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Student Comfort and Well-being Emerge as Influencers of Virtual Classroom Engagement

Dr Andrew Kemp^a, Dr Sarah Dart^b, Professor Edward Palmer^a, Professor Peter Strelan^a, and Associate Professor Helen (Mery) Thompson^b

^a University of Adelaide, Australia; ^b Queensland University of Technology, Australia

Abstract

Student acceptance and voluntary use of virtual classrooms such as Zoom is influenced by various latent factors which can be managed to improve student engagement, and their effects measured by technology acceptance models (TAMs). This study sought to identify factors not currently accounted for in educational TAM research relating to virtual classroom use. To achieve this, we invited 742 students at a major Australian university to respond to four open questions on their attitudes towards using Zoom for learning. Thematic analysis was conducted on 169 valid responses. Themes were mostly aligned with known factors from a published taxonomy of important factors. However, health and well-being, and social comfort, emerged as two new factors affecting student intentions to use Zoom for learning. The findings suggest that these two new constructs influence student voluntary use of virtual classrooms such as Zoom.

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Introduction

The rapid adoption of video-conferencing platforms during COVID-19 (Joia & Lorenzo, 2021; Lee et al., 2021; Wong, 2020) enabled real-time interactions between students and educators in a virtual classroom environment (Hamilton et al., 2020). Zoom was one of the most common software tools used for this purpose, given that it was a mature technology for online synchronous teaching (Correia et al., 2020). The rapid increase in students using Zoom provided an opportunity to explore factors affecting student attitudes and behaviour towards virtual classes for learning.

Technology acceptance models (TAMs) provide a useful framework for examining how various factors affect students' decisions to use or not use educational technologies. While many variations have been developed (Abdullah & Ward, 2016; Davis, 1986; Davis et al., 1989; Venkatesh et al., 2003), Davis' original Technology Acceptance Model (TAM) (Davis, 1986) is easily extendable with relevant factors to suit educational contexts. This model hypothesises that a user's perceived usefulness and ease of use of a technology influence their attitude toward it and in-turn their intention to use it, and that other factors influence usefulness and ease of use.

Previous research has collated the predominant factors influencing user perceptions, culminating in a taxonomy of factors for educational applications of TAMs (Kemp et al., 2019). The taxonomy lists seven primary groupings of factors: attitude, affect and motivation, social factors, instructional attributes, cognitive engagement, system attributes, usefulness and visibility, and perceived behavioural control. This taxonomy is used as a comparative framework for the present study. However, since the taxonomy was published in 2019, the unique circumstances associated with the pandemic and its dramatic impact on higher education practices raised the possibility that new factors influencing student attitudes toward educational technologies may have emerged.

This study's aim was to investigate student attitudes toward Zoom using Kemp et al.'s (2019) taxonomy to identify any previously unidentified factors. A qualitative research approach was employed to explore students' personal perspectives (Creswell, 2018). The findings contribute to the literature to guide construction of educational technology acceptance models and offer implications for educators looking to improve the quality of learning experiences delivered via Zoom.

Literature

Zoom is a virtual meeting tool that has been appropriated for the educational setting that provides users with an efficient environment for communication and collaboration in educational contexts. Its functionality includes videoconferencing, interactive whiteboards, chat, breakout rooms and the ability to share screens (Kohnke & Moorhouse, 2020). Zoom's functions allow students to communicate in ways that are not possible in face-to-face environments, such as with emoticons, or private chat with educators that allow the educator to monitor student engagement or provide feedback.

In investigating student attitudes to Zoom we cross-referenced with factors that are known to affect attitudes toward educational technologies: attitude, affect and motivation, social factors, usefulness, perceived behavioural control, instructional attributes, cognitive engagement, and system attributes (Kemp et al., 2019). Recent research relating to these factors is briefly described to provide context for the analysis.

Attitude, Affect and Motivation

Some students have reported online learning to be 'worse than in-person schooling' (Lee et al., 2021, p. 91). Elsewhere students have indicated a preference for blended delivery (Ashton & Elliott, 2007) and face-to-face socialising with classmates (Ismaili, 2021) even if fully online courses are offered. Wong (2020) reported that students preferred face-to-face for small group activities, though the online mode can facilitate greater communication for shy students and is tolerated for information delivery for larger classes. Behind student attitudes lie several factors, one of which may be e-learning readiness of the students themselves, incorporating aspects such as self-efficacy, motivation, online communication efficacy and motivation towards learning (James, 2021), as well as personality and behavioural characteristics (Cohen & Baruth, 2017).

