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Self-Viewing and Attitudes towards Distance Learning

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Abstract

The outbreak of COVID-19 has dramatically changed learning modes worldwide. To reduce and avoid physical contact, teachers and students conduct remote studies via video conferencing. In this study, we explore the relationship between self-viewing and the attitudes towards distance learning and analyze the factors (such as self-awareness, engagement and communication) influencing this relationship in distance learning. Data is collected using questionnaires ($N = 863$, in which teachers are 200 and students are 663) comprising eight Likert scales (four for teachers, four for students) on teachers' and students' video conferencing. The results show that for distance learning, (i) the frequency of self-viewing can directly affect attitude, and (ii) the frequency of self-viewing can also indirectly affect attitude through communication, engagement, and self-awareness. In this study, the results provide new ideas for the research on cognitive theory, verify objective self-awareness theory and provide some implications for the use of cameras and the effect of cameras on academic performance in distance learning.

Keywords

Distance learning; self-viewing; video conferencing; communication; engagement; self-awareness; attitude.

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1. Introduction

Distance learning (also known as distance education, e-learning, remote education and online learning) is a learning mode in which teachers and students are kept physically separated during instruction. Distance learning uses various information and communication technologies (ICT) to promote teacher-student and student-student communication [1]. Distance learning has emerged with the development of video conferencing technology [1]. Before COVID-19, only a few educational institutions implemented distance or blended learning [2]. However, due to the COVID-19 pandemic, over 1.5 billion students in 165 countries were school dropouts under investigation [3]. To avoid close contact, teachers and students must teach, study and communicate via video conferencing [4]. Based on the United Nations Educational, Scientific, and Cultural Organization (UNESCO) (2020) [4], over 190 countries around the world, representing 98% of the global students, have switched to online courses [2]. There has been a shift in learning mode from mainly face-to-face learning to distance learning worldwide [5].

Distance learning is conducted through video conferencing [1]. In video conferencing, teachers and students need to keep the camera on, so that they can not only see each other's faces, but they can also see their own faces (known as self-viewing). According to cognitive theory, self-viewing can induce participants' feelings of tension and exhaustion, which is called "Zoom fatigue" [6]. Self-viewing represents a cause of a negative attitude towards video conferencing [6], since self-viewing can make participants feel nervous and tired and make it difficult for them to concentrate [6, 7]. In addition, objective self-awareness theory also indicates that self-viewing can allow participants to self-evaluate and be self-critical [8]. Therefore, self-viewing affects the state and performance of teachers and students when video conferencing, which also has an impact on their teaching and learning [6, 7].

Previous research indicated that the relationship between self-viewing and attitude towards video conferencing was linked to public self-consciousness [9]. For people with high public self-consciousness, frequent self-viewing is associated with a negative attitude towards video conferencing [9], whereas for people with low public self-consciousness, frequent self-viewing is associated with a positive attitude towards

video conferencing [9].

In distance learning, self-awareness has an impact on the relationship between self-viewing and participants' attitudes. Self-awareness is divided into situational self-awareness and dispositional self-awareness, and dispositional self-awareness is also called self-consciousness [10]. Dispositional self-awareness cannot be easily changed, while situational self-awareness changes according to different situations [10]. Experimental results showed that for students with low public self-consciousness, a higher frequency of self-viewing was linked with a more beneficial attitude towards video conferencing [9], while students' self-viewing increased their self-awareness, made them feel anxious and under pressure, caused "Zoom fatigue", and led to their negative attitudes and learning experiences [6].

In distance learning, engagement also has an impact on the relationship between self-viewing and participants' attitudes [11]. In distance learning, engagement refers to participants actively engaging in the online course [12]. Self-viewing makes students more engaged and feel like they are in a face-to-face class, similar to traditional learning [13, 14]. Some studies also showed that self-viewing could enable immersion and increase engagement [13, 14]. Moreover, when participants were self-viewing in video conferencing, they could more easily engage in multitasking activities and obtain better outcomes [15]. However, studies also showed that self-viewing decreased participants' engagement, and too much visual stimulation (for example, faces and backgrounds) could be distracting, could increase visual interference and decrease engagement [13, 14]. However, another study indicated that they could not be sure that engagement increased in the "self-viewing" condition [16]. Previous studies did not provide a certain outcome regarding the relationship between self-viewing and engagement. Regarding the relationship between engagement and attitude, several studies indicated that engagement could positively affect attitude [17, 18].

In distance learning, communication also has an impact on the relationship between self-viewing and participants' attitudes. In distance learning, communication refers to the passing of information between participants [19]. Some studies [15, 20, 21] showed that in video conferencing, self-viewing could promote communication among participants and make the interlocutors more aware of each other's intentions

because participants in remote communication were unsure of whether their gestures and expressions were being seen and their true intentions were understood because of the lack of immediate feedback from their interlocutors [22]. Moreover, participants' communication can affect their attitudes. Nonverbal communication increases participants' stress, requiring them to pay attention to other people's nonverbal behavior, which can be exhausting [6].

However, so far, there is no research concerning the effect of teachers' and students' self-viewing on their attitudes towards distance learning, and no study has explored the effect of other factors (such as self-awareness, engagement and communication) on this relationship between teachers' and students' self-viewing and their attitudes towards distance learning.

Consequently, the main objective of this study is to explore whether the self-viewing of teachers and students in video conferencing can affect their attitudes towards distance learning and how it affects their relationships. We also explore the effect of engagement, communication and self-awareness on the relationship between teachers' and students' self-viewing and their attitudes towards distance learning. In addition, we compare teachers and students for differences in this relationship between their self-viewing and attitudes. Cognitive theory is used in our study to explain the effect between the occurrence of environmental stimuli and participants' responses, where we argue that self-viewing can lead to participants' cognitive load and negatively affect their attitudes towards distance learning [6]. Objective self-awareness theory is also used to explain the effect of participants' self-viewing on their self-awareness [6]. In this theory, participants' self-viewing can enhance their self-awareness and cause them to feel stress [6].

We collect data by conducting an online survey comprising four Likert scales for teachers and four Likert scales for students on teachers' and students' video conferencing. We use the structural equation model (SEM) [23, 24] to analyze the data with Mplus 8.3 [24].

This study is based on cognitive theory and objective self-awareness theory, and the results provide more information on these theories and play a significant role in promoting the deepening of cognitive ability and self-awareness. The results of this

study also have implications for education and can serve as a reference for improving teachers' teaching quality and students' academic performance when using video conferencing; for example, teachers and students can keep the cameras on and stay in communication. This study also contributes to exploring the interplay of some factors involved in distance learning, such as self-viewing, attitude, engagement, self-awareness and communication.

This article is organized as follows. Firstly, in the literature review and hypotheses development, we discuss the theories involved in this study, the variables and the hypothesized research model. Next, we describe the method, which includes four parts: the research design, participants, procedure and data analysis. Third, we show the results of the analysis. In the next section, we present the discussion and implications. The final section presents the limitations of this study, and we propose new directions for research on self-viewing in future studies.

2. Literature Review and Hypotheses Development

The literature review and hypotheses development section addresses the theories, main variables considered in this study, the hypotheses and the research model, which is shown in *Fig. 1*.

2.1 Theories

The following related theories are reviewed in this study: cognitive theory and objective self-awareness theory. These theories form the theoretical framework of this paper.

2.1.1 Cognitive theory

Cognitive theory, established by Mayer [25], states that thinking is very important in learning, and cognitive theory focuses on the relationship between the appearance of environmental stimuli and the participants' response. Moreover, cognitive processes of thought are key elements of learning and connections between environmental stimuli and participants' responses [26]. For example, motivation and imagination are both cognitive processes of thought [26]. Cognitive theories in distance learning include cognitive load theory [27] and the cognitive theory of multimedia learning [28-30], both of which are related to our study.

