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Characteristics of engaging teaching videos in higher education: a systematic literature review of teachers' behaviours and movements in video conferencing

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Abstract

Online learning is in high demand due to benefits such as convenience, flexibility, cost efficiency, and improved accessibility. In online learning, video conferencing is an effective technology for collaboration and increasing online student engagement. This study is part of a larger study conducted using design-based research (DBR) to develop a video annotation tool using artificial intelligence (AI) methodologies such as machine learning and deep learning. This systematic literature review is the foundation of the process which identifies the characteristics and indicators of engaging teaching videos. The studies included in this systematic literature review have been gathered from seven databases and selected by applying inclusion/exclusion criteria in accordance with the Preferred Reporting Items for Systematic Reviews. From the selected studies, we identified, categorised, and explained the characteristics and indicators of engaging teaching videos based on teachers' behaviours and movements. In this study, we identified 11 characteristics and 47 associated indicators of the characteristics critical in enhancing student engagement. Teachers and higher education institutions can use these characteristics and indicators as a benchmark to improve the quality of engaging teaching videos and later improve teaching and learning. In the final stage of DBR, the identified indicators can be used to train a machine learning tool, a form of AI. This tool can provide a report on engaging teaching videos by highlighting the teachers' behaviours and movements.

Keywords: Artificial intelligence, Online learning, Student engagement, Teacher presence, Video conferencing, Teachers' behaviours and movements, Characteristics of engaging teaching videos

Introduction

Online learning continues to rise in popularity in higher education across the globe to provide teachers and students with more access to educational opportunities in a flexible manner. Notably, the recent global issue of Covid-19 increased online learning, forcing educational institutes to shift their face-to-face delivery mode to an online delivery method (Ngah et al., 2022). However, besides the benefits of online learning, there are some challenges that students might face, including a lack of engagement (e.g., feelings of isolation and lack of interaction with tutors and other students) (Cesari et al., 2021). With increasing numbers of students choosing online education as an alternative to traditional on-campus classes either because of its various benefits or Covid-19, it becomes more critical to engage students in online learning.

Online learning is technology-based learning, where video conferencing is the most effective web-based technology for teaching and communication, offering more opportunities for collaboration and increasing online student engagement (Al-Samarraie, 2019). Video conferencing allows teachers to provide immediate feedback to students and increase their presence, enhancing student engagement, which is necessary for fostering positive student behaviour and learning in online classrooms (Hew, 2018). However, there are no clear evidence and criteria for measuring for identifying engaging teaching videos.

The research has established that teachers' behaviours and movements in online learning increase their presence, enhancing student engagement (Cents-Boonstra et al., 2021; Dewan et al., 2019; Olitsky, 2007). However, there are no studies or clear consensus which define the characteristics of student engagement based on these human behaviours. Identifying these characteristics and indicators of engaging teaching videos may make learning more effective and enhance students overall learning experience.

This study employed a systematic literature review to identify the characteristics and indicators of engaging teaching videos. It aims to answer the research question: What are the characteristics and indicators of engaging teaching videos? We aim to add new knowledge to the existing literature on engaging teaching videos to improve students' experience in online learning. These identifying characteristics of teachers' behaviours and movements in video conferencing could assist in training deep learning algorithms. Artificial intelligence (AI) is assisting people in transforming education and fundamentally changing teaching, learning, and research. AI has the ability to understand student feedback in text format using natural language processing (NLP) techniques (Shaik et al., 2022) to process and learn temporal and spatial components in a video (Liu et al., 2022). However, no studies have been conducted to identify and categorise these characteristics to create a database of such behaviours, which can further use to develop a video annotation tool.

Previous research

This study aimed to identify the characteristics and indicators of engaging teaching videos. Five areas inform the study, and these areas were identified based on their relevancy to the research and have been described further in the following sections.

Online learning in higher education

Online learning has been defined as using technology and media to deliver, support, and enhance learning and teaching (Howlett et al., 2009; O'Doherty et al., 2018). Similarly, Chen et al. (2018) highlighted that online learning is augmented by adopting advanced digital tools and other technological platforms. Generally, researchers agree that technology is a crucial and effective medium for providing education and enhancing social interaction in online learning (Chen et al., 2018; Howlett et al., 2009; O'Doherty et al., 2018).

In recent decades, online learning has gained increasing attention in higher education. Further, Covid-19 has also forced the higher education sector to undergo a massive digital transformation due to the sudden closure of face-to-face teaching (Carolan et al., 2020). This change required universities to evolve toward online teaching by having the technological resources available and involving teachers who lack technological capacities for online teaching (García-Morales et al., 2021). Unfortunately, many educational institutions were not ready for this new experience. In his research, Stott (2016) highlighted that many online courses in higher education involving "poor levels of student engagement pose challenges to institutions, instructors and learners" (p. 51).

Student engagement in online learning

Student engagement is essential to improving the quality of learning and teaching. Student engagement plays a critical role in student achievement and learning (Kahu et al., 2019), and it is fundamental for students' satisfaction, motivation, and performance (Hu & Li, 2017). Over the years, there have been multiple definitions of the term "student engagement" in research. Student engagement was referred to as student involvement, student experience, academic integration, academic engagement, and student efforts (Krause & Coates, 2008). Kahu et al. (2019) defined student engagement as students' emotional, behavioural, and cognitive connection to their study, directly impacting their success and achievement. When students are engaged in the learning process, they are emotionally connected, which has improved student success.