Social Factors

Social cues are important influencers of behaviour (Ajzen, 1991; Ajzen & Fishbein, 1980). During the COVID-19 disruption, faculty and students were forced into the online mode as a matter of public safety. This meant non-verbal social engagement (Ebner & Greenberg, 2020) developed in face-to-face contexts was altered to suit the online environment. Social cues are important in new situations when people are not entirely sure how to behave (see Bandura, 1977; Sanna, 1992) and group settings can also moderate student behaviour (Karau & Williams, 1993). Given the rapid transition to online learning methods and technologies during the onset of COVID-19, it could be expected that instructors and students would have been looking to others as guides to how to behave in the new setting.

Usefulness And Perceived Behavioural Control

Students acknowledge the access and convenience advantages of online learning (Ashton & Elliott, 2007; Ismaili, 2021). Opportunity (Sarver, 1983), accessibility and individual agency (Dart et al., 2020) are important contributors to a student's control over their learning. Zoom supports student agency by making classes available regardless of student location (Sayem et al., 2017). Zoom also allows educators and students to collaborate in small groups (Eraković & Topalov, 2021), use polls, share screens, communicate in non-verbal ways (Kohnke & Moorhouse, 2020) and conduct interactive tutorials (Sayem et al., 2017). These features of instruction, collaboration, communication, and presence are also part of traditional face-to-face classes, so the features of Zoom have supported efforts to move teaching from the face-to-face to online. Thus, Zoom appears *prima facie* useful because it allows some essential functions of teaching and because it facilitates access for remote students.

Instructional Attributes

Instructional attributes encompass instructor attitude, instructor knowledge, design and characteristics of teaching materials, instructor-learner interaction, learner-learner interaction, collaboration, and feedback (Kemp et al., 2019).

Teacher presence is important for online courses to reach their pedagogical objectives (Joia & Lorenzo, 2021; Van Wart et al., 2020) in terms of use of the technology and facilitating students' metacognition during studies (James, 2021). Dart and Woodlands (2022) have also described the importance of instructors developing knowledge facilitation skills that incorporate student-centric approaches. Student outcomes and satisfaction improve when instructors facilitate interaction

rather than act as pedagogical sources of information (Arbaugh, 2002). Students have reported that interaction is more frequent in face-to-face settings and that lack of interaction in an online class impedes learning (Ismaili, 2021). Interaction and discussion that occurs in face-to-face classes supports independent online learning (Ashton & Elliott, 2007). Class discussion is also a critical success factor in online environments (Selim, 2007). While student attitudes towards online learning vary, technology-mediated discussion can suit students who prefer anonymity or 'whose cultural expression gives them little capital in an English-dominant, vocally expressive classroom' (Ashton & Elliott, 2007, p. 176). Interaction and class engagement lead to a feeling of membership and influence, which promotes 'e-learning stickiness' (Luo et al., 2017, p. 155), or habitual use. Non-verbal forms of interaction also exist: students have come to value the emoticons, screen sharing and collaboration that Zoom can afford them (Eraković & Topalov, 2021), and interactive Zoom tutorials support student engagement and satisfaction (Sayem et al., 2017).

Instructors have been called to offer more interactive teaching, in part to combat the social distance students can feel in online environments (Volery & Lord, 2000), which requires a degree of technological competence. However, while Lee et al. (2021) noted that many educators turned to a technocentric approach as COVID-19 hit, it was soon realised that this did not satisfy students' desires for actual human connection. Ebner & Greenburg (2020) also noted that technological acumen is insufficient when teaching through Zoom. Educators have also more recently become aware of the need to support students' social and emotional well-being (Hamilton et al., 2020), with social presence and online comfort being important factors for student acceptance (Ismaili, 2021; Van Wart et al., 2020). In line with this, Lee et al. (2021) found that students feel safer in Zoom environments where there are opportunities to give and receive feedback and build trust.