One of the core tenets of cognitive load theory is that the cognitive capacity of a learner's available working memory is limited [27]. Cognitive load theory explains why taking an online video course causes participants to feel unusually tired and experience "Zoom fatigue", as participants have to pay attention to nonverbal behaviors, making it harder for them to send and receive messages [6]. The cognitive theory of multimedia learning shows that if people have to deal with irrelevant material (not learning-related content) during an online class, their cognitive ability to deal with important material in the course is reduced [31]. This also indicates that self-viewing during an online video class may affect participants' cognitive ability in the class.

2.1.2 Objective self-awareness theory

Objective self-awareness theory indicates that people who are self-reflective usually find flaws in themselves, which leads to negative effects for them [8]. Wicklund [8] stated that objective self-awareness theory indicated several phenomena. First, when participants had self-focused attention, they would self-evaluate, which could be either advantageous or disadvantageous based on the nature of significant self-differences [8]. In addition, given that significant differences were negative, initiation of self-attention produced attempts to avoid mirrors and similar stimuli; in experiments, attention could be diverted from the self through passive transfer and motor activity [8]. Finally, reducing differences occurred if the self-focused stimulus could not be escaped [8].

According to self-awareness theory, people are more likely to be self-critical when they see a mirror image of themselves [8]. Bailenson [6] therefore proposed that seeing a mirror might lead to more prosocial behavior, but self-assessment might cause anxiety and stress. A constant “mirror” on Zoom is likely to lead to self-evaluation and negative repercussions, which is also a cause of “Zoom fatigue” [6].

2.2 Constructs and hypotheses development

2.2.1 Attitude

In this study, attitude refers to teachers’ and students’ attitudes towards distance learning [32]. Korkmaz [32] stated that attitude played a crucial role in distance learning, and one of the necessary conditions for the success of distance learning was the attitudes of students. In addition, teachers’ and students’ positive attitudes towards distance learning can positively affect teachers’ teaching quality and students’ academic performance during distance learning [33-35]. Therefore, in our model, we use attitude as our outcome variable.

The teachers’ and students’ attitudes scales are adopted from Pan and Lin [36] and are modified to measure their attitudes towards the video conferencing they participated in. The words are adjusted to best fit the Chinese context and the differences in the context between teachers and students. For example, a teacher’s item is “Online

courses make teaching easier for me”, and a student’s item is “Online courses make my study easier” [36]. The measured items for the teachers’ and students’ attitudes constructs are shown in *Appendix A* and *Appendix B*.

2.2.2 Self-viewing

Self-viewing refers to the behavior in which participants see their own faces while video conferencing [9]. Self-viewing is crucial in distance learning because, based on cognitive theory and objective self-awareness theory, participants’ self-viewing is a key factor in video conferencing [6, 31, 37]. Self-viewing affects participants’ state and performance when video conferencing [6, 7], and self-viewing can also increase participants’ engagement [13, 14] and communication [15, 20, 21]. In our study, self-viewing refers to the behavior of teachers and students seeing their own faces while video conferencing.

The teachers’ and students’ self-viewing during video conferencing is measured by asking “How often is your own face visible to you during your virtual class meetings?” [9], which is shown in *Appendix A* and *Appendix B*.

Prior studies demonstrated that participants’ self-viewing had a beneficial effect on their attitudes towards video conferencing [9, 38]. For people with low public self-consciousness, the more frequent participants’ self-viewing is, the more positive their attitudes towards video conferencing are [9]. In addition, there was also a study indicating that when participants spoke during video conferencing, self-viewing was beneficial to their satisfaction with the video conferencing process and their enjoyment of the meeting [21]. Similarly, in our model, if the frequency of teachers’ and students’ self-viewing is high, their attitudes can be more positive. Hence, the relationship is hypothesized as follows:

H1: Self-viewing has a positive effect on attitude.

2.2.3 Self-awareness

Self-awareness refers to “an ongoing process by which a person becomes aware of their own mental, physical experiences, emotional states, and behavioral life patterns”, and people with self-awareness are free to express their feelings [37, 39-41]. They can

also experience the feelings of others, and become more motivated and self-disciplined [37, 39-41]. Self-awareness is a significant factor in a “self-viewing” condition [42]. Self-awareness (also known as situational self-awareness) involves three parts: awareness of immediate surroundings, public self-awareness and private self-awareness [42]. The awareness of immediate surroundings means attention to one’s physical surroundings [42]. The feature of public self-awareness is attention to those characteristics of the self that it presents to others [42]. Private self-awareness involves attention to inner, personal feelings and aspects of oneself [42]. In our model, self-awareness means teachers’ and students’ self-awareness during video conferencing.

The teachers’ and students’ self-awareness scales are adopted from Govern and Marsch [42] and are modified to measure teachers’ and students’ self-awareness. The words are adjusted to better fit the Chinese context. The measured items for the teachers’ and students’ self-awareness constructs are shown in *Appendix A* and *Appendix B*.

According to objective self-awareness theory, several studies showed that participants’ self-viewing could have a positive effect on their self-awareness [37, 43-45]. This indicates that when participants face mirrors, they will self-evaluate, and their self-awareness will be increased. Similarly, when teachers and students see their own faces while video conferencing, their self-awareness can be increased. Hence, we propose the following:

H2: Self-viewing has a positive effect on self-awareness.

Prior studies demonstrated that participants’ self-awareness had a beneficial influence on their attitudes towards distance learning [40, 41]. This result indicated that people with high self-awareness could have a positive attitude [40, 41]. Similarly, in our study, if teachers and students have high self-awareness in video conferencing, they can have a positive attitude towards distance learning. Thus, we propose the following hypothesis:

H3: Self-awareness has a positive effect on attitude.

2.2.4 Communication

Communication refers to exchanging information in conversations, and participants can send and receive messages [21, 46]. Communication is a significant factor in distance learning, because a sense of online community is created by teacher-student communication [47]. Another significant reason is that students can share their ideas and experiences with others, and they can also participate in distance learning together during student-student communication [47]. Thus, in our model, communication means that in conversations, teacher-student and student-student exchange information in distance learning [47].

The teachers' and students' communication scales are adopted from Tzafilkou, Perifanou [34] and are modified to measure teachers' and students' communication during the video conferencing they participated in. The words are adjusted to best fit the Chinese context and the differences in the teachers' and students' contexts. For example, a teacher's item is "It is easy to communicate with students when I teach virtually", and a student's item is "It is easy to communicate with others (teacher and other students) in video conferencing" [34]. The measured items for the teachers' and students' communication constructs are shown in *Appendix A* and *Appendix B*.

Studies found that during video conferencing, participants' self-viewing had a positive effect on their communication [15, 21]. Self-viewing can promote communication among participants because it makes interlocutors more aware of each other's intentions [15, 21]. Actually, in remote conversations, participants are unsure of whether their gestures and expressions are being seen and their true intentions are understood because of the lack of immediate feedback from their interlocutors; however, self-viewing may allow them to adjust their expressions in time to avoid misleading their intentions [15, 22]. In addition, self-viewing also indirectly affects communication. One study indicated that communication could be affected by self-viewing through self-awareness [20]. Therefore, in our model, if the frequency of teachers' and students' self-viewing is higher, they can communicate more frequently. Hence, we propose:

H4: Self-viewing has a positive effect on communication.

