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TALKED: A VIDEO CONFERENCING TOOL FOR ONLINE LEARNING IN RESPONSE TO EDUCATION TECHNOLOGY AMIDST THE COVID-19 PANDEMIC

Sheila A. Abaya[1+]
Allyssa Thea J. Besana[2]
Christian Jude G. Ceballos[3]
Christelle Alaine P. Cruz[4]
Raya J. Jubilo[5]
Carla Angela V. Piamonte[6]

[1,2,3,4,5,6]*Department of Computer Studies and Systems, University of the East, Caloocan, Philippines.*
[1]*Email: sheila.abaya@ue.edu.ph*
[2]*Email: besana.allyssathea@ue.edu.ph*
[3]*Email: christianjudeceballos@gmail.com*
[4]*Email: alainecruz4869@gmail.com*
[5]*Email: jubilo.raya@ue.edu.ph*
[6]*Email: piamonte.carlaangela@ue.edu*

(+ Corresponding author)

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ABSTRACT

Video conferencing enables people to conduct live communication regardless of their location. Due to the COVID-19 pandemic, video conferencing tools became the new way of communicating in workplaces and became part of online distance learning in the academic community. Since the researchers were entities in the academe who were mainly affected by the pandemic, it opened the opportunity for the development of a video conference tool that their institution could use without recurring much acquisition or operational cost. The tool provides real-time interaction between users in an unlimited time of discussion. The tool provides chat-box, screen-sharing and whiteboard features. Unlike the usual conferencing tools, the proposed tool is innovated with new features of sharing files, poll creation when asking questions and a word cloud. The tool was evaluated by several students and professors of the University of the East, Caloocan through the criteria of: interactivity, usability and interface consistency.

Contribution/ Originality: The improved video conferencing tool is a homegrown application intended for the University community for free. With the new feature of file sharing, participants can immediately upload and share the lectures, assignments or activities and can be an alternative tool as a learning management system.

1. INTRODUCTION

Video conferencing, as defined by Cisco, is a part of web calling on the internet. It enables users to collaborate and contact each other through a web browser, computer, mobile, or video device. Due to the COVID-19 pandemic, the demand for video conferencing applications has spiked, given that these are the solutions to avoid physical contact with each other, making it the safest way to communicate. In March 2020, video conferencing apps such as Zoom, Face Time, Houseparty, Microsoft Teams, and the like hit 62 million downloads (Covid-19 Outbreak: Video Conferencing Demand Rises due to Social-Distancing, 2020). Video conferencing apps are slowly becoming part of our routine because of physical isolation during the pandemic period. It also allowed people to work and easily communicate with others regardless of their geographical location (Sydow, 2020). Nowadays, more people tend to use video conferencing tools, especially in online learning. It is considered as part of the online distance learning

system; a communication medium used for lectures, tutorials and remote visits which can either be point-to-point or multipoint, linking more locale with audio and video in real-time (Alhlak, Ramakrisnan, Hameed, & Mohseni, 2012).

Ever since the pandemic started, more schools have begun using video conferencing tools as an alternative way to continue education amid the pandemic and to protect students, professors, and other staff from physically going to different places. Most of the conferencing tools available can be used for conducting meetings, screen-sharing, whiteboard, video and audio preview screens, video recording, chatbox, and reaction icons. However, there are still some capabilities that can be integrated into the application for a more interactive environment such as poll creation, user file sharing and word cloud.

These features were the motivation for the development of a video conference tool that can be used by students freely at their own set-up and enjoy additional tool capabilities during online learning amid the pandemic for better communication and interactive learning environment.