Cognitive Engagement

Cognitive engagement encompasses perceived loss of time ('time flies'), focus, enjoyment and vividness (Kemp et al., 2019; Saade & Bahli, 2005). Yang & Kwok (2017) demonstrated that cognitive engagement leads to student enjoyment. Perceived loss of time is caused in part by playfulness (Saade & Bahli, 2005) and a user's cognitive immersion within a technology or learning activity, which relates to the learner's focus and learning engagement. An example of engaging content includes worked example videos (Dart et al., 2020), where video length, colourful pens and synchronisation of narration and diagrams are carefully balanced to maintain interest. Interactive tools such as Mentimeter can also foster student engagement because of the quick student responses that others can see (Moorhouse & Kohnke, 2020), triggering the curiosity and interest of other students. While videos and technologies such as Mentimeter, Padlet and Go Soapbox are not features of Zoom, the screen-sharing function allows them to be used within a Zoom class. Screen fatigue can be a challenge (Kohnke & Moorhouse, 2020; Schade, 2020), which relates to physical and/or mental exhaustion that some report following extended use of Zoom (Ebner & Greenberg, 2020).

System Attributes

System attributes such as ease of access, support and design (Volery & Lord, 2000) influence user attitudes toward online systems, with technology reliability and access being of high import

(Selim, 2007). According to Yang and Kwok (2017), internet connectivity, system usability and technical issues are negative influences on student attitudes to online educational systems. Privacy and students' concerns about being recorded or identified can moderate their attitude towards using such technologies (Arapaci et al., 2015). Zoom experienced privacy issues initially (Young, 2021), with some issues being mitigated by adding per-meeting IDs and password access (Kohnke & Moorhouse, 2020). Finally, the design and function of the user interface has been shown to influence continued usage intention (Cho et al., 2009) and Eraslan Yalcin & Kutlu (2019) demonstrated that the user interface influences both perceived usefulness and ease of use.

With this background in mind, we developed a survey to understand students' attitudes toward Zoom for learning during the COVID-19 pandemic. The guiding research questions were:

1. What factors do students perceive as important when using Zoom for learning?
2. What are the emerging factors (if any) that were not identified in previous TAM research?

Method

Participants and Setting

The study was administered in Semester 2, 2020, by engaging students enrolled in a large first-year psychology subject at the University of [Authors' Institution] in Australia, which enrolls approximately 23,000 students across three faculties. At the time of data collection, learning was delivered fully online because of COVID-19 pandemic restrictions. All synchronous classes were being conducted via Zoom following the rapid transition which occurred in Semester 1, 2020.

Data Collection

Our research sought to uncover potentially unidentified factors influencing students' attitudes to using Zoom for learning. A qualitative research approach was thus employed to enable rich and direct insights into student perspectives (Creswell, 2018; Trafimow, 2014), and allow for the identification of potential new influencing factors.

Data were collected through a voluntary, online anonymous survey hosted on the Qualtrics platform, and respondents received course credit for completing the survey. The course through which data were collected was a large first-year psychology course common to several disciplines across the Arts, Sciences and Health Sciences, and was deemed sufficiently broad to gather perspectives for an exploratory qualitative study. Ethics approval was granted by the [Authors' School] Human Research Ethics Sub-Committee. In this research we focussed on the open-ended questions designed to understand what aspects of Zoom learning experiences students perceived to be working, need improvement, and require instructor attention (Table 1).

Table 1

Open questions asked of respondents

Code	Question text
Q01	What makes Zoom preferable for learning over other types of learning methods?

OQ2	What features of Zoom would you suggest improving to enhance learning?
OQ3	What could instructors do to improve your experience of learning via Zoom?
OQ4	Is there anything not covered by this survey that influences your use of Zoom for learning?

Out of a possible 742 students studying the subject, 169 students completed the survey, representing a 23% response rate. The demographic indicators of respondents are listed in Table 2, which are in broad alignment with the first-year psychology student cohort.

Table 2

Demographic indicators of respondents (n = 169)

Variable	Classification	Frequency	Percentage
Age	Up to 25	154	91%
	Over 25	15	9%
Gender	Female	121	72%
	Male	47	28%
	Neither male nor female	1	<1%
Origin	Domestic	151	89%
	International	18	11%

Data Analysis

Kemp et al.'s (2019) taxonomy was used to support identification of emergent factors influencing students' decisions to engage with Zoom, given the framework had mapped the TAM landscape in an educational context immediately prior to the pandemic's onset. The primary categories of the taxonomy of TAM factors were used to deductively code comments in the present study (Braun & Clarke, 2006). However, the authors remained open to new factors, and thus where a response referred to a theme that did not align with an existing category, it was coded as a potential emergent factor.