The relationship between communication and self-awareness has not been thoroughly studied in the research. Existing literature showed that based on the Johari Window model [48, 49], communication could promote self-awareness [48, 49]. The Johari Window model is a graphical model of awareness in interpersonal relations; that has four quadrants: open area, hidden area, blind area and unknown area [50]. Open area is defined as what we know and others know, whereas blind area means what others know but we do not [50]. Hidden area means what we know but no one else knows, and finally, the unknown area is what no one, including us, knows [50]. The wider the open quadrant, the more participants' self-awareness will be [48]. Thus, the model could also indicate that the more teachers and students communicate with others, the greater their self-awareness. Hence, we propose the following hypothesis:

H5: Communication has a positive effect on self-awareness.

2.2.5 Engagement

Engagement is defined as “the psychological investment and effort of participants in something they need to do” [51]. Engagement is important in distance learning, because it can increase learners' performance [52]. In distance learning, engagement refers to teacher engagement and student engagement [51, 52]. Teacher engagement is defined as “the psychological investment and effort of teachers towards teaching the skills and knowledge they wish students to master” [51, 52]. Student engagement refers to “the psychological investment and effort of students in understanding or learning the knowledge, skill or craft that scientific and technical work has long facilitated” [51, 52].

The teachers' and students' engagement scales are adopted from Omar, Ali [53] and are modified to measure teachers' and students' engagement during the video conferencing they participated in. The words are adjusted to better fit the Chinese context and the differences in the context between teachers and students. For example, a teacher item is “I can discuss my ideas freely when teaching virtually”, and a student item is “I can discuss my ideas freely in video conferencing” [53]. In addition, the factor loading of a reversed item is low, so I delete it from the teachers' and students' scales: “I feel isolated when teaching virtually” and “I feel isolated in video conferencing” [53]. The measured items for the teachers' and students' engagement

constructs are shown in *Appendix A* and *Appendix B*.

Several studies indicated that engagement had a positive effect on attitude [17, 18, 54, 55]. This result indicated that if participants engaged in video conferencing, their attitudes would be more positive. Similarly, in distance learning, our model can also show that the more engaged teachers and students are, the more positive their attitudes can be. Hence, the relationship is hypothesized as follows:

H6: Engagement has a positive effect on attitude.

Some studies showed that participants' communication could affect their engagement positively in distance learning [14, 56-58]. During video conferencing, teachers cannot determine whether the students are actively engaging in the class; only if students interact in a breakout room or communicate with others in the chat box can communication better promote student online engagement when distance learning [14, 56]. In addition, students' engagement can be influenced strongly and positively by their effective communication practices and communication tools in distance learning [57, 58]. Therefore, in our study, the results can show that teachers' and students' communication enhances their engagement. Hence, we hypothesize:

H7: Communication has a positive effect on engagement.

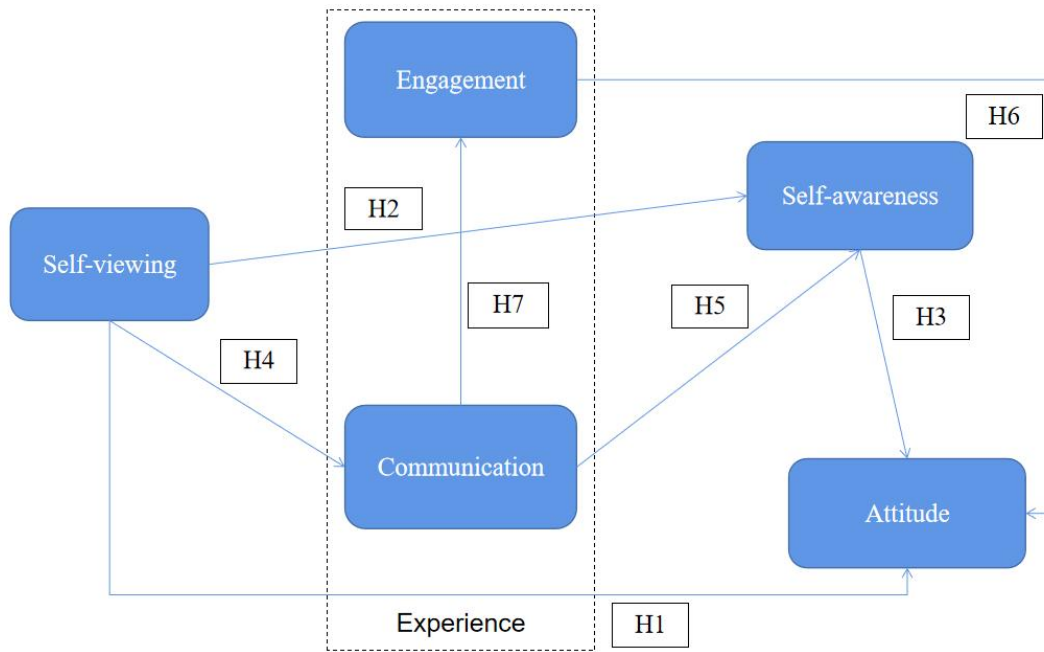


Fig. 1. Hypothesized model.

3. Methodology

This methodology section describes the methods adopted in this study. It also introduces the research design, research data collection tools, study populations and sampling, procedures and analysis.

3.1 Research design

In our study, a questionnaire is adopted to obtain the data. The questionnaire is reviewed by four researchers and modified based on the feedback received. The questionnaire includes eight scales (four for teachers and four for students), as well as background questions.

3.2 Participants

Participants are randomly recruited online in China because China was the first country to adopt quarantine measures during the pandemic [59]. On February 12, 2020, the Ministry of Education of China (MOE) called for all schools to start online teaching in the upcoming semester [59]. Therefore, the number of online courses in China is very large [59]. Participants include 200 teachers and 663 students, all over 18 years old, and who have experience teaching or taking online courses. *Table 1* shows the demographics of the teachers and students: most are between the ages of 18 and 28 (74.2%), and the majority are students (76.8%).

In terms of the teacher participants, 51.0% are 29 to 39 years old, and 53.5% are male. The educational background of the students taught by the teachers is mostly junior high school (28.0%) and then undergraduate (26.5%). Most teachers teach two to three days a week (56.5%) and mostly take 2 to 4 hours of online video classes a day (57.0%). Regarding the degree to which teachers control the switching of the camera, 42.0% say they can mostly control the switching of the camera, while some can completely control the switching of the camera (37.5%). Most teachers have a quiet private space for video teaching (44.0%). In addition, 57.0% of teachers often interact with the students. *Table 2* provides the teacher respondents' demographic profiles.

In terms of student participants, 84.2% of the respondents are 18-28 years old and 62.7% are male. Regarding students' education status, most are undergraduate

(65.9%). Many students attend classes two to three days a week (57.8%) and almost half take two to four hours of online video classes a day (45.9%). Some students can control the switching of the camera most of the time (40.0%) but others cannot most of the time (33.2%). Most students have a quiet private space for online classes most of the time (40.7%), followed by some students who have a quiet private space for online classes all of the time (36.8%). Almost half (49.5%) of the students interact with others very often. *Table 3* provides the students' demographic profiles.

Table 1. Teacher and student respondents' demographic profiles.

Variables	Category	Number	%
Age	18~28	640	74.2
	29~39	203	23.5
	40~50	20	2.3
	50 years old and older	0	0
	Total	863	100
Occupation	Teacher	200	23.2
	Student	663	76.8
	Total	863	100

Table 2. Teacher respondents' demographic profiles.