Fredricks et al. (2004) discussed three types of engagement – behavioural, emotional, and cognitive – described in the literature, along with the approaches researchers used to measure engagement. Adding collaborative and social to the behavioural, emotional, and

cognitive dimensions described by Fredricks et al. (2004), Redmond et al. (2018) proposed an online engagement framework for higher education with five dimensions. Redmond et al. (2018) also identified descriptive indicators for each engagement dimension. For example, students' cognitive engagement can be described as thinking critically, justifying decisions, distributing expertise, integrating ideas, activating metacognition, and developing deep discipline understandings.

Several studies relate students' engagement and learning outcomes to online learning. Muir et al. (2019) suggested that educational outcomes, student retention rates and completion time can be improved in online learning by understanding the factors that influence student engagement. The literature on pedagogic excellence has placed student engagement as central to effective and deep-level learning, student satisfaction and retention (Cents-Boonstra et al., 2021; Kahu et al., 2019; Kuh et al., 2008). The above literature establishes the importance of student engagement in general but needs to be more focused on engaging teaching videos.

Consistent with the literature mentioned above, Zepke and Leach (2010) also provided that, in online learning, teachers' presence is the key to engagement. Abou-Khalil et al. (2021) added that teachers must understand which engagement strategies are the most effective for engaging students in online classes.

These studies on online engagement looked at engagement as a whole, not specifically focusing on engaging teaching videos. There are no studies or clear consensus which define the characteristics of student engagement in video conferencing based on teachers' behaviours and movements.

Use of technology in online learning

Technology such as learning management systems, interactive tools, and video conferencing presents an opportunity for teachers and institutions to engage students innovatively in their learning. Ullah et al. (2019) noted that technology provides support, develops contact between teachers and learners, and causes us to re-evaluate our education methods to fulfil the requirements of students for changing learning. Researchers (Hsu & Hsieh, 2011; Johnson et al., 2008; Revere & Kovach, 2011) agreed that if technology is applied appropriately in online learning, it can foster student engagement and enhance their performance and course satisfaction.

With the advancement in technology in online learning, video conferencing has become one of the most common tools for synchronous and asynchronous teaching (Roth et al., 2020). Video conferencing allows teachers and learners to communicate in real time via live audio and video (Lieux et al., 2021). There are currently several video conferencing platforms, including Zoom, Skype for Business, WebEx, Microsoft Teams and GoTo

Meeting (Döring et al., 2022). In this designed-based project, the researchers will use video recording via Zoom.

Video conferencing allows wireless screen sharing, whiteboard sharing, interactive chat rooms, opinion polls, and discussion platforms. Video conferencing enhances the sense of human connection, permitting educators and students to establish their presence in online learning (Burke et al., 2022). In their research, Wang et al. (2018) stated that students' engagement is highly needed to utilise video conferencing tools and conduct online learning successfully. Video conferencing provides an opportunity for interaction and engagement, enabling the participants to bridge the psychological and communication distance between trainers and participants and among participants (Torrato et al., 2021). The relation between video conferencing and student engagement has been established above; however, there is a lack of literature on the characteristics and indicators of student engagement in video conferencing.

Teacher presence and role in enhancing student engagement

Teachers' presence, expertise, and commitment to online learning significantly ensure quality learning. According to Stone and O'Shea (2019), such presence plays a critical role in online learning by establishing a connection with students and enhancing their engagement. In another study, Ergün and Kurnaz Adıbatmaz (2020) defined effective online teachers as those who discover the needs of their students and provide a safe learning environment in which students believe they can learn. Teachers who support their students through timely, proactive and embedded support can establish their presence and actively engage students through synchronous and asynchronous methods (Stone & O'Shea, 2019). Similarly, various studies have suggested that effective teacher presence and mutual relations between teacher and student can also prevent learner isolation, which might inhibit student engagement (Harbour et al., 2014; Starr-Glass, 2020). In general, the effects of teachers' behaviours and movements on student engagement in online learning have attracted many researchers' attention (Cents-Boonstra et al., 2021; Ma et al., 2015).

Engaging teachers' presence and role in enhancing student engagement

As discussed, teachers' behaviours and movements in online learning significantly impact student engagement. In this regard, Aelterman et al. (2019) further highlighted that teachers' motivating behaviours enhance student engagement, feelings of competence, and relatedness support. These behaviours consist of (a combination of) autonomy support, a structure to enhance students' sense of competence, and relatedness support (Aelterman et al., 2019; De Meester et al., 2020). Teachers' motivating behaviours might be addressing students' interests or opinions by asking questions, offering choices, encouraging independent problem-solving, providing support and constructive feedback, and providing

warmth and regard to develop mutually positive relationships with students (Aelterman et al., 2019; Haerens et al., 2013).

In conclusion, numerous investigations have been conducted on the effects of teacher presence in enhancing student engagement in video conferencing. Technology mediates teacher presence, with video conferencing being the most used technology. Teachers' non-verbal cues, such as facial expressions and body language afforded by video conferencing tools, promote high immediacy, social presence, and a sense of connectedness, facilitating learning and increasing learners' engagement. Similarly, their motivating behaviours, such as asking questions, providing feedback, addressing student concerns, and establishing social and cognitive presence, can further enhance student engagement. Through this systematic literature review, we identify characteristics and indicators of engaging teaching videos based on teachers' behaviours and movements. These characteristics and indicators might include measurable teachers' behaviours and body movements that enhance student engagement in video conferencing. Aladsani (2021) described body movements as non-verbal cues, such as facial expressions, gestures, and eye movements. According to Olitsky (2007), these characteristics, including behaviours and movements, help motivate, inspire, and engage students in online classes.