To reduce bias and promote quality assurance in the data analysis process (Walther et al., 2013), two researchers coded textual responses independently using NVivo software (QSR International Pty Ltd. Version 12, 2018). After an initial round of coding, the researchers engaged in a discussion to compare preliminary coding outcomes and develop better shared understanding of theme definitions. A second round of coding was subsequently completed. Cohen's Kappa and percentage agreement were used as guides of confluence between coders. Cohen's Kappa is a measure of inter-rater agreement that takes into account agreement by chance and so is more robust than percentage agreement alone (Vieira et al., 2010). Greater than 92% agreement was achieved between two coders and Cohen's Kappa ranged from 0.74 to 0.99 for all categories, indicating at least substantial agreement (Landis & Koch, 1977). Finally, responses were analysed to identify the recurring ideas within responses coded to each primary taxonomic category.

Results

The results are reported around the seven primary taxonomic groups of Kemp et al. (2019) of attitude, affect and motivation, social factors, usefulness and visibility, instructional attributes, perceived behavioural control, cognitive engagement, and system attributes. The analysis revealed that there was a gap in the taxonomy relating to health and well-being. Additionally, a gap was identified within the social factors primary group, relating to social comfort. Students referenced usefulness only in the context of accessing classes, rather than of learning. Therefore, usefulness and perceived behavioural control are reported together here, despite being considered separately in the taxonomy. Verbatim quotes which exemplify the underpinning themes are included. The results for already-known factors are reported first with newly emergent factors following.

Attitude, Affect and Motivation

Students provided a spectrum of attitudes towards learning with Zoom. However, comments tended to be negatively skewed, potentially a reflection of the COVID-19 situation forcing students online in a rapid and chaotic transition, with many students stating their preference for face-to-face learning. For example, "I do not prefer zoom over any other learning methods known to me" and "It isn't preferable. It is currently the greatest inhibitor to my motivation to study and attend classes". Other students were more pragmatic and recognised the value of Zoom while still often preferring traditional methods: "It has been great during COVID, but I would prefer face-to-face". Some students indicated the lack of social interaction was a key driver of their negative attitudes towards Zoom, for example "I just don't like online learning and much preferred it when everything was in person", and "staring at a screen all day is never going to be preferable to being in a room full of other people who you are free to interact with". Others had more positive attitudes, for example "Zoom allows for interaction with other students and tutors/lecturers which is not the case with recordings". Capturing several positive aspects, one student related "I like Zoom plus lecture recording, I probably do prefer lecture recording. Zoom is good because its super user friendly and because I work/study I don't lose time/ money travelling into uni".

Usefulness And Perceived Behavioural Control

Convenience and accessing learning at any time and place were major positives for students, and themes that were highly mentioned. Students appreciated being able to manage sleep, personal routines, employment obligations and costs associated with travel. For some, the location convenience helped negate perceived negative effects of distance learning through Zoom. As one student commented, a substantial benefit of using Zoom was "the ability to attend and interact with the class/lecture without having to physically go to class as transport to university from my house is quite strenuous and time consuming". In addition to its benefits for access to learning, some students commented about Zoom's ease of use in terms of navigation and undertaking group work, which demonstrated that Zoom could be useful to facilitate group interactions.

Instructional Attributes

We uncovered three broad themes aligned with instructional attributes: class interaction, instructor practice and feedback and information exchange.

The most prevalent theme to emerge was class interaction. Respondents generally acknowledged that their own peers were not interacting, for example “I lacked the motivation to attend these zoom sessions as no one would really contribute”, and “A major issue with Zoom is the lack of participation from peers in breakout rooms”. Reasons for why students may not have been participating were in comments such as: “I prefer face-to-face contact in person for trading of ideas and easier to grasp nuances in body language not always available via Zoom”, and “it is the lack of face-to-face interaction that fails it”. There were also suggestions to not overuse breakout rooms because “discussion just doesn’t happen”. Another student suggested: “When break out rooms and peer collaboration happen, the instructor should assure that all peers are interacting”. These insights around class interaction intersect with social comfort, discussed further below, and possibly contribute to it.