Variables	Category	Number	%
Age	18~28	82	41.0
	29~39	102	51.0
	40~50	16	8.0
	50 years old and older	0	0
	Total	200	100
Gender	Male	107	53.5
	Female	93	46.5
	Others/Prefer not to say	0	0
	Total	200	100
Education status of the students taught by the teacher	Kindergarten	2	1.0
	Elementary school	34	17.0
	Junior high school	56	28.0
	High school	31	15.5

Variables	Category	Number	%
	College	12	6.0
	Undergraduate	53	26.5
	Postgraduate	7	3.5
	PhD	5	2.5
	Total	200	100
Frequency at which teachers teach using video conferencing	One day or less a week	35	17.5
	Two to three days a week	113	56.5
	Over three days a week	52	26.0
	Total	200	100
Amount of time teachers spend in online video courses in a day	Less than an hour	5	2.5
	1 hour to 2 hours	61	30.5
	2 hours to 4 hours	114	57.0
	4 hours to 6 hours	17	8.5
	More than 6 hours	3	1.5
	Total	200	100
Degree to which teachers control the switching of the camera	None	3	1.5
	Mostly out of control	38	19.0
	Mostly in control	84	42.0
	Complete control	75	37.5
	Total	200	100
Whether teachers have a private space for online classes	None	7	3.5
	Rarely	32	16.0
	Mostly	73	36.5
	Always	88	44.0
	Total	200	100
Interaction frequency	Never	1	0.5
	Rarely	13	6.5
	Often	114	57.0
	Very often	40	20.0
	Always	32	16.0
	Total	200	100

Table 3. Description of student respondents' demographic profiles.

Variables	Category	Number	%
Age	18~28	558	84.2
	29~39	101	15.2
	40~50	4	0.6
	50 years old and older	0	0
	Total	663	100
Gender	Male	416	62.7
	Female	242	36.5
	Others/Prefer not to say	5	0.8
	Total	663	100
Student's education status	High school or below	39	5.9
	College	144	21.7
	Undergraduate	437	65.9
	Postgraduate	38	5.7
	PhD	5	0.8
	Total	663	100
Frequency at which students study using video conferencing	One day or less a week	81	12.2
	Two to three days a week	383	57.8
	Over three days a week	199	30.0
	Total	663	100
Amount of time students spend in online video courses in a day	Less than an hour	9	1.4
	1 hour to 2 hours	193	29.1
	2 hours to 4 hours	304	45.9
	4 hours to 6 hours	115	17.3
	More than 6 hours	42	6.3
	Total	663	100
Degree to which students control the switching of the camera	None	24	3.6
	Mostly out of control	220	33.2
	Mostly in control	265	40.0
	Complete control	154	23.2
	Total	663	100
Whether students have a private	None	29	4.4

Variables	Category	Number	%
space for online classes	Rarely	120	18.1
	Mostly	270	40.7
	Always	244	36.8
	Total	663	100
Interaction frequency	Never	7	1.1
	Rarely	173	26.1
	Often	328	49.5
	Very often	118	17.8
	Always	37	5.6
	Total	663	100

3.3 Procedure

The questionnaire used to obtain the data is reviewed by four researchers and modified based on the feedback received. The questionnaire involves eight scales (four for teachers and four for students) and demographic information. In the experiment, we translate these scales from English to Chinese for Chinese teachers and students.

The empirical data are collected online from teachers and students from different provinces of China. After deleting invalid questionnaires (the deleted data includes questionnaires with short answer times, questionnaires with the same IP address, and questionnaires that are improperly filled in or included unreasonable data), a total of 863 valid questionnaires are received from teachers and students across China, including 200 teacher and 663 student questionnaires. The questionnaires are distributed electronically via Weibo (a social platform similar to Instagram) and Douyin (the Chinese counterpart of TikTok) from September 21 to October 7, 2022. Teachers and students can quit the questionnaire at any time if they encounter uncomfortable questions or answers. All participants volunteer for the study, and the data are collected anonymously.

3.4 Analysis

In this study, confirmatory factor analysis (CFA) [60, 61] is used to detect whether the relationship between a factor and the corresponding measure is consistent with the

theoretical relationship we designed. In this study, structural equation model (SEM) [23, 24, 62] is also used. Since the present study adopts a research model with multiple relationships, it employs SEM, which is a multivariate statistical analysis technique and a suitable method to test a network of relationships between variables [23, 24].

A pretest ($N = 200$) is conducted to ensure that the four scales achieve good reliability and validity. The Cronbach's alpha (CA) for participants' attitudes items is 0.897. The CA of participants' self-awareness items is 0.896. The CA for participants' engagement items is 0.838. The CA of the participants' communication items is 0.898. As the results show, the CA values all exceed 0.7, so the reliability of these scales is very good [63]. After that, we measure the validity of the scale, first using the Kaiser-Meyer-Olkin (KMO) and Bartlett's test. As *Table 4* shows, the KMO values of these scales all exceed 0.7, with p -value < 0.001 , so factor analysis can be conducted [64, 65]. The composite reliability (CR) is used to assess the construct reliability, and the average variance extracted (AVE) is used to determine the convergent and discriminant validity in SPSS version 25. The CFA results demonstrate adequate fit to the data [66, 67]: $\chi^2/df = 1.541$, root-mean-square error of approximation (RMSEA) = 0.052, comparative fit index (CFI) = 0.926, Tucker-Lewis index (TLI) = 0.918, and standardized root-mean-square residual (SRMR) = 0.050. Every CR range from 0.887 to 0.922, all are higher than the recommended threshold of 0.60 [68], and every AVE range from 0.550 to 0.664, all are higher than the recommended threshold of 0.50 [68]. All of the above results indicate satisfactory reliability and validity.

Table 4: Instrument validity and reliability (Pretest).

Factor	Number of items	Cronbach's alpha	KMO	Factor loading	AVE	CR
Attitude	6	0.897	0.888***	0.787-0.838	0.663	0.922
Self-awareness	9	0.896	0.922***	0.666-0.806	0.550	0.916
Engagement	5	0.838	0.845***	0.683-0.812	0.612	0.887
Communication	6	0.898	0.880***	0.799-0.832	0.664	0.922

Notes. $N = 200$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

4. Results

Firstly, correlation analysis is conducted to understand the relationship between the main variables in our study. In addition, we measure the validity of our instruments through confirmatory factor analysis (CFA) [60]. Finally, we build and test the measurement model according to our research hypotheses to confirm them.

4.1 Descriptive analysis and bivariate correlation

Table 5 and *Table 6* show the means, standard deviations, and correlations of teachers' and students' measurements of this study, which are calculated to describe their responses to each variable in the survey and identify the relationship between different variables in our study.

Regarding teachers, the analysis shows that self-viewing has a significant moderate correlation with attitude, self-awareness, engagement and communication ($r = 0.339, 0.284, 0.243, 0.239; p < 0.01$). Attitude is found to be significantly correlated with self-awareness, engagement, and communication ($r = 0.645, 0.695, 0.711; p < 0.001$). In addition, engagement and communication have a highly significant and positive correlation with self-awareness ($r = 0.836, 0.752; p < 0.001$), and engagement and communication also have a highly significant correlation ($r = 0.871; p < 0.001$). The correlation results indicate that teachers' self-viewing has a significant and beneficial effect on their attitudes, and in this relationship between teachers' self-viewing and attitudes, self-awareness, engagement, and communication are correlated with other covariance. The Pearson correlations Heatmap for teacher-measured variables depicts the relationships between the two intersecting variables [69], which is shown in *Fig. 2*.