Method

This study is part of a larger study that employed design-based research (DBR) to design a machine learning instrument that autogenerates a report every time a video (recorded lecture) is processed against formal behaviours and movements. DBR and similar approaches have become familiar and well-regarded strategies for designing interventions and solving classroom problems in various contexts (Getenet, 2019). Although DBR is considered a long-term and concentrated approach to educational inquiry, it can also be an effective methodology for a short-term project (Goff & Getenet, 2017; Pool & Laubscher, 2016). It has also proven especially suitable for technological interventions (Anderson & Shattuck, 2012). Based on the principles of DBR, the larger study was structured in three phases to design a machine learning instrument. These phases are listed in Figure 1.

The first phase comprised contextual analysis, which includes identifying characteristics and indicators of engaging teaching videos through a systematic literature review. The first phase is where the current study focuses, which will provide background information and the basis for designing the video annotation prototype. The second phase involves video annotation, where these identified characteristics and indicators will be applied to recorded lecture videos. In the second phase, the focus will be on explaining how these characteristics of engaging teaching videos will be used to train deep learning algorithms, which act as a classification tool for the video annotation tool. The last phase of the study is testing the tool and evaluating the whole process for further refinement of the deep

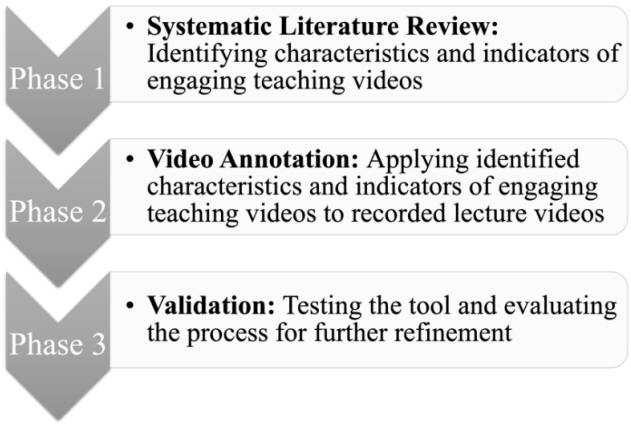

Fig. 1 Research phases

learning strategies. This study represents the first phase of a study that focuses on identifying the characteristics and indicators of engaging teaching videos.

We have conducted a systematic literature review to identify and analyse engaging teaching video characteristics and indicators based on teachers' behaviours and movements. Each author contributed to the study at various levels to ensure the validity of the systematic review process. The first author identified the characteristics and indicators of engaging teaching videos from the literature, the second and third authors validated the interpretation and analysis of the findings. The fourth author designed the AI methodology for future research, formally analysed the project scope, and validated the results. This process helped to validate the results.

The systematic literature review best suits the project's needs as it aims to identify, critically appraise, and summarise the existing evidence related to the topic (Martin et al., 2017). It has also assisted us in determining concepts and understanding the evolution of terminology related to a field of inquiry (Cook et al., 2008). The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) have been used to organise the data for a systematic literature review. The flow diagram describes the reports' identification, screening, eligibility, and inclusion criteria that fall under the scope of a review (Selcuk, 2019). We have used the PRISMA 2020 statement, the updated version of the PRISMA 2009 statement. This revised statement includes new reporting guidance that reflects advances in methods to identify, select, appraise, and synthesise studies (Page et al., 2021).

Database and search terms

The researchers collected all possible studies on a given topic and designed, reviewed, and analysed their results. Based on the selection criteria, the researcher has selected databases for search (please refer to Tables 1 and 2 selection criteria and list of databases). The researcher has applied inclusion and exclusion criteria in the systematic literature review.

Table 1 Selection criteria for databases

Selection criteria	Description
Availability of relevant topics	The databases contain the data (peer-reviewed) related to education and can be narrowed down to modes of delivery such as online/video/e-learning.
Availability of data in full text	The data should be available in full text, and the selected databases provide most data in full text.
Boolean Operator	The database must support Boolean Operators or any other operators that help combine keywords for search.
Availability of data on all aspects of Educational Technology and E-Learning	Even though the study focuses on video learning, part of e-learning, all aspects of Educational Technology and E-Learning may provide similar engagement characteristics.
Geographical coverage	The research will broadly focus on global student engagement in video learning; hence, international data will play a crucial role.
English Language	The research will include the relevant data available in the English Language.
Consultation with Research Librarian (Expert Opinion)	Research Librarian suggested a group of databases focusing on learning and teaching (related to the topic).

Meline (2006) stated that inclusion and exclusion criteria justify the purpose of a systematic literature review. Inclusion criteria are everything a study must have to be included in the review. In contrast, exclusion criteria are the factors that would make a study ineligible to be included in the review. Table 1 summarises the selection criteria for databases. Seven databases were selected based on the criteria listed and described in Table 1.

The exact search phrase is applied on database A+ Education, Academic search ultimate, EBSCOhost Megafile ultimate, LearnTechLib and ProQuest One Academic, while for Scopus, it is different. The list of the databases and the relevant search phrase used in each database is shown in Table 2.

Table 2 Selected databases

Database	Search phrase
A+ Education Academic search ultimate EBSCOhost Megafile ultimate: - eBook Collection (EBSCOhost) - Education Research Complete - E-Journals - ERIC LearnTechLib ProQuest One Academic Taylor & Francis Online	(Characteristic* OR factor* OR Indicator*) AND ("video learning" OR "eLearning" OR "e-learning") AND ("student engagement" OR "student involvement") AND ("higher education" OR university OR college)
Scopus	(Characteristic* OR factor* OR Indicator*) AND ({video learning} OR {eLearning} OR {e-learning}) AND ({student engagement} OR {student involvement}) AND ({higher education} OR university OR college)

The general search terms for all databases included main and unique keywords, and quotation marks and asterisks were applied to the keywords and connected using Boolean Operators.