2. REVIEW OF RELATED LITERATURE

2.1. Video Conferencing for Learning

Over the last few years, distance learning has arisen because of technological advancements like the internet and web conferencing software. As a result, instructors and instructional designers need to reevaluate and reexamine traditional practices to the new learning experience. The inability to access is one of the challenges in online learning but is currently being addressed (Bernard, Rojo de Rubalcava, & St-Pierre, 2000). While VC can be all the more successfully utilized for enhanced exercises, by utilizing the networking tools, a significantly more student-focused environment could be created (Gibbs & Gosper, 2012). Such a framework gives significantly more chance to students to collaborate than essentially tuning in to "instructor talk" that we discovered during the regular distance education VC (Anderson, 2008). The study suggests that the instructor's interaction plays a significant role in this type of learning, and they should be more approachable (Saw et al., 2008). Web-video conferencing has features that allow participants to decide whether to use sound, voice, chatbox, and video instruments. This study explored the correlation of accessible tools used, student inspiration, engagement, and performance on the final exam within the context of distance learning for prospective university students. This might give guidelines for both tutors and students in online learning courses on how to produce the utmost of the learning process (Giesbers, Rienties, Tempelaar, & Gijselaers, 2013). Students who take up e-learning courses by their choice have a wide variety of abilities and expectations. While the student who has not formerly enrolled in video conferencing has little support assessing their ability and expectation (Osborn, 2001). The comparative positive results of having a weekly web conference encourage and improve student web-based learning (Dyment & Downing, 2018). The study, just as experience, showed that VC could introduce a few restrictions that can influence the students' academic performance. Based on the results, there is no significant evidence that there is a negative impact of using Video conferencing for accounting subjects which concludes that it can be considered a proper instructing tool. The same with the findings of Allen et al. (2004), who specified that there is no distinct negative effect in distance learning (Florit, Montaño, & Anes, 2012).

With the utilization of Internet-based work area video-conferencing, students can access local speakers worldwide to grow their language learning encounters and improve their language proficiency and culturally diverse awareness (Xiao, 2007). Institutions for higher education are progressively utilizing web-conferencing in a learning environment. Video conferencing enables students to talk with other individuals such as journalists, scientists, politicians, and other people that allow both instructors and students to communicate even if they are not in the same place (Nedeva, Dineva, & Atanasov, 2014).

2.2. WebRTC

WebRTC has emerged over the past years, providing real-time communication without additional software support and expenses. It also provides flexibility for interactive communication services in different topologies from

point-to-point, many-to-many, or with a multipoint conferencing unit (MCU) (Vucic & Skorin-Kapov, 2015). W3C and IETF implemented a project that enables communication in real-time. The objective is to provide real-time media stream services that can smoothly exchange data, audio, and video. It enables developers to develop an application more effortless for the video calls, sound, video-sharing, and sharing of the screen for the participants, etc. The first standard that allows peer-to-peer allocation of multimedia data in web browsers is WebRTC (Jang-Jaccard, Nepal, Celler, & Yan, 2016). WebRTC is an open project that gives real-time sound and video conversation within web browsers. It supported features constructed into the web browser to capture media streams from local devices, and it transmits media and data to other participants (Vucic, Skorin-Kapov, & Suznjevic, 2016). WebRTC's advantage is that it is incorporated into almost all known web browsers and can run without additional plugins (Jansen, Goodwin, Gupta, Kuipers, & Zussman, 2018). Web Real-Time Communication or WebRTC is a new technology that allows real-time communication between browsers to stream information to other people, including text, sound, or direct transferring of data (Feher, Sidi, Shabtai, Puzis, & Marozas, 2018). WebRTC is a recent standard and a collection of libraries that enable interactive communications of both video and data (Edan & Mahmood, 2020). WebRTC provides an application programming interface (API) that enables and supports communication between browsers without plugins. WebRTC can do peer-to-peer streaming with video and audio calls, file sharing, and many more. Various companies use WebRTC in their services and products, including Firefox Hello, addLive, and Facebook's mobile messenger (Feher et al., 2018). WebRTC has immediately gotten famous as a video conferencing platform, mostly because it is accessible in various browsers. To control real-time interaction over UDP, it uses Google Congestion Control (GCC). The presentation during a WebRTC call might be impacted by a few components, including the underlying WebRTC implementation, the gadget used, network attributes, and topology. The study evaluated the performance of WebRTC in different network types, between wired and wireless networks. This study assessment shows that streams have a somewhat higher need than TCP streams while rivaling cross traffic. Generally, while in several considered scenarios WebRTC carries out, the researcher noticed significant situations wherein there is an opportunity to get better (Jansen et al., 2018). Google, Mozilla, and Opera supported WebRTC, which targets to provide high-quality real-time communications across web browsers with only JavaScript and HTML5 (Panagiotakis, Kapetanakis, & Malamos, 2013). RTC can be in half-duplex where there are two directions where data is transferred but on only one carrier and not simultaneously or in full-duplex mode with two directions where data is transmitted but simultaneously on one circuit (Rahmatulloh, Darmawan, & Gunawan, 2019).

