REVIEW OF EMPIRICAL STUDIES ON THE VIDEO CONFERENCING TOOLS AND METHODS

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**Abstract**

This paper is based on a review of 9 articles 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 videoconferencing in Education. The analysis categorised the findings into two areas: 1) Videoconferencing in Educational Programs and (2) Evaluation of Open and Distance Learning (ODL) Tools. This led to identification of 7 themes to provide empirical evidence of what was said of videoconferencing in teaching and learning and the challenges. The 7 themes are Attitude of Educators and Students, Digital Skill, Videoconferencing Software Tools, Advantages and Disadvantages of Videoconferencing Software Tools, Videoconferencing Engaging Tools, Social Apps and Videoconferencing Hardware Tools. Zoom was the most frequent mentions followed by Microsoft Teams and Google Meet. This review provides the information to enable ideating a portable video conferencing toolkits and online applications for engaging learning experience design in higher education classrooms.

1. **INTRODUCTION**

Video conferencing has become invaluable in education, particularly catapulted during the COVID19 pandemic which 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. Cole, Ray & Zanetis, (2004) defined videoconferencing 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 videoconferencing closely followed the trajectory of its status as a ‘cutting edge’ technology in different educational environments. The implication of recommendation on adoption of video conferencing systems (VCS) and good practices is to collect best practice scenarios of educational video conferencing carried out against a backdrop of a body of literature. The aim of study is to conduct an empirical exploratory literature review of video conferencing technologies, methods and principles of use, and good practices to engage students online in various classroom environments by the recent drastic changes.

1. **METHODOLOGY**

The search for relevant literature was 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 were searched using the following search strings: Videoconferencing, 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: Mobile and remote; Engagement: Interaction, communication and discussion; Learning Experience Design: Learning environment and flipped (classroom). The search period was set starting from 2017 based on the recommendation of Crompton and Burke (2020) covering the last five years to explore how technologies and pedagogies evolved. The search was also limited to Exclude all systematic reviews & include empirical papers only.

1. **RESULTS AND DISCUSSION**

The literature on videoconferencing reflects much of the academic material available focusing on university experiences in distance learning, in which a range of communication devices were used to facilitate learning at a distance. The articles were categorised into two areas: (1) Videoconferencing in Educational Programs and (2) Evaluation of Open and Distance Learning (ODL) Tools.

* 1. Videoconferencing in Educational Programs

There were 4 articles reviewed.

3.1.1 e-Video conferencing; Higher education; Student development; Lifelong learning; Online Meetings & Video Conferencing; Supervising (Alsharani et al., 2020)

A qualitative study was on investigating the potential of using videoconferencing in supervision practices using unstructured interview with open and semi-structured questionnaire. The respondents were postgraduates. It provided insights using “reflective interview notes” with unstructured interview to capture students’ perception of videoconferencing and how teleconferencing related services can empower the current supervision practices using structure and formed dialogues between students and supervisors in Arabic universities. The quality analysis indicated that videoconferencing use were positive in which most students were found to favour the use as a supplement to the traditional face-to-face approach. The students meet their supervisors at any time and from anywhere enabling the sharing files and screen and recording the session. In addition, communication barriers between them particularly when the supervisor is a foreigner are reduced, and the work progress can be monitored with their supervisor. The major challenges of the e-videoconferencing relate to internet speed issue and the need for a reminder or notification.

3.1.2 Learning analytics in synchronous online education: Making video conferencing more data-driven and interactivity-focused (Vashisht & Gautam, 2020)

This paper reported on a product created more suitable to synchronous online called Acadly as a solution for in-person teaching and learning on both desktops/laptops as well as mobile platforms. Acadly retains the video broadcasting portion of the Zoom platform, however, the Zoom chat and Zoom polls are replaced by Acadly’s own chat and polling options, respectively. The Acadly platform uses the Learning Tools Interoperability (LTI) to make all data regarding attendance, discussions, poll participation, and quiz performance transferable to the Learning Management System (LMS) like Moodle, Brightspace, Canvas and Blackboard, and sends all learning data back to the LMS gradebook. Accordingly, instructors can share quizzes, polls, word clouds, and videos with students during online classes, Notably, all the data points are collected and consolidated with some available in real-time (during the meeting) while others can be exported for analysis after the meeting. Thus, it indicates that creating own video conferencing platform allows control over several components of the lessons.