Inclusion and exclusion criteria

This search resulted in 1,170 studies. There were 70 duplicates removed, and we were left with 1,100 peer-reviewed articles. However, additional inclusion and exclusion criteria were applied to obtain relevant and consistent data. This process has two steps. First, after gathering the papers from different databases, we removed the duplicates and passed the data through the first exclusion process. The first inclusion/exclusion criteria (please refer to Table 3) were applied to the abstract and topic name.

After applying the first inclusion/exclusion criteria to the abstract and topic name, we were left with 63 articles. These criteria were based on the type of data (peer-reviewed articles), sample size, and period of papers published from 2010 to 2021.

Second, after the first exclusion process, including reading the topic and abstract, the remaining data went through the second step. Each remaining peer-reviewed article, book, journal, and conference was reviewed for further category. The first author reviewed the articles, and the second and third authors validated the results. Table 4 represents the second step of inclusion and exclusion criteria.

Table 3 Step 1 - Inclusion and exclusion criteria

Inclusion criteria	Example/s
Peer-reviewed	Any peer-reviewed articles, books, journals, and conference proceedings
Sample size	Any peer-reviewed study has 50 or more participants
Time period	Any peer-reviewed study published from 2010 to 2021
Linguistic range	Any peer-reviewed study published in languages other than English can be translated into English
Mode of learning	Any peer-reviewed study focused on online, e-learning, video, and blended learning
Level of education	Any peer-reviewed study focused on higher education, university education and college
Geographical location	Any peer-reviewed study conducted in any geographical location
Exclusion criteria	**Example/s**
Different modes of learning	The study focused on mobile/intelligent phone learning The study focused on learning via video games The study focused on MOOCs (massive open online courses)
Study with a different focus	Any peer-reviewed study does not examine the indicators/factors/characteristics of student engagement in online, e-learning, video, and blended learning
Time period	Any peer-reviewed study published before 2010
Grey literature	Any data which is unpublished or has been published in a non-commercial form

Table 4 Step 2 - Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
The study focused on engagement indicators and characteristics.	The study focused on the learning management system only.
The study focused on teachers' role in student engagement.	The study focused on social media only.
	No discussion on teachers' role and responsibility to enhance engagement.
	The study focused on MOOCs only.

In the second inclusion and exclusion criteria, we reviewed all the remaining 63 articles thoroughly. After the second step, inclusion and exclusion criteria, we were left with 34 articles that were included in the review. From these 34 articles, we identified, analysed, and categorised the characteristics of engaging teaching videos based on teachers' behaviours and movements in the results section.

The summary of the whole process is shown in Figure 2 using a PRISMA flow diagram. As shown in Figure 2, 1,170 peer-reviewed articles were identified from seven databases, and 70 articles were duplicates and removed before the screening. Based on the title and abstract, 1,037 articles were removed in the first screening. In the second screening, the pending 63 articles were assessed for eligibility, and 29 were excluded based on the second step of the exclusion process. In the end, 34 studies were included in the review.

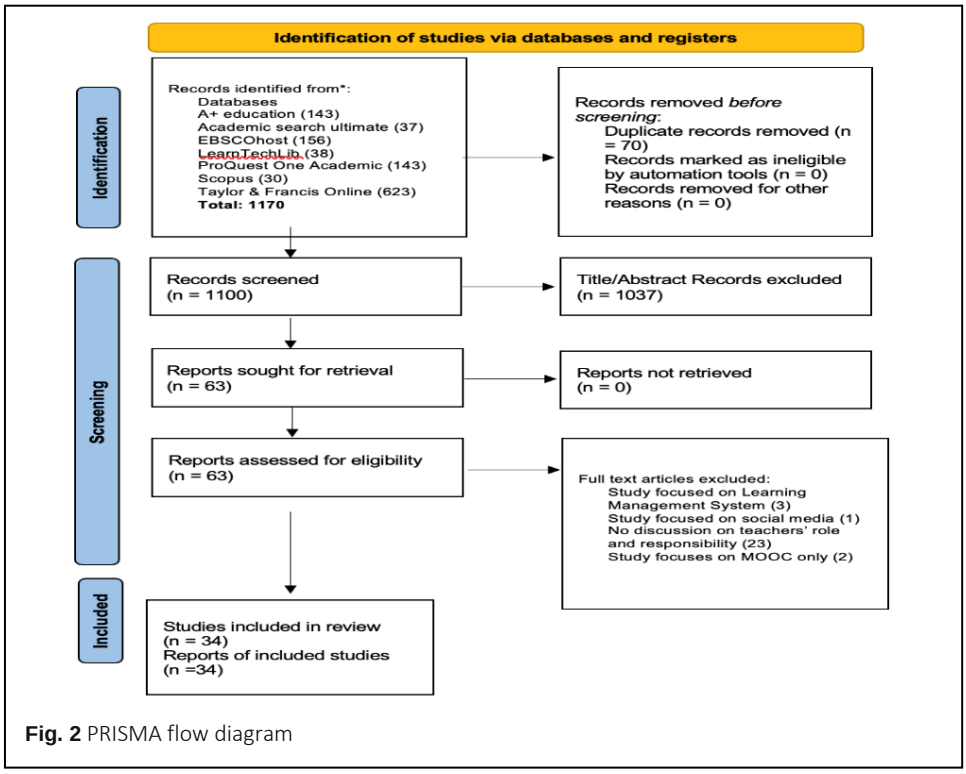

Fig. 2 PRISMA flow diagram

Results

This systematic review of literature aimed to identify the characteristics and indicators of engaging teaching videos. The research question guiding this study was: What are the characteristics and indicators of engaging teaching videos? We have reviewed 34 studies showing 11 main characteristics of engaging teaching videos. We further identify the indicators which can describe each characteristic. The identification and categorisation of indicators into the 11 main characteristics are supported by the significant findings in the reviewed study and research concerning teaching video engagement. These characteristics can be grouped into three broad areas: teachers' behaviours, teachers' movements, and use of technology. Table 5 represents the 11 characteristics and three broad areas of an engaging teaching video, followed by a description.