2.3. WebRTC Implementation

To allow real-time communication within any web application, WebRTC depends on the three APIs: Media Engine that enables the microphone and camera to be accessed (Emmanuel & Dirting, 2017). RTCPeerConnection to connect to a peer, their web location should be known, and with the use of RTCPeerConnection, they can have a connection and will have the Session Description, which indicates the data they want to send, an object that indicates what kind of data they want to send. RTCDataChannel API is needed for establishing a text chat. It is like a channel but virtually connects peers and sends and receives messages in real-time. It is also able to share a file (Xue & Zhang, 2016). The results of the study that is conducted in the rural areas of Indonesia, WebRTC was able to provide a reasonable quality in a network that has less than 500kbps bandwidth, and it can provide video streaming with an excellent quality when it has reached 2048kbps bandwidth (Bandung, Subekti, Tanjung, & Chrysostomou, 2017).

3. METHODOLOGY

3.1. Project Design

Figure 1 shows the home page of TalkED, where the options Start Now or Learn More buttons are visible. Figure 2 shows the features of TalkED as a conference tool, which are screen sharing, whiteboard, word cloud, recording, chat, polls, show participants and file sharing. Figure 3 shows the options for hosting a meeting or joining

a meeting. Figure 4 shows the actual room where one can view the participants and the authorized user can remove the participant from the meeting or can send a private message. Figure 5 shows the features of the tool such as polls, word cloud, whiteboard and recording of the meeting, lock room, share room and the time of the meeting when a certain participant joined. Figure 6 shows the collaborative whiteboard where all of the participants can write on it simultaneously.

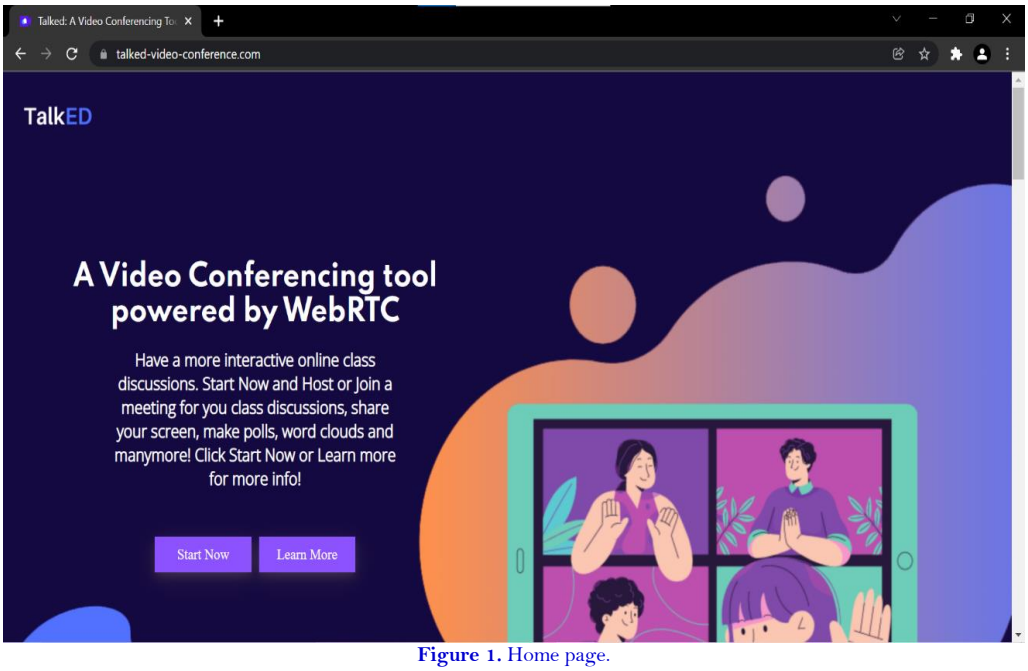

Figure 1. Home page.