Regarding students, the analysis shows that self-viewing has a significant moderate correlation with attitude, self-awareness, engagement and communication ($r = 0.371, 0.346, 0.345, 0.330; p < 0.001$). Self-awareness, engagement and communication are significantly correlated with attitude ($r = 0.738, 0.786, 0.785; p < 0.001$). Moreover, self-awareness is significantly correlated with engagement and communication ($r = 0.723, 0.760; p < 0.001$), and engagement and communication also have a highly significant correlation ($r = 0.844; p < 0.001$). Similar to teachers, the results of the

correlation indicate that students' self-viewing has a significant and beneficial effect on their attitudes, and in this relationship between teachers' self-viewing and attitudes, self-awareness, engagement, and communication are correlated with other covariance. The Pearson correlations Heatmap for student-measured variables depicts the relationships between the two intersecting variables [69], which is shown in *Fig. 3*.

Table 5. Means, standard deviations and Pearson correlations for teacher-measured variables.

Teacher	Mean	SD	1	2	3	4
1. Self-viewing	2.845	0.988	-			
2. Attitude	3.647	0.889	0.339***	-		
3. Self-awareness	3.773	0.754	0.284***	0.645***	-	
4. Engagement	3.830	0.835	0.243**	0.695***	0.836***	-
5. Communication	3.817	0.840	0.239**	0.711***	0.752***	0.871***

Notes. $N = 200$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

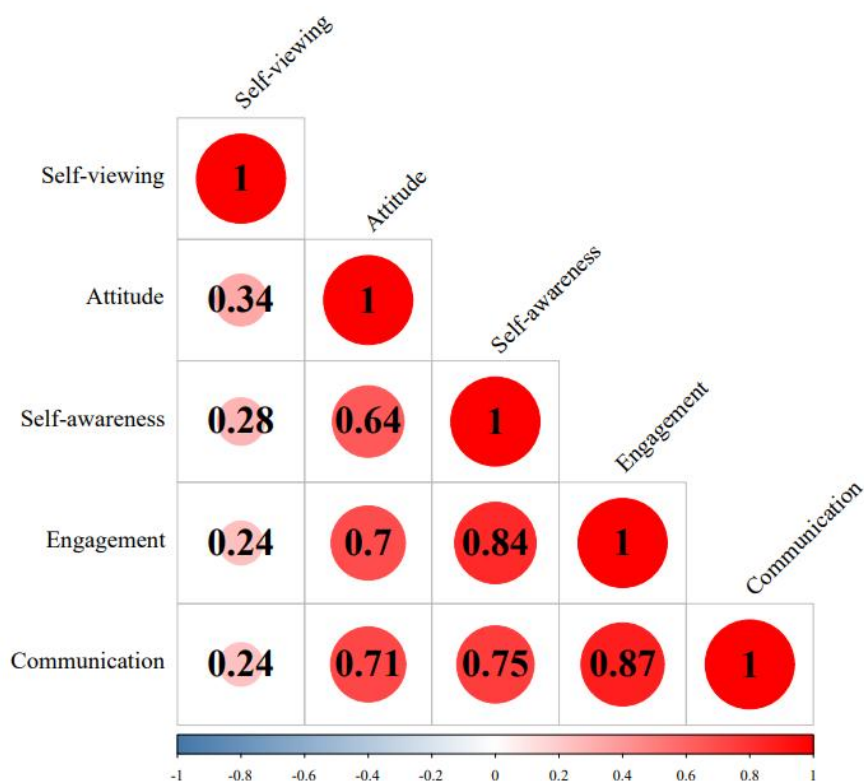


Fig. 2. Pearson correlations Heatmap for teacher-measured variables.

Table 6. Means, standard deviations and Pearson correlations for student-measured variables.

Student	Mean	SD	1	2	3	4
1. Self-viewing	2.750	0.902	-			
2. Attitude	3.593	0.782	0.371***	-		
3. Self-awareness	3.646	0.682	0.346***	0.738***	-	
4. Engagement	3.603	0.773	0.345***	0.786***	0.723***	-
5. Communication	3.641	0.780	0.330***	0.785***	0.760***	0.844***

Notes. $N = 200$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

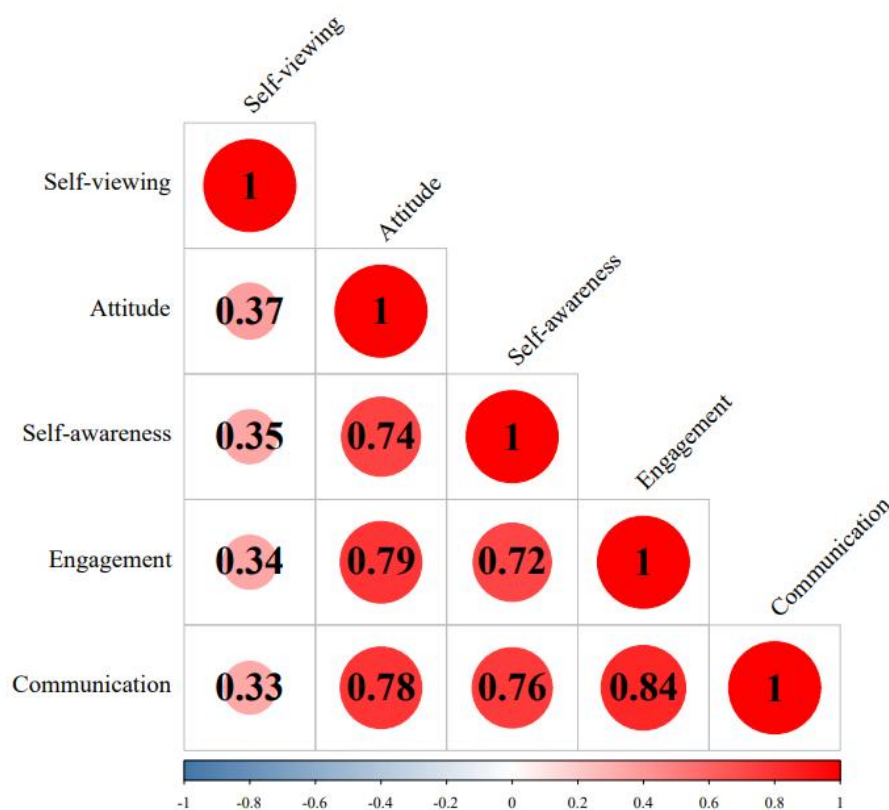


Fig. 3. Pearson correlations Heatmap for student-measured variables.

4.2 Confirmatory factor analysis

Confirmatory factor analysis (CFA) through Mplus version 8.3 is used to evaluate the instrument's validity [60]. Table 7 provides the CFA results, which demonstrate adequate fit to the data [66, 67]: in terms of teachers' results, $\chi^2/df = 1.707$, RMSEA = 0.059, CFI = 0.924, TLI = 0.916, and SRMR = 0.056. Moreover, in terms of students' results, $\chi^2/df = 2.031$, RMSEA = 0.039, CFI = 0.951, TLI = 0.946, and SRMR =

0.077. We measure AVE, CR and CA of teacher scales and student scales. Expected indexes for good measurement are at least 0.5 for AVE, at least 0.6 for CR and at least 0.7 for CA [63, 68]. As we can observe in *Table 8* and *Table 9*, all indexes are above the thresholds, which indicates good convergent validity. As *Table 7*, *Table 8*, and *Table 9* show, the reliability and validity of the teachers' and students' instruments are good and meet the requirements [63-68].

Table 7. Confirmatory factor analysis (CFA).

Model	χ^2	df	χ^2/df	RMSEA	CFI	TLI	SRMR
Teacher	500.014	293	1.707	0.059	0.924	0.916	0.056
Student	647.994	319	2.031	0.039	0.951	0.946	0.077
Acceptable range			< 3	< 0.08	> 0.9	> 0.9	< 0.08

Table 8. Instrument validity and reliability (Teacher).