Encouraging active participation: The first characteristic that emerged was the presence of teachers encouraging participation in various forms. According to Almutairi and White (2018), one of the five benchmarks when measuring effective educational practice is the active and collaborative learning happening in the classroom. The extent to which students are involved in or invited to interact and work with other students might affect their devotion to the academic experience. The students must be allowed to participate in purposeful classroom activities. This characteristic is described in various studies with multiple indicators for encouraging active participation. The description of each indicator and the relevant studies where these are described are shown in Table 6.

As listed in Table 6, six descriptive indicators of encouraging active participation have been identified. For example, Jia et al. (2021) highlighted two indicators to encourage active participation, creating a safe and open environment to allow students to ask questions and inviting students to turn on their webcams.

Using technology effectively: The second characteristic identified from this systematic literature review is using technology effectively. In 2018, Bolliger and Martin pointed out that satisfaction with online teaching experiences is generally related to three components – students, instructors and institution (Walters et al., 2017). Out of the three mentioned

Table 5 Areas of engaging teaching videos characteristics

Teachers' behaviours	Teachers' movements	Use of technology
Encouraging active participation	Using non-verbal cues	Using technology effectively
Establishing teacher presence		
Establishing social presence		
Establishing cognitive presence		
Questions and feedback		
Displaying enthusiasm		
Establishing clear expectations		
Demonstrating empathy		
Demonstrating professionalism		

Table 6 List of indicators, descriptions, and relevant studies for "encouraging active participation"

Indicators	Description	Relevant studies
Encouraging students' participation in discussion	Teachers to engage students in discussions or debates to yield their interest and motivate a deeper understanding.	Farrell and Brunton (2020)
Encouraging students to share their knowledge and ideas	Teachers to ask for students' participation in active learning methods by sharing their perceptions, knowledge, and ideas.	Almarghani and Mijatovic (2017)
Encouraging students to ask questions	Teachers to create a safe and open environment that allows students to ask their questions to enhance the student interaction experience.	Jia et al. (2021)
Encouraging collaborative learning activities	Teachers to create opportunities for students to interact with each other through group activities or collaborative work.	Carraher Wolverton et al. (2020)
Encouraging meaningful interaction	Teachers to construct a welcoming and efficient online learning environment by fostering regular and meaningful communication with students, and providing meaningful answers to students' enquiries.	Stone and Springer (2019) Walters et al. (2017)
Encouraging students to turn on their webcams	Teachers to stimulate face-to-face communication by turning on and inviting students to turn on their webcams.	Jia et al. (2021)

areas, the student-related and instructor-related satisfaction levels are said to be from students having accessible online technology and teachers providing reliable and effective technology, respectively (Walters et al., 2017). These indicators, with a brief description and the relevant studies reviewed, are shown in Table 7.

Table 7 Indicators, relevant descriptions, and relevant studies for "using technology effectively"

Indicators	Description	Relevant studies
Screen sharing & Enabling chat, camera, and microphone	Teachers to assure students of their presence and positively impact student engagement and satisfaction by communicating in real time through chat, camera, microphone and screen-sharing.	Roque-Hernández et al. (2021)
Varying the presentation media	Teachers to vary the presentation media (e.g., videos, slides, note sharing, etc.) to capture student attention and foster engagement.	Jia et al. (2021)
Providing technical support to students	Teachers to provide technical support when needed as a demonstration of teachers' pedagogical skills in addressing the challenges of delivering effective online learning experiences.	Fatani (2020)
Providing multiple communication channels	Teachers to promote satisfactory and effective learner-instructor interaction by taking the initiative in providing multiple communication channels.	Bolliger and Martin (2018)
Providing interactive software tools	Teachers to increase the value of online lesson by incorporating interactive software tools into the lesson.	Roque-Hernández et al. (2021)
Enabling class recording for later review	Teachers to increase the value of the online learning experience by enabling class recording, which allows students access to classroom sessions from the comfort of their home and if they can want to review afterwards.	Leslie et al. (2015)

As seen in Table 7, we have identified six indicators for the effective use of technology. For example, Roque-Hernández et al. (2021) described the impact of real-time communication on student engagement and interactive software tools.

Establishing Teacher Presence: The third characteristic identified was establishing teacher presence. The lack of teacher presence contributes to disengagement in online classrooms due to students' feelings of isolation (McNeill et al., 2019). Therefore, it is critical to create an environment in which the teacher's presence is maintained so that students are more motivated and, thus, performance is positively influenced. The indicators in Table 8 demonstrate how teachers can be present and supportive in an online learning environment as used in the studies reviewed.