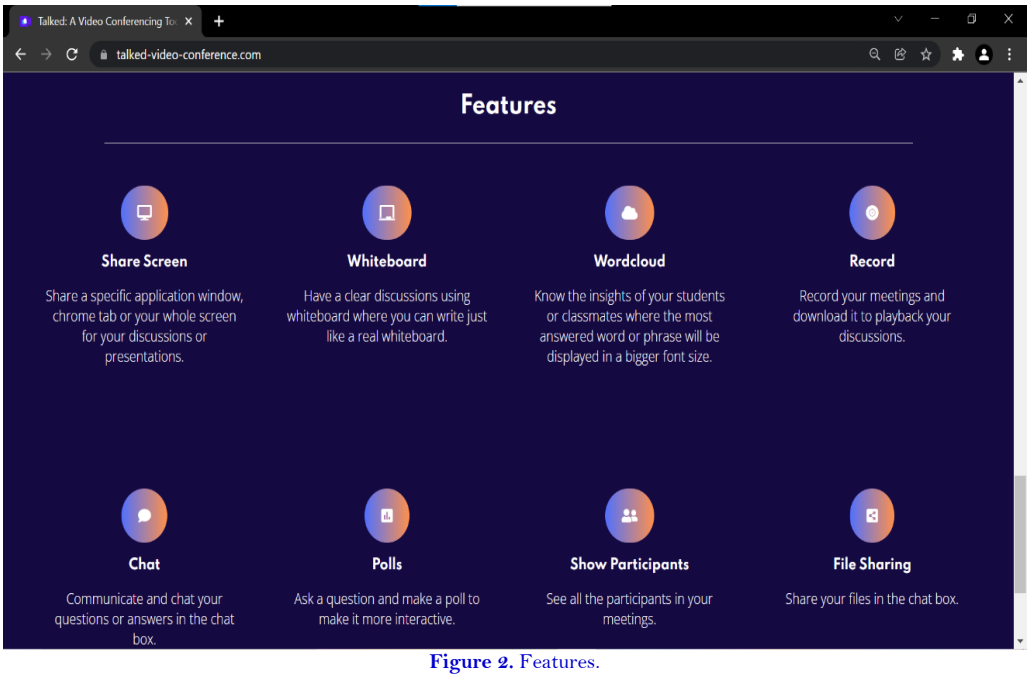

Figure 2. Features.

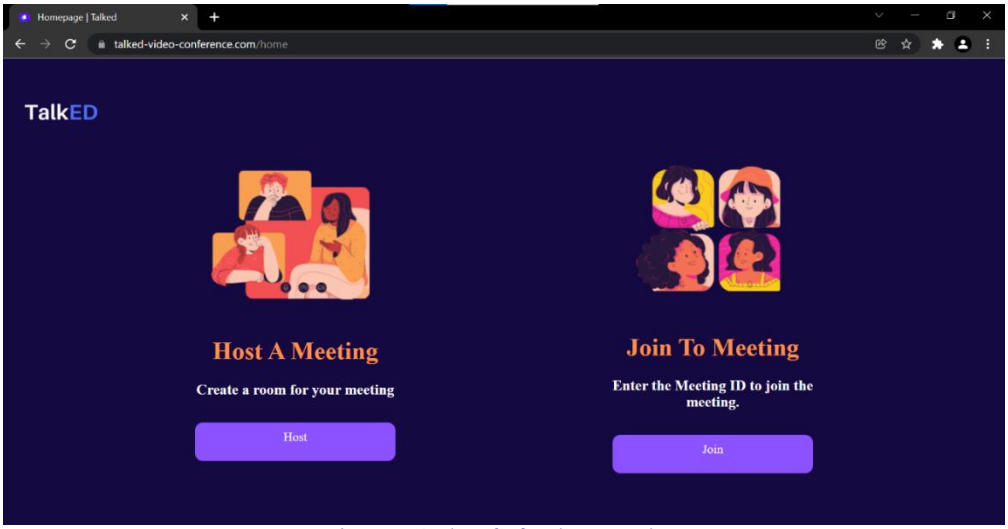

Figure 3. Options for hosting a meeting.