Factor	Number of items	Cronbach's alpha	KMO	Factor loading	AVE	CR
Attitude	6	0.929	0.919***	0.831-0.893	0.740	0.945
Self-awareness	9	0.916	0.933***	0.703-0.844	0.602	0.931
Engagement	5	0.889	0.845***	0.835-0.870	0.732	0.932
Communication	6	0.923	0.900***	0.798-0.886	0.722	0.940

Notes. $N = 200$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Table 9. Instrument validity and reliability (Student).

Factor	Number of items	Cronbach's alpha	KMO	Factor loading	AVE	CR
Attitude	6	0.898	0.900***	0.794-0.832	0.663	0.922
Self-awareness	9	0.891	0.929***	0.665-0.759	0.536	0.912
Engagement	5	0.860	0.859***	0.754-0.822	0.642	0.900
Communication	6	0.904	0.912***	0.800-0.862	0.677	0.926

Notes. $N = 200$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

4.3 Structural equation model analysis

For teachers, the hypothesized model we propose is verified using structural equation model (SEM) analysis, and the results show a satisfactory fit for the data [66, 67], as

indicated in *Table 10*: $\chi^2 = 572.706$, $df = 318$, $\chi^2/df = 1.801$, RMSEA = 0.063, CFI = 0.911, TLI = 0.902, and SRMR = 0.059. For students, our results indicate that the model fits with the data well [66, 67], showing adequate fit indices: $\chi^2 = 911.018$, $df = 318$, $\chi^2/df = 2.865$, RMSEA = 0.053, CFI = 0.946, TLI = 0.941, and SRMR = 0.034. *Fig. 4* and *Fig. 5* depict the standardized path coefficients and also show the significance of the relationships of the variables in the teachers' and students' models. The dotted line represents nonsignificant relationships.

Table 10. Fit measures for the structural model.

Model	χ^2	df	χ^2/df	RMSEA	CFI	TLI	SRMR
Teacher	572.706	318	1.801	0.063	0.911	0.902	0.059
Student	911.018	318	2.865	0.053	0.946	0.941	0.034
Acceptable range			< 3	< 0.08	> 0.9	> 0.9	< 0.08

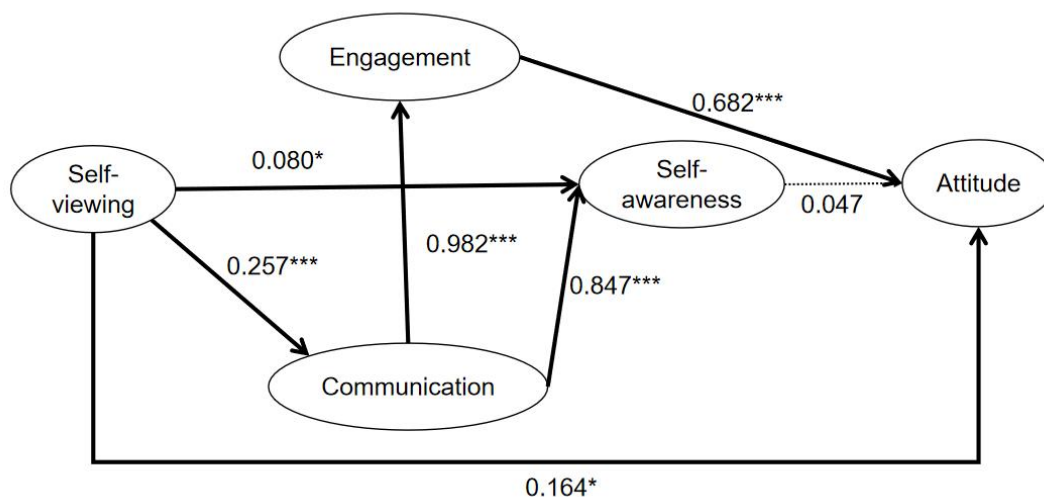


Fig. 4. The teachers' structural equation model.

Notes. $N = 200$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

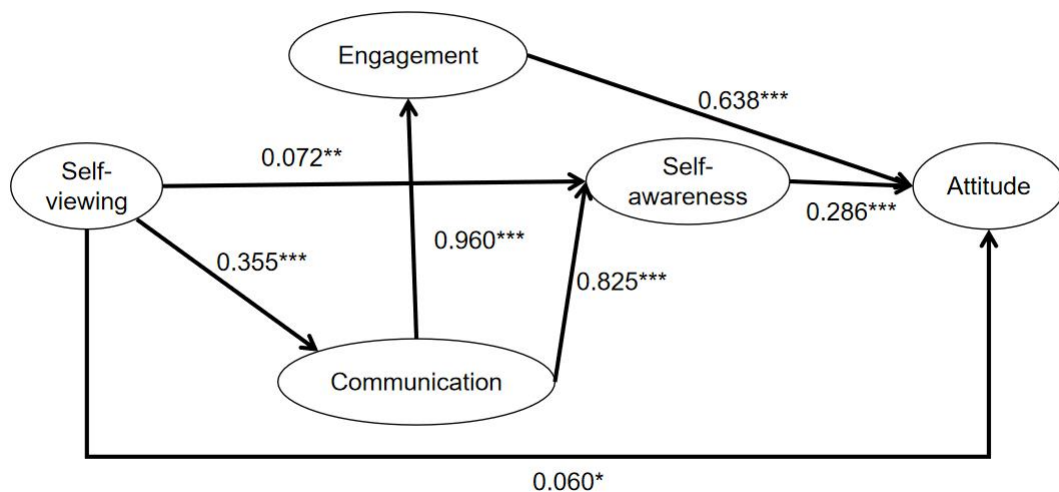


Fig. 5. The students' structural equation model.

Notes. $N = 200$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

In terms of teachers (as shown in *Table 11*), for the first hypothesis, the direct and positive effect of self-viewing on attitude is statistically significant, which indicates that self-viewing has a slight positive and significant impact on attitude ($\beta = 0.164$, $t = 2.480$, $p = 0.013$). In hypothesis 2, the positive effect of self-viewing on self-awareness is supported ($\beta = 0.080$, $t = 1.982$, $p = 0.047$). The result for hypothesis 3, this hypothesis is not supported, because the direct and positive effect of self-awareness on attitude ($\beta = 0.047$, $t = 0.227$, $p = 0.821$), shows this relationship is not significant. There is a significant and positive impact between self-viewing and communication; hence, hypothesis 4 is supported ($\beta = 0.257$, $t = 4.205$, $p < 0.001$). For hypothesis 5, the significant and positive effect of communication on self-awareness is also supported ($\beta = 0.847$, $t = 19.510$, $p < 0.001$), which also indicates that self-viewing can have an indirect and positive effect on self-awareness. For hypothesis 6, the effect of engagement on attitude ($\beta = 0.682$, $t = 3.585$, $p < 0.001$) is significant, as communication has a positive effect on engagement and engagement has a positive effect on attitude, so communication can have an indirect and positive effect on attitude. Moreover, for hypothesis 7, the effect of communication on engagement ($\beta = 0.982$, $t = 55.600$, $p < 0.001$) is significant.

Table 11. Parameter estimates of the structural equation model (teachers).