Table 8 Indicators for establishing teacher presence

Indicators	Description	Relevant studies
Clear and concise explanations of information	Teachers to enhance students' comprehension of the knowledge and information by providing clear and concise explanations of information through means such as teachers' discourses, demonstrations, replications, perceptions, or slides.	Ullah et al. (2019)
Recognising and considering learners' differences	Teachers to consider learner differences when choosing the formats for delivering the information. The differences can be in an individual's learning preferences, technical skills, prior knowledge, and learning and technological needs.	Ergün and Kurnaz Adıbatmaz (2020)
Using an appropriate style of presentation	Teachers to maximise the efficiency of the classroom in online education by using any appropriate style of presentation that can hold students' interest.	Fatani (2020)
Allowing sufficient time for students' information processing	Teachers to maximise the efficiency of the classroom in online education by demonstrating the capability to understand and provide students with sufficient time to take notes on the lesson while presenting and explaining the information.	Fatani (2020)
Providing learning resources	Teachers to provide students with various learning resources, videos, etc., to increase students' active participation.	Tanis (2020)
Giving clear instructions	Teachers to be clear and detailed in communicating the instructions, expectations, roles and responsibilities to show commitment to meeting the course goals.	Gina (2017)
Using a range of teaching strategies	Teachers vary the perspectives they bring to the lessons and use various teaching strategies. The multiple roles teachers might take during the teaching help increase the effectiveness of learner-instructor interaction.	Gómez-Rey et al. (2016)
Appropriate speed of lecture delivery	Teachers to deliver the lecture at an appropriate speed to meet the students' expectations of instructor engagement in the teaching process (through instructors' way of presenting or teaching the knowledge).	Richards and Velasquez (2014)

Table 8 shows eight indicators of establishing teacher presence, their description, and relevant studies. For example, Fatani (2020) described the use of the appropriate style of presentation and providing sufficient time for students to take notes as indicators to maximise the efficiency of the classroom.

Establishing Social Presence: The following characteristic identified from this systematic literature review was establishing a social presence. Lim et al. (2021) adopted the definition of Gunawardena and Zittle (1997), which relates social presence to 'the degree to which a person perceives their communication partners to be "real" in mediated communication'. With that being established, Lim et al. (2021) would argue that the social presence students might experience in the classroom would be from their engagement in class discussions, team projects or conversations with their instructor. It can be understood that social presence is related to students' willingness to engage in online learning activities, which may also be related to their online classroom satisfaction level. The indicators in Table 9 reflect how social presence is demonstrated in engaging teaching videos in various studies.

As shown in Table 9, we have identified four indicators for establishing a social presence. For example, according to Muir et al. 2019 social presence can be established by maintaining regular, active, and constructive communication with students.

Table 9 Indicators for establishing a social presence with their description

Indicators	Description	Relevant studies
Maintaining constant teacher-student interaction	Teachers to maintain their social presence in the online classroom by constantly being involved in students' learning to avoid creating the isolated and lonely feelings students might have behind the screen.	Gómez-Rey et al. (2016)
Encouraging student-student interaction (Peer collaboration)	Teachers to allow students to take part in student-student interaction through collaborative learning activities to enhance the comfortable and supportive learning environment.	Paulsen and McCormick (2020)
Active and constructive communication	Teachers must establish a robust and consistent presence by maintaining regular, active, and constructive communication. The engagement of lecturers can reflect their impact on students.	Muir et al. (2019)
Taking on multiple roles	Teachers to take on multiple roles of planners, models, coaches, facilitators and communicators in the classroom to demonstrate engaging online communication and active participation. The more involvement from instructors, the more productive the learning environment can be, and students are more prompted to respond to online communication.	Seaton and Schwier (2014)

Table 10 Indicators for establishing a cognitive presence

Indicators	Relevant studies
Giving students a sense of puzzlement (trigger)	Jia et al. (2021)
Providing opportunities for students to reflect (exploration)	Jia et al. (2021) Purarjomandlangrudi et al. (2016)
Leading students to think and learn through discussion with others (integration)	Jia et al. (2021) Stone and Springer (2019)
Helping students apply knowledge to solve issues (resolution)	Jia et al. (2021)

Establishing Cognitive Presence: According to Trenholm et al. (2019), an engagement sub-construct relates to students' level of involvement in learning activities. It is called "cognitive engagement", which suggests that learning happens when students seek comprehension and understanding in strategic learning activities. Jia et al. (2021) also pointed out that "cognitive" would promote student engagement.

The indicators for establishing a cognitive presence can be seen in Table 10.

Table 10 represents the indicators for establishing a cognitive presence, such as trigger, exploration, integration and resolution. The table also highlights the relevant studies on these indicators.

Questions and Feedback: It has long been established that student-teacher interaction is vital in increasing student engagement in all learning contexts, including online learning (Abou-Khalil et al., 2021). Any two-way interaction would boost students' engagement in a class by maintaining their interest and motivation in the learning process rather than solely listening to teachers' presentations (Trenholm et al., 2019). The indicators for questions and feedback are listed and described in Table 11.

Table 11 Indicators for questions and feedback

Indicators	Description	Relevant studies
Addressing students' questions & Providing prompt feedback	Teachers to develop two-way interaction in online classrooms to increase student engagement and motivation. The interactions should be interactive, for example, posing questions or making time for students to make questions, giving answers or feedback to students.	Trenholm et al. (2019)
Asking for questions and feedback	Teachers to invite learners' participation in online learning by asking for their contribution by asking for course-related questions and feedback.	Abou-Khalil et al. (2021)
Clarifying misunderstanding	Teachers to use different strategies to contribute to students' understanding of course concepts and clarify any misunderstandings so that students' interests, motivations and perceptions are emphasised.	Purarjomandlangrudi et al. (2016)

As seen in Table 10, we have identified three indicators of questions and feedback from the mentioned studies. These three indicators have been described as two-way interaction, student contribution through questions and clarification of any misunderstanding.

Displaying Enthusiasm: The teachers play a prominent role in planning and conducting online learning with active communication and reliable technology to enhance student engagement. Consequently, students might benefit more from online education if teachers are to show them enthusiasm and motiving and support relationships (Walters et al., 2017). Studies such as McNeill et al. (2019) and Greenberger (2016) described this characteristic with two indicators. The indicators in Table 12 reflect how enthusiasm might be displayed in engaging teaching videos.