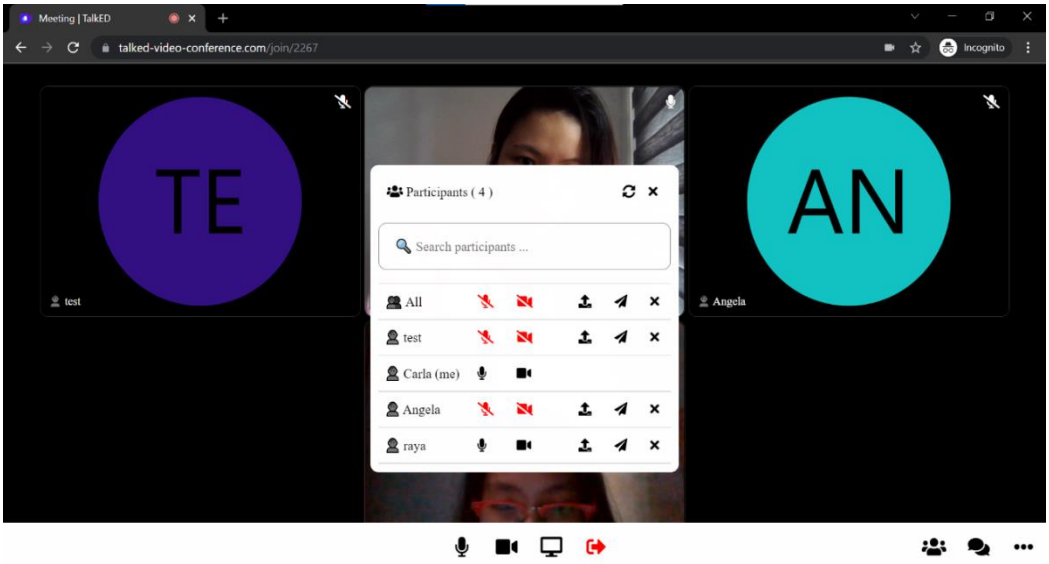

Figure 4. Actual room.

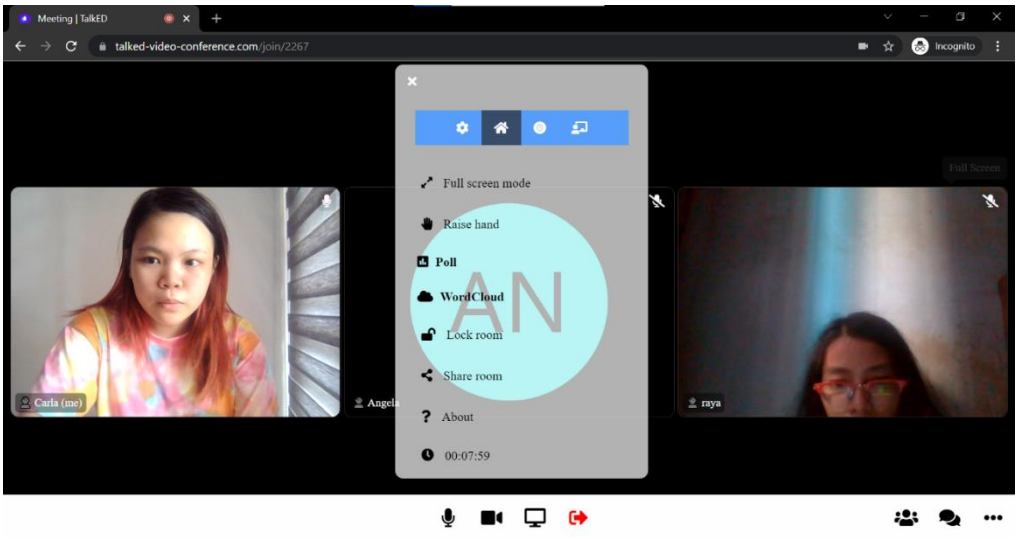

Figure 5. Other features.

