

Review of Empirical Studies on Video Conferencing Platforms and Hardware for Best Practices

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Abstract: Video conferencing (VC) has become invaluable in education, catapulted during the COVID19 pandemic which was declared by the World Health Organisation in March 2020. It became a service connecting a far-flung remote teaching and learning across the globe. In the process, different tools and methods serve diverse ability to keep virtual classrooms engaging and efficient. The forceful shift to incorporation of online teaching and learning resulted in a new era in education which continued even after the end of the pandemic two years later. The implication of recommendation on adoption of VC systems and good practices is to collect best practice scenarios of educational VC carried out against a backdrop of a body of literature. The aim of study is to conduct an empirical exploratory literature review of VC technologies and methods to engage students online in various classroom environments by the recent drastic changes. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was used to include the articles to be reviewed. This paper is based on an analysis of 18 research articles with empirical studies specifically from two electronic databases, namely the Institute of Electrical and Electronics Engineers (IEEE) and Science Direct which are open and accessible in the field of educational technology searched using the search strings relating to VC in Education. The analysis categorised the findings into three areas: 1) VC Software Platforms (2) Platforms integrated with VC Software Platforms and 3) VC Hardware. This review provides the information to enable ideating a portable VC toolkits and online applications for engaging learning experience design in higher education classrooms.

Keywords: Video Conferencing, VC Platforms, Online Teaching and Learning, Virtual Classroom, Portable Hardware Tools

1. Introduction

The COVID19 pandemic declared by the World Health Organisation in March 2020 caused a massive disruption to the education sector. The only connection between educators and learners was through Video conferencing (VC) which had become an invaluable service connecting the far-flung remote teaching and learning across the globe. There was no time to assess which software platforms, hardware tools and methods would serve ability to keep virtual classrooms engaging and efficient. In the unprecedented period of the pandemic, Camilleri and Camilleri (2021) highlighted educators were pressurised to utilize digital technologies including learning management systems (LMSs) as well as VC programs to reach the students isolated at home to prevent contagion (Bolumole 2021, Gandolfi, Ferdig and Kratcoski 2021). Thus, the forceful shift to incorporation of online teaching and learning leading to the development of diverse ability from a global laboratory of VC system resulted in a new era in education after the end of the pandemic two years later. Cole, Ray and Zanetis (2004) defined VC as synchronous audio and video communication through computer or telephone networks between two or more geographically dispersed sites. Lawson et al (2010) in their literature review, stated that VC closely followed the trajectory of its status as a 'cutting edge' technology in different educational environments. This steered the way as Camilleri and Camilleri (2022) had put it for the mushrooming of a lot of VC tools, platforms and apps like Zoom, Google Meet, Microsoft Teams and Slack. Paying attention in a class, staying engaged, and actively participating in a lecture have been widely stated as critical components for learners' academic success.

The implication of recommendation on adoption of VC system is to collect best educational VC platforms and hardware carried out against a backdrop of a body of literature. The aim of study is to conduct an empirical exploratory literature review of VC technologies/methods engaging students online in various classroom environments by the drastic changes during the pre-Covid through Post Covid-era. The scope of the review covers the evaluation of VC platforms and hardware for the ideation of a VC Toolkits within the 2024 timeframe of the ERASMUS+ Portable VC Toolkits and Online Applications for Engaging Learning Experience Design in Higher Education Classroom (EdViCon).

2. Methodology

The search for relevant literature was specifically from review articles published in journals from two electronic databases, namely the Institute of Electrical and Electronics Engineers (IEEE) using IEEE Xplore and ScienceDirect Search which are open and accessible in the field of educational technology. The following search strings were used: Videoconferencing platforms and tools, online teaching and learning, Virtual conference: hybrid, online conference, Zoom, Teams, Google, Meet/Hangout, Webex, Adobe Connect and Skype; Online application: Software, platform and system; Portable VC tools: Mobile and remote; Engagement: Interaction, communication and discussion; Learning Experience Design: Learning environment and flipped classroom. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Moher et al, 2009) was used with the four phases: identification, screening, eligibility, and included (Fig. 1.). The search period was set starting from 2020 to 2024 covering at least 5 years based on the recommendation of Crompton and Burke (2020) to explore how video conferencing system evolved from empirical papers only. Manually extracted data based on content analysis such as article type, journal name, year of publication, topic, title, research methodology and research results on the VC technologies/methods, specifically on the software and hardware tools engaging students online in various classroom environments were conducted. Only original and peer-reviewed literature written in English was selected.