3.1.3 Videoconferencing in the Learning Process during the Pandemic at a University in Lima (Rio-Chillccee et al., 2021)

A case study analysed the use and impact of videoconferencing tools 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 videoconferencing has not affected their educational development.

3.1.4 Video conferencing in the e-learning context: explaining learning outcome with the technology acceptance model (Railey, et al., 2021)

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A technology acceptance model (TAM) with a cross-sectional research design explained how the use of technology influences learning outcomes emanating from engagement with the Zoom video conference platform. The structural equation modelling was used to analyse the relationships among the TAM 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.

* 1. Evaluation of Videoconferencing Tools

There are 5 articles reviewed in the category of evaluation of videoconferencing tools.

3.2.1 Evaluating Students’ Preferences of Open and Distance Learning (ODL) Tools (Saidi et al., 2021)

A case study revealed both educators and students’ preference of the top four ODL tools are similar as listed: Google Classroom, Campus’ Learning Management System (uFuture/iLearn, Blackboard, Spectrum), Schoology and Edmodo in Malaysian Universities. Other including Flipgrid, Edpuzzle, Moodle, Quizzes are less preferable while Kahoot, Padlet, Jamboard and iSpring have no responses by students. The types of social media or chat applications indicated similar trend of preferences by the educators and students’ preference for ODL as listed in higher order: WhatsApp, Telegram, Email, Facebook, Instagram, and Twitter. In addition, the study also indicated that most of the students preferred synchronous with 46% where they preferred to learn as per scheduled or at specific time, rather than asynchronous with 30%, whilst 24% claimed that, both synchronous and asynchronous style worked best for them.

3.2.2 Implementation of Online Learning using Media during the covid 19 Pandemic (Sapura et al., 2021)

The study was on the implementation of online education using online media in a sample of Indonesian Universities using an interactive analysis method through interview via telephone interviews and/or Zoom Cloud meeting. The results showed two areas: 1) students had already had the basic facilities needed for online education; 2) online education was flexibly being implemented, encouraging learning independently, motivating to learn more actively concluding that increasing of independent learning, attention, motivation, and the courage to express ideas and problems was advantage of online education.

3.2.3 Remote learning via video conferencing technologies: Implications for research and practice (Camilleri & Camilleri, 2022)

This study on remote learning via video conferencing technologies for research and practices implicated that the educational institutions’ facilitating conditions including the organizational and technical infrastructures are critical to students and educators, to overcome barriers for their engagement with technology, especially during the early stages of adoption. Synchronous video conferencing can be used in blended learning approaches as current software are interactive and enabled two-way communications. However, much improvement has to be made as their study reflected with respondents’ of not completely pleased with the quality of educational services that was delivered through video conferencing technologies and suggested educators should use a range of resources when they are presenting their virtual lectures to entice the students’ curiosity.

3.2.4 Improving the efficiency of remote conference tool use for distance learning in higher education: A kano based approach (Fujs et al., 2022)

A kano based approach was used to identify efficiency of remote conference tools for a particular course from students and teachers’ perspectives. The result of three different case studies has clearly demonstrated the benefits of the kano based approach to show the importance of use of different remote conference tools features in decision making to be adapted to the specifics of each course where online lectures and tutorials need to be taken into consideration separately.

3.2.5 Impact of female students’ perceptions on behavioural intention to use video conferencing tools in COVID-19: Data of Vietnam (Bui et al., 2020)

The behaviour intention as reported has an implication that gender could be contributing factors from their studies on female students’ perception on using video conferencing tools (VDT) that include Microsoft Teams, Google Meet, Zoom in distance learning. This was derived from their review on Technology acceptance model 3 (Venkatesh and Bala (2008) with indication that computer self-efficacy, computer playfulness and social influence were external variables that have indirect effects on behavioural intention.