We used the term ‘instructor practice’ to capture how instructors manage student behaviour and interaction, competency in use of Zoom as a platform, and the application of pedagogical principles. Students provided some suggestions for how educators could act to improve these aspects. Students discussed the importance of tailoring the lesson design to the platform, such as “prepare classes to accommodate Zoom type of learning instead of a face-to-face type” and “alter assignment tasks to suit online learning”. Another respondent suggested that educators should ‘have a lesson plan which they follow - riddled with interactive activities to promote class engagement’. Students also noted the significance of their instructor’s abilities in using Zoom smoothly and confidently. Others identified that “some instructors don’t seem to have a complete knowledge of how to use every feature of zoom properly”.

A smaller number of responses related to feedback specifically. These students appreciated that Zoom allowed them to ask questions and receive quick responses, and that Zoom offered “more feedback and interaction than other methods” which supported “real-time learning where you can ask questions on the spot”. Interaction and feedback were closely related, and as one student eloquently put it: “Zoom allows for interaction with other students and tutors/lecturers which is not the case with recordings. This also allows students to ask question and conduct discussions about content which helps to learn and understand the information”.

Cognitive Engagement

Overall, the responses showed that students are hopeful of more engaging learning activities as part of the Zoom learning experience because distraction was a key concern: “it is difficult to stay focused when watching a 2 hour zoom lecture at home and...it is much easier to lose focus in a zoom class”. Another student echoed this sentiment that a physical social setting helps engagement: “I think Zoom is fine how it is, though I just prefer face-to-face learning as I get easily distracted”. Students offered suggestions such as ‘make it fun’, by providing more activities and to aim to make the experience more engaging.

System Attributes

The responses revealed two main themes relating to system attributes: functional augmentation, and quality of connection, image, and audio. Functional augmentation suggestions included “greater ability to interact in a variety of different avenues”, for example by adding a “screen for cooperative activities” or “making it easier to respond to the screen the teacher puts up”. One student advocated for adding native interactive capabilities beyond simple polling by adding

“some quiz - like activities such as Kahoot but on the Zoom app”. Many students commented on the instructor’s use of the screen share functions, such as “better screen sharing or use of drawing tools for visuals”. One student noted that the Zoom recording does not include the chat and another expressed frustration of using a small screen laptop when the instructor uses large dual monitors.

Students also highlighted that there were significant connectivity and quality issues, for example “Wi-Fi availability and high traffic on server can cause disruptions such as lags or lack of audio”. Comments about noise were accompanied by concerns about quality of the image and network capacity. One student put it succinctly: “[educators need to] have a better internet connection”.

Health And Well-being as an Emergent Factor

A theme that emerged that was not related to any of the known taxonomic groups involved physical and mental well-being. On the positive side, one student related that “I am physically disabled, so using Zoom in replacement of face-to-face lectures has been great as I have to travel a great distance to get to my campus”. In terms of physical health, one student wrote that “When using my computer for Zoom all day I get a sore back and eyes”. Although some students mentioned that Zoom helps them communicate when they otherwise may not, one student stated that “as a person with social anxiety the microphone and photo aspects of zoom give me panic attacks and so aren’t conducive to my mental health”. These types of comments indicate that Zoom can be associated with positive or negative health effects depending on each student’s health situation.

Social Comfort as an Emergent Factor

The thematic analysis revealed an emergent theme relating to ‘social comfort’, a term we have employed to capture the feeling of preferring and enjoying being connected with others. We suggest this sits within the Social Factors primary taxonomic group in Kemp et al.’s (2019) taxonomy. Students reported “I much prefer being able to go into class and physically interact with other classmates”, and:

The largest factor that causes me to prefer face-to-face learning over Zoom is the social aspect. While Zoom provides a useful alternative to this in circumstances where it is needed (e.g., social distancing, absent students), it can feel isolating and it is much more difficult to make friends. (Student respondent)

Contrary views were also noted where respondents saw a positive in not having to be physically present with others: “Zoom is more preferable for me because I don’t have to meet people and I don’t have to walk out of my room”. Another student wrote that “sometimes it can be easier to talk as its not face-to-face and therefore you feel more comfortable”. Students expressed frustration with the social norms of their peers regarding not interacting within Zoom classes. Thus, social comfort can work both ways and encompasses students who desire in person company, and those who try to avoid it.

Discussion

Themes that emerged from the analysis were able to be aligned with the primary categories of Kemp et al.'s (2019) taxonomy, except for health and well-being, and social comfort. In addition to a discussion of key themes, implications for educational practice will be offered in this section.