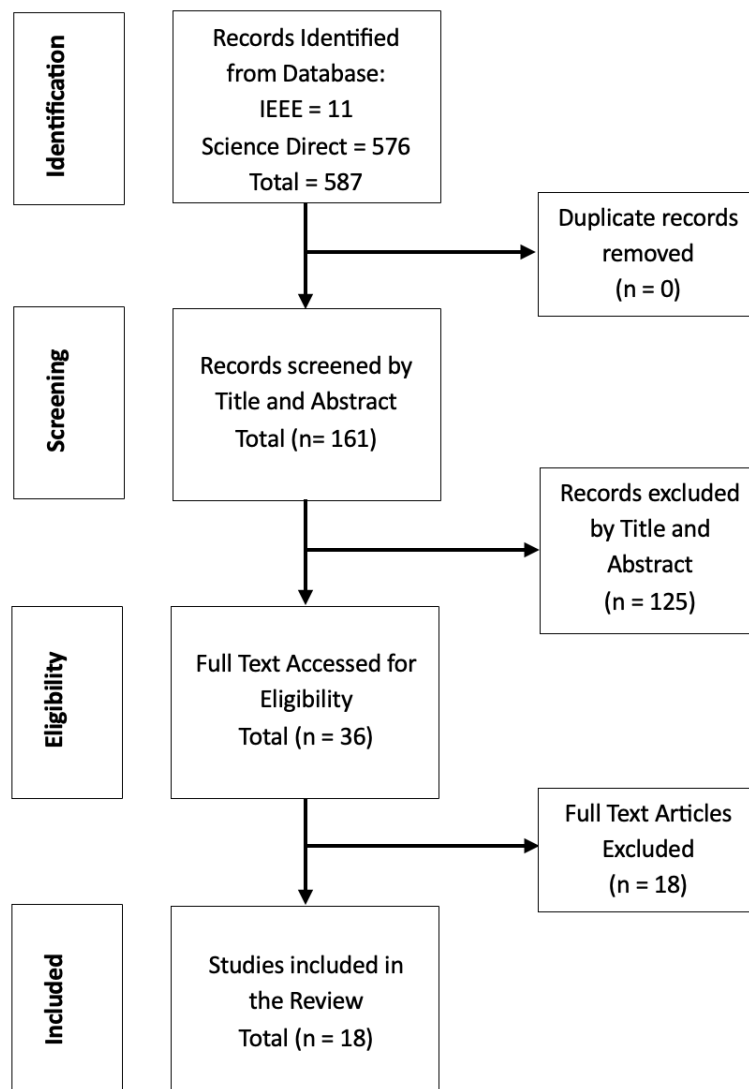


Figure 1: PRISMA flow chart of selection process

The initial sample was 587 scientific articles based on previously determined keywords. Subsequently, the articles were selected based on title, abstract, and keywords with 161 relevant empirical studies being found. Following that, 36 were identified as appropriate to the selection criteria after thoroughly reviewing their entire

content based on criteria 2 and 3. Finally, 19 papers were analysed where the distribution included 2020 (n = 2), 2021 (n = 4), 2022 (n = 5) and 2023 (n = 7) while there was no related literature in 2024.

3. Results and Discussion

The literature on VC reflects much of the academic material available focusing on university experiences in distance learning, in which a range of VC platforms and hardware were used to facilitate learning at a distance. The articles were categorised into three areas: 1) Videoconferencing Software Platforms (2) Platforms integrated with Videoconference Software Platforms and 3) Videoconferencing Hardware.

3.1 Videoconferencing Software Platforms

All articles reviewed were made in reference to the technology specifically VC software platforms that allows teachers-students in different locations to hold real-time face-to-face teaching and learning. Table 1 shows the VC software platforms and the analysis identified from literature reviewed.