Hypothesis	Relationship of variables	β	SE	t	p
Hypothesis 1	Self-viewing \rightarrow Attitude	0.164*	0.066	2.480	0.013
Hypothesis 2	Self-viewing \rightarrow Self-awareness	0.080*	0.040	1.982	0.047
Hypothesis 3	Self-awareness \rightarrow Attitude	0.047	0.209	0.227	0.821
Hypothesis 4	Self-viewing \rightarrow Communication	0.257***	0.061	4.205	0.000
Hypothesis 5	Communication \rightarrow Self-awareness	0.847***	0.043	19.510	0.000
Hypothesis 6	Engagement \rightarrow Attitude	0.682***	0.190	3.585	0.000
Hypothesis 7	Communication \rightarrow Engagement	0.982***	0.018	55.600	0.000

Notes. $N = 200$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

In terms of students (*Table 12*), for hypothesis 1, the relationship between self-viewing and attitude ($\beta = 0.060$, $t = 2.483$, $p = 0.013$) is supported, so students' self-viewing has a direct impact on their attitudes. Moreover, the impact of self-viewing on self-awareness is supported ($\beta = 0.072$, $t = 2.566$, $p = 0.010$), and self-awareness ($\beta = 0.286$, $t = 5.677$, $p < 0.001$) has a positive impact on attitude; hence, hypotheses 2 and 3 are supported, and self-viewing can have an indirect positive effect on attitude. In addition, for hypotheses 4 and 5, the effects of self-viewing on communication ($\beta = 0.355$, $t = 10.040$, $p < 0.001$) and communication on self-awareness ($\beta = 0.825$, $t = 43.271$, $p < 0.001$) are significant and supported, so self-viewing can have an indirect impact on self-awareness. For hypotheses 7 and 6, communication has a positive effect on engagement ($\beta = 0.960$, $t = 107.546$, $p < 0.001$), engagement has a positive and significant effect on attitude ($\beta = 0.638$, $t = 13.393$, $p < 0.001$), and communication can have an indirect effect on attitude.

Table 12. Parameter estimates of the structural equation model (students).

Hypothesis	Relationship of variables	β	SE	t	p
Hypothesis 1	Self-viewing \rightarrow Attitude	0.060*	0.024	2.483	0.013
Hypothesis 2	Self-viewing \rightarrow Self-awareness	0.072**	0.028	2.566	0.010
Hypothesis 3	Self-awareness \rightarrow Attitude	0.286***	0.050	5.677	0.000
Hypothesis 4	Self-viewing \rightarrow Communication	0.355***	0.035	10.040	0.000
Hypothesis 5	Communication \rightarrow Self-awareness	0.825***	0.019	43.271	0.000
Hypothesis 6	Engagement \rightarrow Attitude	0.638***	0.048	13.393	0.000
Hypothesis 7	Communication \rightarrow Engagement	0.960***	0.009	107.546	0.000

Notes. $N = 200$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

For teachers, regarding indirect effects, the structural model shows that the positive effect of self-viewing on self-awareness is mediated by teachers' communication ($\beta = 0.217$, $t = 4.216$, $p < 0.001$). Moreover, communication positively and significantly affect attitude mediated by engagement ($\beta = 0.669$, $t = 3.545$, $p < 0.001$). In addition, self-viewing positively and significantly affect engagement mediated by communication ($\beta = 0.252$, $t = 4.213$, $p < 0.001$), and the results are shown in *Table 13*.

Table 13. The standardized regression coefficient for mediation analysis (teachers).

Path	β	SE	t	p
Self-viewing \rightarrow Communication \rightarrow Self-awareness	0.217***	0.052	4.216	0.000
Self-viewing \rightarrow Self-awareness \rightarrow Attitude	0.004	0.017	0.219	0.827
Communication \rightarrow Self-awareness \rightarrow Attitude	0.040	0.177	0.226	0.821
Communication \rightarrow Engagement \rightarrow Attitude	0.669***	0.189	3.545	0.000
Self-viewing \rightarrow Communication \rightarrow Engagement	0.252***	0.060	4.213	0.000

Notes. $N = 200$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

For students (*Table 14*), self-viewing has an indirect positive impact on attitude that is

mediated by their self-awareness ($\beta = 0.020$, $t = 2.315$, $p = 0.021$), and self-viewing has an indirect positive impact on self-awareness that is mediated by students' communication ($\beta = 0.293$, $t = 9.682$, $p < 0.001$). Communication has a positive indirect effect on attitude via self-awareness ($\beta = 0.236$, $t = 5.633$, $p < 0.001$). The structural model also shows that the effect of communication on attitude via engagement ($\beta = 0.612$, $t = 13.052$, $p < 0.001$), and self-viewing has an indirect effect on engagement via communication ($\beta = 0.341$, $t = 9.934$, $p < 0.001$).

Table 14. The standardized regression coefficient for the mediation analysis (students).

Path	β	SE	t	p
Self-viewing → Communication → Self-awareness	0.293***	0.030	9.682	0.000
Self-viewing → Self-awareness → Attitude	0.020*	0.009	2.315	0.021
Communication → Self-awareness → Attitude	0.236***	0.042	5.633	0.000
Communication → Engagement → Attitude	0.612***	0.047	13.052	0.000
Self-viewing → Communication → Engagement	0.341***	0.034	9.934	0.000

Notes. $N = 200$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

5. Discussion and implications

This study tests whether participants' self-viewing in video conferencing affects their attitudes. We also explore the effect of engagement, communication and self-awareness on this relationship between self-viewing and attitude. Our research promotes and deepens cognitive theory and objective self-awareness theory in cognitive ability and self-awareness. Our results also provide new contributions to teachers' and students' teaching and learning during video conferencing concerning the use of cameras.

Our study confirms that self-viewing has a positive effect on attitude, which is consistent with previous studies. Prior studies confirmed that participants' self-viewing in video conferencing had a positive effect on their attitudes and made them feel satisfied [9, 38]. The findings of this study show that teachers' and students' self-viewing has a weak positive effect on their attitudes during video conferencing, and the impact of teachers' and students' self-viewing on their attitudes is significant. In addition, students' attitudes are indirectly affected by self-viewing via self-awareness, engagement and communication, and teachers' attitudes are indirectly affected by self-viewing via engagement and communication. However, our study is also inconsistent with cognitive theory, which indicates that environmental stimulation harms attitude [6, 31]. According to cognitive theory, self-viewing can make them feel exhausted, and their cognitive ability to deal with important material in the course is reduced [6, 31]. However, some participants state that they dislike self-viewing, but they would like to monitor their appearance and behaviors in video conferencing. Therefore, their attitudes towards distance learning are still positive. In distance learning, teachers and students can keep the cameras on during video conferencing since self-viewing can let them pay more attention to their performance and behaviors; therefore, they have a positive attitude towards distance learning and then achieve better academic outcomes [33, 34].

Our findings concerning the relationship between self-viewing and self-awareness are also congruent with prior studies. Several studies showed that participants' self-awareness could be positively affected by their self-viewing [37, 43-45]. Furthermore, according to objective self-awareness theory, self-viewing can promote self-awareness [8, 37]. The findings of our study also show that teachers' and students'

self-viewing has a weak positive and significant effect on their self-awareness. Hence, our results deepen the objective self-awareness theory; when participants see their own faces, they can self-evaluate, which can have a positive or negative effect depending on their self-differences, and their self-awareness increase [8]. In distance learning, teachers and students can keep cameras on to see their own faces. When they self-view, they find their merits or demerits and become more aware of their own psychological and emotional changes [37, 39-41], which can enhance teachers' and students' self-awareness.