Factors That Aligned with the Taxonomy

Participant comments relating to general attitude revealed that dissatisfaction emerges due to the disruption to established teaching and learning norms, with Zoom learning being a confronting transition (see Ismaili, 2021; Wong, 2020). However, these data were collected during COVID-19 and so were likely confounded by wider environmental factors that affected much more than learning. Some students found value in being able to continue their studies even with the disruptions at the time, echoing advantages of online learning platforms such as improved access, convenience and student agency (Ashton & Elliott, 2007; Dart et al., 2020; Ismaili, 2021). Students specifically called out benefits such cost and being able to better manage employment. This suggests that students could be given a choice of attendance mode to help them balance their own lives, and if framed this way, may improve attitudes towards its use.

Students recommended that instructors deliberately design their lessons to suit the online synchronous context and be better prepared to direct and manage student behaviour in class. These findings are in line with Arbaugh (2002) who suggested that student-centric constructivist approaches may be more accepted than teacher-centric objectivist pedagogy. Students' wishes for their instructors to be competent using Zoom also touch on the technology aspect of their teaching practice. In addition to improved instructor confidence, students valued interaction with others in a social and learning sense, even though interaction in Zoom classes was perceived as limited. Ashton & Elliot (2007) showed that in-class interaction also supports individual online learning, with interaction linked to student satisfaction (Arbaugh, 2002). Social loafing theory (Karau & Williams, 1993; Sanna, 1992) suggests that students may not consider there is anything to gain by participating, or that they lack the self-efficacy to be competent amongst peers. Responses indicated that the removal of face-to-face group cues may be contributing to these possible causes. There are non-verbal ways to communicate and interact in Zoom, in addition to speaking with the camera on (Kohnke and Moorhouse, 2020), and these need to be fully explored to promote engagement.

Whereas cognitive engagement is associated with student enjoyment (Yang & Kwok, 2017) and influences student intention to engage with the learning (Moon & Kim, 2001), our results indicated that students' experience in this area was poor. Many commented on how easy it was to become distracted and lose focus, mostly due to isolation issues or being in a familiar home environment. Given the low engagement reported by students in this study, it is unsurprising that their attitudes towards learning through this platform were generally also negative. Considering student complaints that they lose focus easily and do not feel engaged, incorporation of interaction features into the Zoom platform would make these functions more immediately available for instructors, who might begin to use them if easily available on the interface (see Cho et al., 2009). In terms of service quality, students recommended higher quality internet connection and audio quality and these results were in agreement with Selim (2007), and instructors could consider this as part of their technology setup.

Health and Well-being

Health and well-being had no equivalent in the taxonomy at any level, implying that this theme could be added as an additional primary category in Kemp et al.'s (2019) taxonomy, and should therefore be considered for future research involving TAMs. The results showed that health and well-being can manifest as physical health in terms of managing physical disabilities and social isolation within online environments (Lee et al., 2021; Volery & Lord, 2000), through to mental health and well-being. A minority expressed strong negative health effects such as sore eyes or anxiety, in agreement with Ritzhaupt et al. (2022). While these effects can be due to the technology itself, and the anxiety around speaking and performing in online environments, they can also be due to how the instructor supports cohesion and well-being in online environments (Hamilton et al., 2020). Specific supports may include keeping online sessions short, establishing new norms for communication with peers, scaffolding behavioural norms, and excusing students from direct participation if it affects their health. Together these supports may address students' emotional well-being vis-à-vis online learning (Hamilton et al., 2020). Other, asynchronous options may also be explored to alleviate anxiety produced by cameras, microphones, and synchronous online learning such as discussion boards and tools such as Padlet, allowing students to summarise discussion.

Social Comfort

Although the existing taxonomy characterised social factors through the lenses of social norms and influence from others, our results showed that simply being around others is another influential social determinant of student behaviour. This aligns with other research that has shown that students prefer and enjoy being with others during class because of the greater sense of social connection and presence (Ashton & Elliott, 2007; Ismaili, 2021; Lee et al., 2021; Wong, 2020). Ebner & Greenberg (2020) showed that the familiar social and para-linguistic cues stemming from social proximity support student engagement and interaction, leading to a sense of membership and influence within the social group (Luo et al., 2017). This implies that the screen was not able to convey the expected implicit signals people pick up from each other in physical settings and this may contribute to reduced class interaction. It is possible that students are uncertain how to act in the absence of physical cues leading to an infinite loop of inaction and lack of engagement. The effect of the loss of physical social cues and how this affects behaviour needs to be more fully explored. As such, we suggest that social comfort be added as a new secondary level grouping to Kemp et al.'s (2019) primary social factors group. The practical implications are that instructors could coach students towards new standards of engagement and encourage use of Zoom features (such as emoji, chat and Zoom reactions) to reduce the sense of isolation.