Table 1: Videoconference software tools from research articles

Software Platform	Analysis of Research Articles	References
Zoom, Microsoft Teams, Google Meet	Implication that gender could be contributing factors from their studies on 254 female students' perception on using video conferencing tools. 83.07% perceived their computer self-efficacy using Google Meet while 56.69% Zoom and 5.51 Microsoft Teams.	Bui et al. (2020)
Zoom	The video broadcasting portion of Zoom are used, however, the Zoom chat and Zoom polls are replaced by own chat and polling options of Acadly, a Classroom Response System and Attendance Automation Platform) launched in 2017.	Vashisht & Gautam (2020)
Zoom	The engagement with the Zoom VC in the platform Technology acceptance model (TAM) with a cross-sectional research design explained how the use of technology influences learning outcomes based on 2 variables: PU (extent to which one believes that using specific technology will develop their performance), PEOU (partly refers to the mental effort and ease of learning exerted when using technology), and behavioural intentions in reference to Zoom. The main conclusion drawn is that PEOU with Zoom strongly affected PU, attitude, and perceived levels of learning when using the platform. Further, PU with Zoom predicted intentions to use Zoom in the future, directly and indirectly, on the relationship between PEOU and behavioural intentions; however, PU failed to influence perceived learning outcomes in the video conference class. Therefore, while PU predicted future use, it did not influence how well students reported their current performance in their video conference course. In consideration of findings, students and instructors should be well trained on the use and functionality of video conference software before its implementation in video conference classrooms.	Railey et al. (2021)
Zoom, Google Meet, Skype, Discord Tool	A case study analysed the use and impact of VC platforms in learning process with findings that vast majority of teachers have a very high knowledge of the Zoom and Google Meet platforms and only medium-low knowledge of the Skype, Microsoft Teams and Discord tools. Thus, it influenced their decisions to use Zoom and Google Meet tools more frequently to teach classes as evidenced by the 56.3% responses of students to usage of Zoom. Aligning to the students' perception, similar trend was observed in their knowledge in the scale of medium-high knowledge of the Zoom and Meet platforms while however, they have low-zero knowledge of the Skype, Microsoft Teams and Discord tools. They concluded their study indicated 66.6% of both teachers and students have stated that VC has not affected their educational development.	Rio-Chillccee et al. (2021)
Google Classroom, Zoom, Cisco Webex, Microsoft Teams	Comparison indicated that Google Classroom was both educators and students' top preference with 97.3% and 94.2% respectively followed by preference for Zoom was 22.0% by educators and 10.0% by students. Microsoft Team preference was 14% by Educators and 11.0% by Students. Less than 10% of both educators and students indicated Cisco Webex.	Saidi et al. (2021)
Zoom, Google Meet	The comparative investigation on using zoom and google between 2 years, the use in 2021 dominated more ($r = 0.346$, $p < 0.01$), with a shift from often to almost always.	Hurajova et al. (2022)
Microsoft Teams	A statement was made that a difficult thing about teaching remotely with Microsoft Teams program, only four faces could be seen at the same time. This related to the need for visibility of students and requested to use programs at home that are only accessible at their school.	Klusmann et al. (2022)

Software Platform	Analysis of Research Articles	References
Microsoft Teams	The high eigenvector centrality value of MS Teams represents that the students are more prone to the “off-the-shelf” resources prepared by the instructors. Microsoft Teams and the Learning management System (LMS) have shown a high clustering coefficient that denotes their tendency toward making clusters in the whole network indicating the importance of Microsoft Teams. This attributed to the audio-visual feature preference.	Muhuri and Mukhopadhyay (2022)
Zoom	Zoom synchronously connected remote learners to in-person learners, peer mentors, and instructors in the First Year research Immersion (FRI) research labs. Students perceived zoom was a good attempt to enable them to converse about what was happening in lab without their physical presence. They were also able to be engaged throughout the process in asking questions about the steps.	Shamoon-Pour et al. (2022)
Zoom, Microsoft Teams, Google Classroom, Click Meeting, Discord Tool	From 621 respondents, there had been a visible rise especially in the usage of Zoom, Microsoft and Google Classroom during the Covid-19 Pandemic. Microsoft Teams increased in knowledge about the tool by 73 percentage points with the highest number of respondents indicated the use of MS Teams with 3.9 on a 5-point scale). Zoom increased in knowledge about the tool by 62 percentage points, was in second place (3.14)in usage. Google Classroom increased in knowledge about the tool by 27.21 percentage points, was in second place (1.62). The most frequently used e-learning tools during the COVID-19 pandemic have been mainly VC platforms such as MS Teams and Zoom.	Stecula and Wolniak (2022)
Zoom, Google Classroom	The students completely agreed on screen sharing functions in the Zoom online class which is an essential skill for online class effectiveness. The features of Zoom applications in the online class are vital instruments to enhance respondents' online learning process with reference to chat function for them, raise hand and students poll functions as important feature to engage students more in the Zoom online class. Zoom was agreed to work as a catalyst of make the classes live and induce as a source of interaction among the students. The students have given second priority on Google classroom so that they can enjoy all benefits of uploaded materials of online class afterwards to minimize confusion.	Alom et al. (2023)
Zoom	Identified indicators and characteristics of engaging teaching videos to recorded lecture videos using Zoom was used to design an AI-enabled that autogenerate a report on engaging teaching videos.	Verma et al. (2023)
Zoom	Students' engagement, as reported during their typical Zoom classes, was explained in part by their motivations, anxiety, and mediated by mind-wandering. These results were important as it encouraged instructors to better attend to factors that positively impact students' mind-wandering and online engagement.	Wong et al. 2023
Webex, Zoom	Participants from 28 schools listed that WeBex and Zoom were the frequently used during VC sessions.	Fütterer et al. (2023)