In our results, the relationship between self-awareness and attitude is different in student and teacher participants. For teachers, their self-awareness has not been confirmed to affect their attitudes, which is not consistent with the results of previous studies [16, 21]. However, for students, self-awareness can positively affect their attitudes, which is consistent with the results of previous studies [16, 21]. When teachers teach, they pay more attention to what they are saying compared to students. Based on objective self-awareness theory, when teachers' self-awareness increases, they can self-evaluate and be self-critical when they are teaching, so they may pay more attention to their mistakes in teaching, which may cause them to have a negative attitude. The different results of teachers and students need to be studied in the future. Hence, in distance learning, schools and teachers can try to improve students' self-awareness. They can increase their self-awareness by letting them see their own faces [37, 43-45] or communicate with others [48, 49]. When students have more self-awareness, they can pay more attention to their performance as well as to the psychological and emotional changes in self-viewing [8]. When they find negative emotions or shortcomings, they can adjust, and their attitudes towards distance learning can improve; as a result, they should obtain better grades [34].

Our findings on the relationship between self-viewing and communication are congruent with those of previous studies. Previous studies confirmed the positive impact of participants' self-viewing on their communication [15, 21]. Our study extends the previous research by examining the effect of self-viewing and communication in video conferencing. Previous studies showed that there was some effect on the relationship between self-viewing and attitude [14, 45]. As stated in the previous literature, self-viewing had a significant positive effect on communication.

Therefore, in distance learning, to improve teachers' and students' performance, they can keep the cameras on during video conferencing. Self-viewing allows teachers and students to better understand the speaker's intention and avoid misunderstandings, thus enhancing communication [15, 21]. In this case, they can acquire more communication with others in distance learning, and they can exchange their educational ideas and experience to improve their teaching and learning outcomes [48].

Our results are also congruent with previous studies on the relationship between communication and self-awareness. Previous studies found that participants' communication could promote their self-awareness based on the Johari Window model [48-50]. Similar to the previous literature, our results indicate that teachers' and students' communication also has a positive effect on self-awareness. Hence, in distance learning, teachers and students need to be more actively communicate with others. According to the Johari Window model, when the open area, which means what we know and others know, is wider, participants' self-awareness will increase [48]. When they communicate with others and acquire more knowledge, their self-awareness will increase; in this case, they can express their ideas and feelings and become self-disciplined [37, 39-41], which is beneficial to their achievements.

Our findings on the relationship between engagement and attitude are also consistent with previous literature that confirmed that engagement could affect attitude [17, 18, 54, 55]. In our results, for teachers and students, engagement can improve their attitudes in video conferencing. Hence, in distance learning, teachers and students need to actively engage in video conferencing. With high engagement, they can be immersed in learning and teaching, and their attitudes towards learning tend to be positive, which can improve their teaching and learning [6, 7, 37].

Our findings are congruent with previous studies with regard to the relationship between communication and engagement. Previous studies indicated that participants' participation could be increased by effective communication [57, 58]. Our results are congruent with prior studies showing that teachers' and students' communication had a strong positive impact on their engagement in video conferencing. Therefore, in distance learning, teachers and students need to increase their communication with others. Teachers and students share ideas to let the speakers know that the listeners are

paying attention to their ideas, which makes them more engaged in the learning environment. When they are more engaged in video conferencing, their performance can be enhanced [52].

6. Limitations and suggestions for future research

Our study is not without limitations. First, the sample of teachers is not large enough, and this study is conducted in a Chinese environment; hence, it may not be applicable to other countries due to cultural differences. Therefore, the results cannot be directly generalized. Second, the learning environment (such as a private, quiet room) and participants' information and communication technology (ICT) ability may have affected the results. Hence, future studies may measure whether the learning environment and ICT can affect the results.

Appendix

Appendix A. Teachers' Constructs and Measurement Items.

Constructs	No. of items	ID	Items	Sources
Self-viewing	1	TSV	How often is your own face visible to you during your virtual class meetings?	Adapted from [9]
Attitude	6	TAT1	Online courses make teaching easier for me.	Adapted from [36]
		TAT2	During online classes, there is effective communication between teachers and students.	
		TAT3	I can let students take the initiative to acquire knowledge and information during the online class.	
		TAT4	Online courses improve students' thinking and problem-solving skills.	
		TAT5	Online courses give students more opportunities to create their own knowledge.	
		TAT6	Hypertext (can jump text, pictures, videos, links and other content) online teaching can improve students' learning motivation.	
Self-awareness	9	TSA1	I was keenly aware of everything in my environment.	Adapted from [42]
		TSA2	I was conscious of what was going on around me.	
		TSA3	I was conscious of all objects around me.	
		TSA4	I was conscious of my inner feelings.	
		TSA5	I was reflective of my life.	
		TSA6	I was aware of my innermost thoughts.	
		TSA7	I was concerned about the way I presented myself.	
		TSA8	I was self-conscious about the way I looked.	
		TSA9	I was concerned about what other people thought of me.	
Engagement	5	TEN1	I can discuss my ideas freely when teaching	Adapted from [53]

Constructs	No. of items	ID	Items	Sources
			virtually.	
		TEN2	I can ask questions freely when teaching virtually.	
		TEN3	My virtual classes are engaging.	
		TEN4	I feel motivated to teach virtually.	
		TEN5	Virtual class discussions with other students can enhance my teaching experience.	
Communication	6	TCO1	It is easy to communicate with students when I teach virtually.	Adapted from [34]
		TCO2	It is useful to communicate with students when I teach virtually.	
		TCO3	I enjoy communicating with students when I teach virtually.	
		TCO4	I have control when communicating with students in my virtual class.	
		TCO5	I am interested (engaged, motivated) when I communicate with students in my virtual class.	
		TCO6	I have the flexibility and many opportunities to communicate with students in my virtual class.	

Appendix B. Students' Constructs and Measurement Items.

Constructs	No. of items	ID	Items	Sources
Self-viewing	1	TSV	How often is your own face visible to you during your virtual class meetings?	Adapted from [9]
Attitude	6	SAT1	Online courses make my study easier.	Adapted from [36]
		SAT2	There is effective communication between teachers and students during online classes.	
		SAT3	I can actively acquire knowledge and information during online classes.	
		SAT4	Online courses improve my thinking ability and problem-solving ability.	

Constructs	No. of items	ID	Items	Sources
		SAT5	Online courses give me more opportunities to create my own knowledge.	
		SAT6	Hypertext (the ability to jump text, pictures, videos, links, etc.) online teaching can improve my learning motivation.	
Self-awareness	9	SSA1	I was keenly aware of everything in my environment.	Adapted from [42]
		SSA2	I was conscious of what was going on around me.	
		SSA3	I was conscious of all objects around me.	
		SSA4	I was conscious of my inner feelings.	
		SSA5	I was reflective of my life.	
		SSA6	I was aware of my innermost thoughts.	
		SSA7	I was concerned about the way I presented myself.	
		SSA8	I was self-conscious about the way I looked.	
		SSA9	I was concerned about what other people thought of me.	
Engagement	5	SEN1	I can discuss my ideas freely in video conferencing.	Adapted from [53]
		SEN2	I can ask questions freely in video conferencing.	
		SEN3	Virtual classes are engaging.	
		SEN4	I feel motivated to attend the video conferencing.	
		SEN5	Virtual class discussions with the teacher and other students can enhance my learning experience.	

Constructs	No. of items	ID	Items	Sources
Communication	6	SCO1	It is easy to communicate with others (teachers and other students) in video conferencing.	Adapted from [34]
		SCO2	It is useful to communicate with others (teachers and other students) in video conferencing.	
		SCO3	I enjoy communicating with others (teachers and other students) in video conferencing.	
		SCO4	I have control when communicating with others (teacher and other students) in video conferencing.	
		SCO5	I am interested (engaged, motivated) when I communicate with others (teachers and other students) in video conferencing.	
		SCO6	I have the flexibility and many opportunities to communicate with others (teacher and other students) in video conferencing.	

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