to fully participate in virtual environments. Furthermore, it is important that the design of such platforms and tools meets the needs of users with any disabilities (PwD). Finally, it is worth mentioning some cultural and organizational challenges that may still exist, since adapting to the change to remote work and learning models requires mentality adjustments to the new ways of working, studying and participate in events - including managing virtual teams and developing digital skills.

3.2 Future Trends

Among possible future trends, it is observed that greater integration of immersive technologies such as VR and AR into video conferencing platforms and virtual learning environments is expected, improving the user experience and expanding educational and collaborative possibilities. Furthermore, it is believed that adaptive and personalized tools will be essential to meet individual learning and work needs, allowing for more personalized and effective experiences. It is also observed that the trend towards hybrid work and learning models that combine face-to-face and virtual interactions will become increasingly common, offering flexibility and adaptability to users. Furthermore, rapid technological evolution will continue to drive new forms of digital interaction, promoting continuous innovation in how we collaborate, learn and work.

4 CONCLUSION

Video conferencing technologies and virtual environments are revolutionizing the way we work and learn, offering flexibility and collaboration without geographical limits. However, there is great importance in observing and mitigating associated challenges, such as privacy and security, in a careful and proactive manner. The responsible integration of virtual reality (VR) and reality Augmented augmentation (AR) can further enhance these benefits, providing immersive and effective experiences in both education and work, making activities carried out collaboratively and remotely more attractive (and, thus, reducing the need for travel for physical spaces and reducing the financial and time costs involved). For future work, case studies are suggested relating to users' experiences in relation to the various tools mentioned in the text (and other similar ones), showing what they liked about such platforms and what could be developed/improved in them, later, to further improve the experiences.

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