Figure 2 indicated that Zoom was the most frequent investigated or mentioned VC software platform followed by Microsoft Teams, Google Meet, Google Classroom and Discord Tool. The rest that included Webex, Skype, and Click Meeting only occurred once.

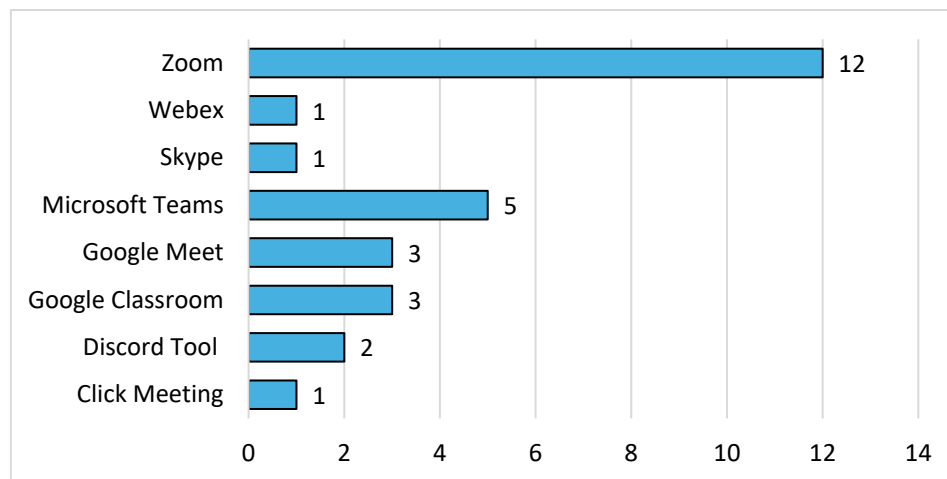


Figure 2: Frequency of video conferencing software platforms in research articles

3.2 Platforms Integrated With Videoconference Software Platforms

Table 2 is a review of learning platform which are communication tools that can be used in conjunction with or integrated into VC platforms to enhance engagement of students during the sessions and improve learning outcomes for effectiveness. These are interactive polls and questions and answers sessions, real-time brainstorming, gamification all with real-time feedback.

Table 2: Platforms integrated with Videoconference Software Platforms – communication tools – learning management software