Two indicators for displaying enthusiasm have been mentioned in Table 12. The studies suggested that teachers can display enthusiasm by setting clearly defined parameters to motivate the students and displaying consistent positive emotions.

Establishing Clear Expectations: Teachers must present themselves professionally and clearly to encourage respectful communication and interaction in any educational context. Teachers are to be clear and detailed in communicating the expectations, roles and responsibilities and be available to respond to requests for information, assistance or feedback. This would help engage students and keep them moving forwards, knowing that instructors are also committed to meeting the course goals (Gina, 2017). Two indicators were identified in the reviewed articles to show how teachers in online education establish expectations through engaging teaching videos.

Table 13 describes two indicators for establishing clear expectations. Ice et al. (2011) stated that expectations could be established by clearly outlining the learning objectives. However, according to Almarghani & Mijatovic (2017), teachers should outline the expectations of students' behaviours and responsibilities.

***Demonstrating Empathy*:** According to Greenberger (2016), students' feeling of belonging and being motivated to strive for academic achievement increases when they feel cared for by their teachers or instructors. Interpersonal closeness helps construct

Table 12 Indicators for displaying enthusiasm

Indicators	Description	Relevant studies
Motivating students	Teachers to create the environment in which they are present, with clearly defined parameters and a focused direction so that students are more motivated, and thus, performance is positively influenced.	McNeill et al. (2019)
Displaying positive emotion	Teachers to display consistent positive emotions to demonstrate their passion for increasing student engagement in online learning activities and positive interpersonal interactions.	Greenberger (2016)

Table 13 Indicators for establishing clear expectations

Indicators	Description	Relevant studies
Outlining the learning objectives	Teachers to clearly outline and communicate the topics and instructions to increase student engagement in online learning.	Ice et al. (2011)
Outlining teachers' expectations of students' behaviours and responsibilities	Teachers to have students experience appropriate levels of autonomy or independence in online learning by outlining teachers' expectations of students' behaviours and responsibilities.	Almarghani and Mijatovic (2017)

empathy, which in turn optimises teacher-student interaction. (Greenberger, 2016). Table 14 shows the identified indicators and descriptions for demonstrating empathy.

In Table 14, three indicators for demonstrating empathy have been described. For example, according to Johnson et al. (2018), teachers can show empathy by ensuring the student's learning environment is respectful, safe, and supportive.

Using non-verbal cues: In distance education, immediacy, like empathy, refers to the interpersonal closeness between online classroom participants and is mediated through verbal and non-verbal cues. By including more of these immediate behaviours, shown below as the indicators, the teachers can ease the physical distance of the online classrooms by increasing student engagement in online learning activities and positive interpersonal interactions (Greenberger, 2016).

Teachers should simulate face-to-face communication to encourage students to be more attentive and engaged in class activities. Moreover, communication is more vivid, fluent and natural if non-verbal language features are included. The indicators for non-verbal language are shown in Table 15.

Table 14 Indicators for demonstrating empathy

Indicators	Description	Relevant studies
Using appropriate changes in tone of voice	Teachers to read and respond to perceived restlessness by appropriate changes in tone of voice or changes in direction.	Trenholm et al. (2019)
Ensuring the learning environment is a respectful, safe, and supportive one	Teachers motivate student engagement by ensuring the learning environment is a respectful, safe, and supportive one in which learners' learning is scaffolded through each interaction. The satisfactory level is significantly correlated with the level of interactions students have with other individuals (it can be with other students or with teaching staff).	Johnson et al. (2018)
Showing concern	Teachers to ensure their social presence in the class by showing a level of concern and the extent to which they encourage student participation.	Gómez-Rey et al. (2016)

Table 15 Indicators for using non-verbal cues

Indicators	Relevant studies
- facial expressions, - gestures, - eye gazes, - silence. Intimacy, a fundamental concept of social presence, is a function of factors such as - eye contact, - physical proximity, - appropriate body language.	Jia et al. (2021) Trenholm et al. (2019)

Table 15 contains the indicators for using non-verbal cues. The studies mentioned in the table described the significance of non-verbal cues as it simulates face-to-face communication and makes communication more vivid, fluent and natural.

Demonstrating Professionalism: According to Richards and Velasquez (2014), it is common for students to hold certain expectations of how teachers engage in the classroom by either presenting themselves or teaching the knowledge. It is investigated that the reviewed articles used indicators listed in Table 16 to inform how teachers should deliver the lecture professionally and appropriately.

In Table 16, the indicators for demonstrating professionalism have been highlighted. According to Gómez-Rey et al. (2016), teachers can demonstrate professionalism by showing in-depth and up-to-date knowledge of the course content. As per Vallade and Kaufmann (2020), teachers can demonstrate professionalism by displaying appropriate behaviour.

Table 16 Indicators for demonstrating professionalism

Indicators	Description	Relevant studies
Demonstrating in-depth and up-to-date knowledge	Teachers should have in-depth and up-to-date knowledge, linked to the course content or instruction, to increase learners' level of satisfaction and perception of course knowledge.	Gómez-Rey et al. (2016)
Displaying appropriate behaviours	Teachers to avoid the specific behaviours that might interfere with classroom instructions or student learning and are identified into three categories as follows: - incompetent behaviours – lack of teaching skills for effective instruction (unclear manner) - indolent behaviours – lack of procedural skills for effective instruction (unprepared, disorganised) - offensive behaviours – lack of interpersonal communication skills for effective instruction (verbal abuse)	Vallade and Kaufmann (2020)

Discussion

In this systematic literature review, 11 characteristics that can support teachers in enhancing online student engagement via video conferencing tools have been identified and presented in the result section. These 11 characteristics were categorised into three main themes (teachers' behaviours, teachers' movements, and use of technology), and 47 indicators were established in these articles that they can enhance student engagement in video conferencing.