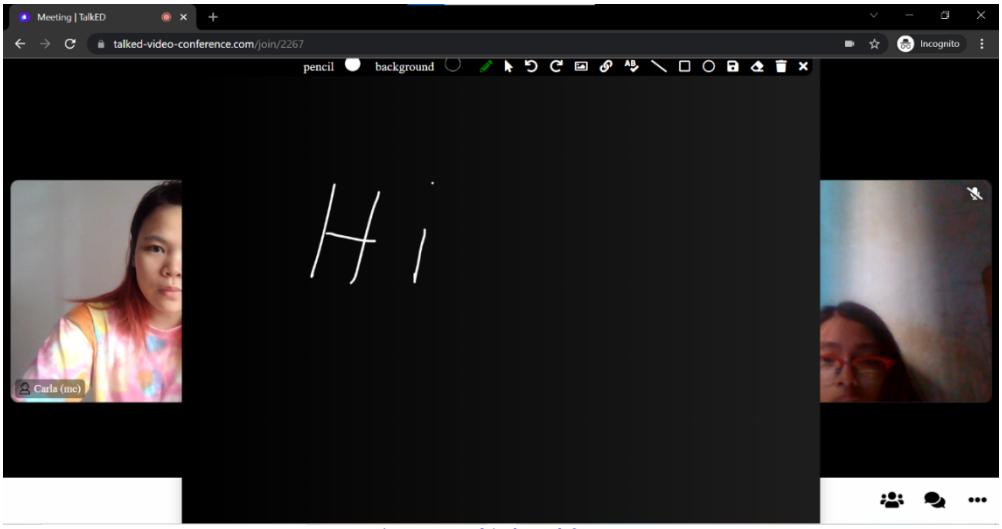

Figure 6. Whiteboard feature.

3.2. Evaluation

The evaluation of the system was gathered from no more than 50 students and professors of the University of the East, Caloocan for the system's effectiveness as a video conferencing tool for online learning. A brief tutorial about the basics of how to use the system was given to the respondents and ample time was given to have a hands-on test on the system to explore and use it for their classroom discussion. The actual use of the conferencing tool was implemented during class hours to check for the application's effectiveness during online discussion and learning. The basis of the evaluation for the system is as follows: Graphical User Interface (GUI) - having a user-friendly design that does not require too many technical skills to navigate. Interactivity - an interactive class discussion that makes the students participative. Ease of use - having an easy-to-use system that makes the task easier for both students and professors that does not require too much learning time.

3.3. Statistical Treatment of Data

Evaluation results were analyzed through the Likert scale model to determine the application's effectiveness and efficiency as a conference tool for students and teachers. Criteria for the tool's effectiveness were referenced in Table 1. The weighted mean per criteria was computed through:

Where:

$$Weighted\ Mean = \frac{\Sigma XW}{\Sigma X}$$

X – Response Count.

W – Weight of Response.

Table 1. Likert's scale.

Scale	Range	Verbal Interpretation
4	3.25 – 4	Strongly Agree
3	2.50 – 3.24	Agree
2	1.75 – 2.49	Disagree
1	1-1.74	Strongly Disagree

4. RESULTS AND FINDINGS

4.1. Project Capabilities

The system is capable of doing the following:

- Host a Meeting with unlimited time and with 100 participants.