Software	Analysis of Research Articles	References
Kahoot, Socrative, Blackboard, Mentimeter, Poll Everywhere, Moodle, Brightspace and Canva.	The platforms were integrated into the Acadly product to help instructors to boost engagement inside the classroom. The pandemic necessitated a change in the approach to be more suitable to synchronous online learning. Zoom chat and Zoom polls were replaced with Acadly's own chat and polling options integrating other platform and sends all learning data back to the LMS Gradebook in the system, collected and consolidated automatically.	Vashisht & Gautam (2020)
Edpuzzle, Quizzez, Kahoot, Moodle, Schoology, Flipgrid, Edmodo, Padlet, Jamboard	The top 3 types with students' dependence on the preference by educators were Schoology followed by Edmodo and Flipgrid while all the others were reported with less than 10% among 485 educators and 485 students as respondents. This analysis helped educators to choose the most effective and convenient platform preferred by students which consequently would assist in identifying the most appropriate approach.	Saidi et al. (2021)
YouTube	An increase in familiarity noted YouTube was the most popular social network with services and applications adapted to e-learning .	Stecula and Wolniak (2022)
Whiteboard	The white board function and screen annotation functions were reported by student's perception as important to enhance students' engagement in the online learning process	Alom et al. (20223)
Blackboard	Seewo interactive whiteboard has customized an "interaction" toolkit for Seewo Pinco, which includes a voting system. With the voting system, teachers can display multiple-choice questions on the board, and students can select their answers using their personal devices. The answer distribution is then presented on the board. Students can see whether they chose the correct answer and how many of their peers selected each option. Teachers can also assess how well students have mastered the content and provide customized feedback immediately. This voting system is known as a student response system (SRS), also referred to as clickers or classroom response systems (CRS). By allowing students to interact with the teaching content in real-time through their personal devices, the voting system ultimately strengthens teacher-student interactions. It was perceived usefulness in improving the learning process (PU-process) and perceived usefulness in enhancing learning outcomes (PU-outcome). IWBs were reported to be significant in PU-process but cannot guarantee PU-outcome. To ensure PU-process, teachers should not focus too much on the entertainment provided to avoid distracting students, nor should they treat IWBs as ordinary information presentation tools. It was reported that it enhanced teacher-student interactions, captured their attention, promoted learning engagement, and alleviated learning anxiety. Furthermore, the Seewo interactive whiteboard can also be beneficial for teachers, as it assists in accessing learning materials, diversifying knowledge presentation, and emphasizing key information.	Lou et al. (2023)
Blackboard, YouTube, TikTok	Without segregation or comparisons of the tool, It was reported to be widely used in the study and proven to be effective in learning and online teaching platform of the university. Students have shown greater enjoyment when that enjoyment or gratification has come from the sensation of learning, and not from any other type of application used is widely known by the students, so their predisposition toward it will be positive indicating personal satisfaction levels increase. TikTok was stated as social network that students have shown greater enjoyment when that enjoyment or gratification has come from the sensation of learning, and not from any other type .In general Post-Covid era, comparison between videoconferencing and face-to-face did not show any difference in perception.	Gil-Cordero et al. (2023)
Moodle	50 % of the respondents do not have the sufficient skills to create online tests and assignments and to use advanced features of Moodle; study revealed that faculty have an adequate level of readiness when it comes to online teaching as they possess the minimum requirements in terms of access to hardware (90 %), t	Zgheib et al. (2023)
AI tools	AI-powered technologies are playing a pivotal role in making virtual meetings more efficient, accessible, and engaging. seamlessly integrates with major VC platforms like Zoom and Microsoft Teams to eradicate background noise, such as keyboard clicks and ambient chatter, ensuring pristine audio clarity	Verma et al. (2023)

Software	Analysis of Research Articles	References
	for all participants. From real-time transcriptions to emotion recognition and intelligent meeting summaries, AI in VC is transforming how teams connect — smarter, faster, and more securely. Intelligence-enabled tool from the reports generated by this manual annotation. With the assistance of this tool, the engagement enhancing teachers' behaviours and movements can be identified from recorded lecture videos, and a report can be generated on engaging teaching videos. For the classification task of video analysis, the deep learning model is adopted in this research. The model is trained with manually annotated videos and determines class imbalance issues and misleading metrics. assist the education institutes in creating moderation in the lecture delivery and whether the teachers are utilising the technology effectively. Additionally, this can help teachers recognise the presence or absence of engagement-enhancing behaviours and movements during their video conferencing sessions.	

3.3 Videoconferencing Hardware

The VC hardware refers to the tangible components and equipment necessary to enable high-quality VC experiences. The VC hardware tools are essential components to facilitate clear audio, visual and video communication in both virtual, face-to-face and hybrid education classrooms. As this review is focus on portable hardware, most affordable, convenient, and adaptable technology, with audio and video capabilities to facilitate VC software are identified from research articles as listed in Table 3.