These identified themes, characteristics and indicators are critical in enhancing student engagement if applied appropriately by teachers in video conferencing. Teachers can use these characteristics and indicators as a benchmark to identify the gap in their teaching performance in online classrooms and improve accordingly. These characteristics and indicators can be applied at the institutional level to enhance and moderate online teaching practice. The educational institute can also use this information to provide professional learning activities for teaching staff to improve their skill in creating engaging teaching videos. In addition, the identified indicators can be measured and contribute to developing a machine learning system that autogenerates a report every time a video (recorded lecture) is processed against the formal behaviours and movements, which is the second part of this study.

Nine characteristics are identified in this systematic literature review under the teacher behaviour theme. The first identified characteristic focuses on encouraging the participation of students in educational activities during video conferencing. Teachers can use different methods to facilitate students' active involvement in the lesson, directly related to students' positive classroom experience in enhancing their learning process. There are six descriptive indicators of encouraging active participation, such as encouraging the students to have meaningful interactions and ask questions. In online learning, teacher presence is vital as it motivates and positively influences the students' performance (McNeill et al., 2019). Establishing teacher presence has been identified as the second characteristic under the teacher behaviour theme. Teachers can use various strategies to maintain their presence and increase the effectiveness of interaction during their online classes. Another characteristic that can enhance student engagement in video conferencing is establishing a social presence. Teachers can establish students' social presence by organising activities that require peer interaction (student-student interaction). Moreover, teachers can also take on multiple roles to demonstrate student engagement and participation.

The fourth characteristic identified under the teacher behaviour theme is establishing a cognitive presence. Teachers can use various methods, such as reflections and discussions, to establish students' cognitive presence in video conferencing. Asking questions and providing feedback is another form of effective student-teacher interaction, as it enhances

student motivation and interest in the learning process (Trenholm et al., 2019). Questions and feedback provide two-way interaction between teachers and students, which is more effective than traditional one-way classroom presentations. Displaying enthusiasm and demonstrating empathy have been considered two crucial characteristics of student engagement in video conferencing under the teacher behaviour theme. By displaying positive emotions such as enthusiasm and empathy, teachers can optimise their interaction with students (Greenberger, 2016). These emotions provide a feeling of belonging and motivation to the students, contributing to their academic achievement.

Teachers should also provide clear and detailed instructions regarding the expected students' behaviours, roles, and responsibilities to enhance student engagement in video conferencing. At the beginning of each video conferencing session, teachers should clearly outline and communicate the learning objectives as it motivates the students to meet their course goals (Ice et al., 2011). Hence establishing clear expectations has been identified as the eighth characteristic under the teacher behaviour theme. The ninth identified characteristic through this systematic literature review is demonstrating professionalism. Teachers need to conduct themselves professionally throughout their teaching, as failure can lead to student disengagement (Vallade & Kaufmann, 2020).

In addition to these above-stated engagement enhancing teacher behaviours, literature has suggested that some non-verbal cues/body movements can also improve student engagement in video conferencing. Physical distance is one of the significant barriers to online learning that affects student engagement (Aladsani, 2021). By using non-verbal cues such as hand gestures, eye gaze, facial expressions, positive body language and appropriate pauses, teachers can make online learning through video conferencing more effective.

The effective use of technology in video conferencing has been identified as another crucial characteristic of enhancing student engagement. As this study focuses on video conferencing, teachers must be fully trained in using relevant technology. With effective use of technology, teachers can find ways to make maximum use of available features of video conferencing. The features such as screen sharing, multiple communication channels, and interactive software tools can make the online classroom environment more engaging (Bolliger & Martin, 2018; Roque-Hernandez et al., 2021).

Limitations

The current study only focuses on higher education, and the identified engaging teaching video characteristics may need to be revised on different levels of education, such as vocational and school education. The researcher only identified the characterises from peer-reviewed articles written in English, and the characteristics identified may not be as suitable for other languages. The research does not explore the practical component in

detail, and the identified characteristics may not work as effectively in practical learning, workshops, or simulations.

Conclusion

The identified characteristics and indicators can enhance students' learning experience by providing an engaging video conferencing environment. Both teachers and educational institutions can benefit from these characteristics and indicators to improve their teaching practices. Further, the identified characteristics and indicators can assist machine learning engineers in training and developing an instrument that autogenerates a report every time a video (recorded lecture) is processed against the formal behaviours and movements.

Implications and future research

The study will have two broader implications: online learning and teaching using video and to support the design of AI to identify engaging teaching videos. Each is described in the following section:

Teaching and learning online in higher education

Despite the popularity of online learning in higher education, student engagement has remained a significant concern. The characteristics and indicators of engaging teaching videos identified in this systematic literature review can assist higher education institutions in enhancing student engagement. These characteristics and indicators can be a benchmark for teachers to improve their teaching and learning practices.

AI design to identify engaging teaching videos

This study will support the creation of an AI instrument based on these identified characteristics and indicators of engaging teaching videos. By applying the characteristics and indicators of engaging teaching videos, researchers can annotate videos to create an AI instrument with the help of open-source project-based annotation software. The AI can be designed based on the deep learning algorithm that will automatically highlight these engaging teaching video characteristics.

Abbreviations

AI: Artificial intelligence; DBR: Design-based research; NLP: Natural language processing; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-analyses.

Authors' contributions

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Declarations

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