Practice Implications

While these results relate to use of Zoom virtual classrooms, the alignment with Kemp et al.'s (2019) taxonomy supports a broad transferability to other educational technologies. One major implication from these findings is the need for educators to focus on improving proficiency with managing virtual classrooms. This includes both technology and classroom management to help create more engaging and active online environments to help students engage both cognitively and socially. Courses that use virtual classrooms should be designed specifically for the online

environment, where student agency, engagement and interaction are actively considered during the design process (Woodlands & Dart, 2023). As part of this, new ways to foster social cues and cohesion appear vital.

The emergence of social comfort, and health and well-being, gives pause to consider further about these two factors within educational practice. The comfort element might be important when there is a choice to learn via people or via technology. For example, recent emergence of artificial intelligence affords interaction and learning without actual human contact where the social comfort factor might be influential. The choice to attend campus or online is relevant here also. Health and well-being would be relevant where technology can affect physical or mental health. One example is virtual learning environments, where motion sickness can sometimes occur (Grassini & Laumann, 2020), or where the wearing of equipment might cause inconvenience or discomfort (Fabris et al., 2019). An implication to come from this is that students could be offered choice of engagement mode so that they can decide the best option for themselves, where possible. The implications for the use of virtual classrooms are less certain since students have more options of attendance mode. These research results do align with pre 2019 literature suggesting that the emerging factors discussed here may have been present, but unexplored, for some time, and the core findings of this research are likely to remain relevant. Universities may wish to consider the impacts technologies have on student wellbeing and comfort as this may impact on learning outcomes and satisfaction. The importance of student social comfort and well-being connects to broader educational practice areas, such as student belonging and inclusive learning. While these topics are beyond the scope of this paper, we highlight the connection to provide a broader context for our findings.

Conclusion

We surveyed students to assess their attitudes toward Zoom for learning using known technology acceptance factors to identify new, emergent factors. The findings revealed two important factors affecting Zoom usage: social comfort, and health and well-being. Students indicated that a preference for physical proximity to others, and physical and mental health effects, can influence their voluntary use of Zoom. Despite acknowledging a general preference for face-to-face learning, students nonetheless acknowledged the convenience of Zoom. However, students were concerned about lack of engagement with other students, instructional style, and instructors' ability to manage the class and foster engagement and interaction.

These results suggested that instructors could better support students by improving their Zoom efficacy, specifically designing for the synchronous online environment, incorporating more engaging tasks and learning new methods to facilitate different kinds of communication and social engagement. The broad theme of broken social connections was apparent, highlighting the need for instructors to work to rebuild them in the online environment to improve student social connection. Providing choice to engage face to face or online modes would also help students manage their well-being.

The research implies that integrating these factors into educational practice may lead to improved student engagement with Zoom for learning. Additionally, the findings suggest that Kemp et al.'s (2019) taxonomy could be expanded to include social comfort and health and well-being. A key limitation of this research is the convenience sample that was used to collect the data, which

relied on a single cohort of students studying a first-year course at an Australian institution and which could include sampling bias. Future work should seek to recruit students from more diverse contexts (such as other discipline and country contexts, as well as student level) to investigate whether other factors emerge that necessitate deeper consideration in technology acceptance research.

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Andrew Kemp: Conceptualization, Methodology, Formal Analysis, Investigation, Writing – Original Draft, Writing – Review & Editing, Data Curation. **Sarah Dart:** Conceptualisation, Methodology, Formal Analysis, Investigation, Writing – Original Draft, Writing – Review & Editing. **Edward Palmer:** Conceptualization, Writing – Reviewing & Editing, Supervision, Data Curation. **Peter Strelan:** Writing – Reviewing & Editing, Supervision. **Helen Thompson:** Writing – Reviewing & Editing, Supervision.

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