Table 3: Videoconference portable hardware tools from research articles

Hardware Tool	Analysis from research articles	References
Laptop, Smartphone, Tablet	Among the types of devices used by the 254 female students as respondents, 80.31% used smartphone during VC, while 70.47 used laptop and 7% used tablet.	Bui et al. (2020)
Webcams, headphones, VCS, cameras and tripods 3D cameras	Few participants were lacking these tools; students perform a task with such a laboratory, they can typically observe the machines, steps and results via webcams. Proper teaching equipment and hardware on both sides must be ensured. Insufficient sound quality or choppy audio transmission during live sessions can be frustrating and annoying. With 3D cameras and tripods, students could observe the experiment from multiple angles	Grodzki et al. (2021)
Laptop, Second larger screen, Good keyboard, Tablet	The respondents made up of 1,115 Dutch educators with 76.7% females and 22.7% males expressed the need of more facilities at home to enable them to provide online education during the Covid-19 pandemics.	Klusmann et al. (2022)
iPod Touch	iPods provided the most affordable, convenient, and adaptable technology, with audio and video capabilities to facilitate mobile Zoom conferencing in the lab. Additionally, to address cleaning and disinfection guidelines, plastic cases and screen protectors	Shamoon-Pour et al. (2022)
Laptop, Tablet, Smartphone	Research shows that the most used e-learning device was a laptop. Most of the respondents found it very useful in e-learning with the usefulness score was 4.75 on a 5-Likert Scale. The usefulness of tablets (3.18) and smartphones (3.35) was assessed at an average level.	Stecula and Wolniak (2022)
Laptop, tablet, smartphone	General availability of technology like laptop and smartphone to use for digital distance teaching indicated that 98% were able to use the technological devices and 99% from the high familiarity group were able to take home and use the one-to-one tablet for school trial with <i>t</i> -test showing statistically significant differences in the frequency of tablet use in class for mathematics. Familiarity with technology seems to be important for how distance teaching was organized (e.g., percentage of digital distance teaching) but, consistently, did not contribute to student-observed learning activities, student-perceived cognitive activation, and students' effort in learning in digital distance teaching. By explicitly connecting tools with student-observed learning activities, students were observed to use tools mostly for passive or active learning activities, as known from studies for face-to-face teaching.	Fütterer et al. (2023)
Multimedia speakers, omni-directional mic, document camera, a tracking camera.	All the hardware tools were installed in the classroom to supplement the Seewo Interactive Whiteboard hardware system.	Luo, et al. (2023)

Hardware Tool	Analysis from research articles	References
Laptop, webcam, microphone	90% have accessed to supplementary tools indicated a high level of technological readiness in term of access to equipment.	Zgheib et al. (2023)

4. Discussion

It was the COVID19 restriction that plunged the educational institutions from conducting physical classroom to online classroom using VC modalities leaving no options. The software VC systems alone are not sufficient to communicate the teachers' writing on a board, presentation slides, the gesture and posture, and engage students in groups or individually with differentiated or engaging activities. Hurajova et al. (2022) described the period as the transition to the online environment being sudden and unexpected that the instructors were unprepared for this crisis, not having adequate time and facilities to plan distance education consistently. Prior to this situation, the education research was delving on the evolution of traditional face-to-face education towards digital education with the advancement of the technologies in developing 21st century students coming from the alpha, Y and Z generations (Chan, 2022). The popular VC platforms for education prior COVID19 were listed as Zoom, Google Meet, Microsoft Teams and Webex Meetings. Rio-Chillcree et al. (2021) and Stecula and Wolniak (2022) attributed to knowledge of usage. According to Klusmann et al. (2022) knowledge of VC software for online education is essential to access to suitable software that should serve the needs of teachers as well as students. Thus, it explains that the most frequent use or mentioned in the same order indicated in Figure 2. In addition, they stated the usage relates to the need for visibility of students, as some online programs teachers were now using for their teaching could only display a maximum of four student videos as in Microsoft Teams. Fütterer et al. (2023) reported the familiarity towards the VC software platform that led to the emergency use during the crisis. Vashisht & Gautam (2020) and Saidi et al. (2021) indicated that these tools have been integrated into the LSMs provided by the education institutions. This is attributed to the software being provided by the education institutions based on the familiarity in using the platforms.

The activities involving lectures, student presentations, group-formation and group work, live quizzes, peer-group assessment, and collaborative design and facilitation are some of the activities that require integration of video-conferencing functionalities and various web-based software. Martin et al. (2020) emphasised that engaging the learner in the online course is vitally important as they are separated from the instructor and peers in the online setting. Accordingly, engagement is examined through the lens of interaction, participation, community, collaboration, communication, involvement and presence. Research from the reviewed articles shows that the students engage and participate less in the online sessions, feel or get excluded by turning off video and microphone for avoiding technical issues or due to the absence of social norms, and require higher levels of motivation to be active in the courses. Stecula and Wolniak (2022) indicated that proper resources also positively influence the absorption of e-learning content. Gil-Cordero et al. (2023) stated that effectiveness in learning is measured with respect to two variables, from a perspective not only of academic satisfaction and by the learning achieved, but also from a user perspective through user satisfaction. Several engaging and real-time collaboration platforms with gamification features data-driven and interactivity-focused to engage students and receiving immediate feedback from students that include Kahoot, Quizzizz, Mentimeter, Polls, mentioned in the review articles (Table 2) have unique features are used based on the knowledge and familiarity (Stecula and Wolniak, 2022). Aldalur and Perez (2023) indicated that such VC platforms with gamification is a strategic attempt that can turn learning into an immersive activity. Blackboard can be used to facilitate discovery learning.