- Participants can mute/unmute their microphones.
- Participants can on/off their videos.
- Participants can share their screens for presentations.
- Send a private message to a certain participant or send a message to all.
- Send a file to all the participants in the chatbox.
- Save the message for the poll and word cloud.
- Clear the chatbox.
- The meeting can be recorded and will be downloaded to the device of the participant who recorded the meeting.
- The list of participants can be seen, and users can kick out a certain participant.
- The participants can use the raise hand feature when they want to get the attention of the speaker.
- Collaborative whiteboard where all of the participants can view and edit the whiteboard simultaneously.
- Polls for interactive questions and answers during discussions.
- Word Cloud, where the instructor can ask questions and the answers by the student will be displayed in a word cloud where the most answered word or phrase will be in a bigger font size.
- Share button to share the meeting link to the others.
- Lock room where the room is only available for the authorized participants.
- Full-screen feature.
- See device settings (Video, Microphone, Speaker) and choose from the option available.
- For mobile, the camera can be switched from front to back camera.

4.2. Evaluation Results

Results from the evaluation of students and teachers considering the criteria of: Usability, Interactivity and Ease of Use are presented in the following tables.

Table 2. Usability factor.

Choices	Response Count (x)	Weight of Answer choice (w)	x*w
Strongly Agree	39	4	156
Agree	9	3	27
Disagree	1	2	2
Strongly Disagree	1	1	1
	∑x: 50		
	∑xw:186		
	weighted mean∑xw/∑x: 3.72		

Table 3. Interactivity factor.

Choices	Response Count (x)	Weight of Answer choice (w)	x*w
Strongly Agree	42	4	168
Agree	7	3	21
Disagree	0	2	0
Strongly Disagree	1	1	1
	∑x: 50		
	∑xw:190		
	weighted mean∑xw/∑x:3.8		

Table 4. Ease of use factor.

Choices	Response Count (x)	Weight of Answer choice (w)	x*w
Strongly Agree	38	4	152
Agree	10	3	30
Disagree	1	2	2
Strongly Disagree	1	1	1
	∑x: 50		
	∑xw:185		
	weighted mean∑xw/∑x:3.7		

The respondents who participated in the survey responded to every question, but most of the answers were Strongly Agree. Table 2 presents the usability of the tool where 78% of the respondents said that it is easy to use because of the organized GUI, 42% of respondents said that the user interface is consistent, and 72% of respondents found the system is user friendly. This explains that manipulating the tool does not require too many technical skills to navigate with its consistent interface. Table 3 presents the interactivity of the tool where 84% of the respondents answered that the added features of the system improved the class discussion, 34% of the respondents answered that it made difference in their usual virtual class session and 86% of the respondents said that the system made the more productive meeting. Table 4 presents the tool's ease of use, of which 64% of the respondents showed their eagerness to use the new tool for their online class. 38% of the respondents answered that they don't need technical support while using the system. 76% of respondents said that the system is easy to learn and use. 74% of respondents also want to recommend the system to other people. With the results derived, it was only proved that the improved application is effective and efficient as a conference tool for students and teachers during online learning.

5. CONCLUSION

The usage of video conferencing tools increased because of the pandemic, where it is used in both work and education. Online learning became the new educational practice to ensure the safety of both students and instructors during these times when we are not advised to have face-to-face classes. This caused both students and instructors to rely on video conferencing tools for their discussions. Still, a problem arose because of a lack of interaction during online classes, limited time in meetings, and a limited number of participants. This led to the researchers' objective to provide a low-cost, less time-consuming, accessible, and more interactive conference tool so that students will be more participative and enable the participation of large numbers of participants with a longer period of discussion.

TalkED is a video conferencing tool powered by WebRTC, which enable participants to experience features that are not present in some of the current conferencing tools. To test the effectiveness of TalkED as a video conferencing tool for online learning, the researchers evaluated the system with the help of 50 respondents including students and teachers from the University of the East – Caloocan Campus. The respondents answered the Google forms which define the effectiveness of the system for online learning using the Likert scale model. It aimed to provide a more interactive class discussion; hence the additional features of whiteboard, file sharing, word cloud, and poll worked well and made the students' and teachers' discussion more interactive. The students can also record the meeting so that they can review their discussions. Overall, the developed conference tool provided a low-cost, more productive, and more interactive class discussion over a longer period.

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Authors' Contributions: All authors contributed equally to the conception and design of the study.

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