* 1. Findings

The findings according to 7 themes are shown in Table 1.

Table 1: Videoconference tools themes

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| Theme | Description | Summary |
| Attitudes of Students/Educators | Reacting positively to video conference in which most students were found to favour the use as a supplement to the traditional face-to-face approach and its flexibility | All articles are pertaining to higher education institutions. There is 1 article indicating gender students’ behavioural intention to use video conferencing tools. |
| Digital Skills | Some teachers still have difficulties at a psychological level due to this new teaching modality. The teachers mentioned that they are in constant training to learn the new digital tools. Students feel comfortable and motivated during their virtual classes. | There are 4 articles highlighting the needs of developing digital skills in attaining the efficient and effective adoption of videoconferencing. |
| Videoconferencing Software Tools | This is made in reference to the technology specifically videoconferencing software that allows teachers-students in different locations to hold real-time face-to-face teaching and learning. | Frequency mentioned in the number of articles are Zoom (8); Microsoft Teams (7); Google meet (4); Skype (2); Discord, Google Hangouts, BigBluebutton; WebEx, Jitsi, Cisco Collaboration Solution |
| Advantages and Disadvantages of Videoconferencing Software Tools | Most advantages pertain to being free, allows screen sharing in real time, meeting recordings, files are stored while disadvantages relate to need of stable internet connection; limited time for free usage and capacity in real time; difficult to track students ́ overall engagement with the lecture. | One article details commonality and specific advantages and disadvantages of each software tools. Another article relates to increasing of independent learning, attention, motivation and the courage to express ideas and problems while in contrasts, the lack of supervision of students, lack of internet signals in remote areas and high quota payments as challenges. |
| Videoconferencing Engaging Tools | These are interactive polls and question and answers sessions, real-time brainstorming, gamification all with real-time feedback. | Kahoot, Socrative, Mentimeter, and Poll Everywhere, Whiteboard, Krita, Google Jamboard, Polls, Quizzes, Word Clouds, Edmondo, Flipgrid, Edpuzzle, Moodle, Padlet |
| Social Media Apps | Social media tools are used for various activities related to social media, including scheduling and immediate feedback. | WhatsApp’s, Telegram, Email, YouTube, Facebook, Instagram, Twitter |
| Videoconferencing Hardware Tools | Video conferencing hardware refers to the tangible components and equipment necessary to enable high-quality video conferencing experiences. | Magnifier for smaller screen, Cell phones, Personal Computer iPods and iPads, Personal Digital Assistants, Microphones, Smartphones and Laptops are being mentioned. |

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 video conferencing tools to extend their knowledge and confidence in using the system as highlighted by Bailey et al. (2021). A big challenge is the resolution of the delivered videoconferencing tools 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.

The issue of interaction has been seen as the key component of a constructivist use of videoconferencing to promote effective learning through the medium. Interactivity can be problematic despite having accessories like breakout rooms and screen sharing in the videoconferencing software like Zoom. It is difficult to track students ́ overall engagement with the lecture. Videoconferencing can be data-driven and interactivity-focused to engage students and receiving immediate feedback from students using platforms that include Kahoot, Socrative, Mentimeter, and Poll Everywhere. In responding to the needs of a “Student Response System,” the generic term used for products that help instructors boost engagement inside the classroom, most benefit effect on efficient of distance learning, equally skilled. Reliable equipment needs to be available, which provides good sound quality and is supported by a fast connection.

1. **CONCLUSION**

In the era of virtual classrooms, the educators are now required to teach partially or entirely onlne 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. 9 articles have been reviewed which were categorised into two areas: 1) Videoconferencing in Educational Programs and (2) Evaluation of Open and Distance Learning (ODL) Tools. This led to identification of 7 themes to provide empirical evidences of what were said of videoconferencing in teaching and learning and the challenges. This review provides the information to enable ideating a portable video conferencing toolkits and online applications for engaging learning experience design in higher education classroom.

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