There should be a strategy to utilize mobile devices to maximize all students' connection to in-person learners, peer mentors, and instructors in online remote situation in real-time. Shamooun-Pour et al. (2022) shared that approach must include giving students responsibilities that allowed them to be engaged and feel like meaningful participants in their investigation on the First Year research Immersion (FRI) research labs. Additional online applications and accessories, the VC hardware are used along with video conferencing systems for sending the information interfaces a student gets in a face-to-face classroom. Gladović et al. (2019) reviewed that the basic equipment for VC include camera and its functionality of zoom option and resizing, audio equipment relating to sound which was immensely important as a delay in sound transmission of only 0.5 second would lead to a discrepancy between speech and body movement which would impede teacher-student interaction and lastly lighting and background. The digital capabilities in the online teaching context involve even the use of camera setup, light settings, body language, eye contact, and other digital and non-digital tools, depending on the field of study. For the educators, managing multiple devices and acting in front of the camera to provide a good experience for the viewers is different from face-to-face interaction. A big challenge is the resolution of the delivered VC platforms should be optimal to cater to the needs of all the students who might encounter Internet

speeds and or data plan restrictions as mentioned by majority of the articles. Some teachers still have difficulties at a psychological level due to this new teaching modality. The teachers mentioned that they needed to be in constant training to learn the new digital tools. Reliable equipment needs to be available, which provides good sound quality and is supported by a fast connection. Grodotzki et al. (2021) highlighted the use of 3D camera. The review by Atal et al. (2023) demonstrated how 360° videos are a preferred method of overcoming the limitations of standard video as they can provide a more realistic and authentic experience. The evolution and advancement into Artificial Intelligence technology will play a pivotal role in making VC more sophisticated as educational institutions are adopting the model of hybrid learning (Verma et al. 2023).

5. Limitation of the Review

The review has encountered limitations related to the scope of the purpose confining to VC software platforms and portable hardware from empirical research articles. Most of the research articles reviewed between 2000 and 2024 did not relate to a broader comparison of various individual platforms and their suitability for educational context but rather congregated approach with hypotheses on skill, competences, experiences, effectiveness, mental health, and satisfaction of using these platforms. Furthermore, most articles concentrated on usefulness in improving the learning process (PU-process) and perceived usefulness in enhancing learning outcomes (PU-outcome). Majority of the research articles are from the aftermath of COVID19 pandemics plunging the education institutions to go online classes with comparatively studies between pandemic and post-pandemics era. The main tools for teaching and learning are being emphasised that the technology used must be clearly introduced to Educators and students to ease the online learning process and consequently enhance students' ability to perform successfully. Instructors must be well informed about the features, usefulness, and technical issues of VC platforms and hardware to extend their knowledge and confidence in using the system as highlighted by Bailey et al. (2021).

6. Conclusion

In the new post-COVID era of virtual classrooms, the educators are now required to teach partially or entirely online, and universities are trying to equip them with additional accessories, software and other resources in the absence of classroom resources. Furthermore, engaging students in the absence of visual clues, room for interaction, lack of understanding about online norms, and lack of technology knowledge etc. reduced the online engagement, which reduces the quality of contact hours. The 18 articles have been analysed categorised into three areas: 1) Videoconferencing Software Platforms (2) Platforms integrated with Videoconference Software Platforms and 3) Videoconferencing Hardware. This review has provided sufficient information to enable ideating a portable video conferencing toolkits and online applications for engaging learning experience design in higher education classroom. It has indicated that basic knowledge of usage and familiarity are the foundation of adopting VC platforms. As for the hardware, audio-visual aids includes headphones, tracking cameras and extended screen are essential tools for visibility and audio quality to engage students with the educators. However, further research should be conducted to address the gap in understanding how the VC tools can effectively support smooth VC to improve the online classroom atmosphere and the dynamics of interaction between educators and students.

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Ethics and AI Declaration

Ethical clearance was not required for the research.

No AI tools were used the creation of this paper.

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