



Article

Sustained Use of Virtual Meeting Platforms for Classes in the Post-Coronavirus Era: The Mediating Effects of Technology Readiness and Social Presence

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Abstract: In response to the COVID-19 pandemic, educational institutions were forced to turn to online classes that are either recorded or taught live on virtual meeting platforms. Students could, therefore, attend classes from virtually any location using their mobile devices and Internet access. Despite the prolonged pandemic, little attention has been paid to whether offering courses on a virtual meeting platform is sustainable. This study, therefore, explores the antecedents of students' intentions regarding the sustained use of virtual meeting platforms for academic courses. We investigated the relationship between technology readiness (TR) and perceived social presence (SP) within a virtual communication setting with course satisfaction and sustained use intention. Data were collected via a survey from 525 college students in South Korea who had attended classes using a virtual meeting platform. Serial mediation analysis revealed a pathway in which SP and course satisfaction in series fully mediate the positive relationship between technology readiness and sustainability. This study discusses the implications in relation to the sustainability of virtual technology-based courses as a replacement of live classroom-based courses from a user perspective. Further research is needed to understand users' negative experiences of attending courses on virtual meeting platforms.

Keywords: virtual meeting platform; technology readiness; social presence; course satisfaction; sustained use intention; serial mediation



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1. Introduction

More than a year has passed since the first case of coronavirus disease (COVID-19) was reported in December 2019 [1]. Since then, the entire world has been experiencing the current pandemic, with many countries implementing stay-at-home regulations to stop the spread of the virus. Education is one of the areas that witnessed the most rapid changes during this period. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) statistics, 190 countries had closed their educational institutions as of May 2020; these institutions account for approximately 90% of the world's students. Among these countries, 100 have not yet announced the reopening of schools, 65 have partially reopened their schools, and 32 have announced that students will complete their education online [2].

Multiple forms of technologies have been adopted in education in the last decades. However, the COVID-19 pandemic has caused a shift from a universal face-to-face education system based on physical classrooms to a system involving online videos and virtual meeting platforms [3,4]. This transition was not due to the natural progression of technological development; rather, the change was forced upon educational institutions by an external factor—the COVID-19 pandemic [5,6]. Although the necessity for this change occurred abruptly, existing technology enabled a quick transition in response to the external pressure, the pandemic. The application of existing communication technology to facilitate education is more than a temporary fix because of the pandemic; it will be used even after the pandemic, and students will be given a choice of education methods [7].

As an example, a study by Pérez-Villalobos et al. found that students in Vietnam and Indonesia preferred distance learning, while students in Poland stated that they would prefer to return to face-to-face learning after the pandemic [8]. These results indicate that the advantages of being liberated from temporal and spatial constraints—an advantage of virtual communication—will still be valid, even when the world is ready to return to physical classroom learning. The value of educational methods involving virtual meeting platforms even after the end of the pandemic requires investigation in terms of its relative effectiveness, as well as students' and instructors' preferences concerning distance learning instead of traditional education methods [9].

To understand the sustained use intentions of educational methods utilizing virtual communication, we must first define the meaning of virtual communication. The term “virtual” indicates a state in which an individual can perform desired actions without physical movement or contact by using new technology media such as a computer [10]. From the communication perspective, virtual communication refers to communication that is carried out from a distance, without requiring physical contact or movement to meet others in person. For example, distance learning in education, which does not require physical contact or movement by students or instructors, is enabled by virtual communication. In its early stages, virtual communication methods included tools such as telephones and chat rooms on the Internet; with technological development came more recent technologies, such as videotelephony and communication systems, that enable virtual meetings. As it advanced, technological development was also applied to education, starting with chat programs used for education in the late 20th century to online community group systems [11].

Among the various virtual communication tools available today, this study focuses on education that utilizes virtual meeting platforms that have been replacing classroom learning since the onset of the COVID-19 pandemic. This system, often referred to as synchronous videoconferencing [12] or technology-mediated learning, is regarded as the most appropriate alternative to classroom learning, as the only aspect not present in this educational method is ‘being in the same place’. Similar to face-to-face communication between the instructor and the learner, this system also offers immediacy and has the advantage of creating a feeling of teaching presence.

Research on online distance education emphasized the role of social presence as it promotes social interactions in online learning [13,14] and decreases the feeling of isolation that is often reported by online students [15]. While students are currently enrolled in classes that utilize a virtual meeting platform due to the pandemic, they are not voluntary online students; therefore, some are possibly more ready to enjoy the advantages that the newly introduced system brought, while others are more likely to experience difficulty and feel isolated. Considering the above, this study focuses on technology readiness (TR) as a major factor influencing the sustained use intention of education via virtual meeting platforms. It also aims to confirm whether TR influences sustained use intention through social presence (SP) perception and course satisfaction. Unlike studies that focus on the effectiveness of the virtual classroom (cost, safety, equity, feasibility, and efficacy [12,16]), this study is novel as it focuses on the effects of individual tendencies (i.e., TR) and the consequent perception (i.e., SP) of the learners. Furthermore, if learning methods should be analyzed based on effectiveness alone, there may be choices in terms of educational systems from the perspective of instructors in the future. However, confirming the sustained use intentions of education methods relating to learners' preferences has unique value, as it explores the significance of virtual communication education methods from a student's perspective. The current research provided empirical evidence supporting the key mediating roles of SP and course satisfaction, as the results revealed that TR, which is an individual trait, did not directly influence individuals' sustained use intentions of virtual meeting platforms. Rather, it had a positive influence mediated by SP and course satisfaction.

2. Theoretical Background and Hypotheses

2.1. Technology Readiness, Social Presence, Course Satisfaction, and Sustainability

Parasuraman defined TR as “people’s propensity to embrace and use new technologies for accomplishing goals in home life and at work” (p. 308, [17]). It is an individual trait that can be conceptualized as an overall state of mind or belief that determines an individual’s predisposition toward the use of new technology [18]. Based on qualitative research, Parasuraman [17] argued that technology can induce both positive and negative emotions in individuals and that some of these emotions may be dominant in individuals, possibly affecting their degree of technology acceptance. Against this backdrop, their study developed a technology readiness index (TRI), arguing that the accuracy of consumer behavior prediction increases when the consumers’ level of TR is considered when a company develops a new technology [17]. The TRI developed by Parasuraman [17] has four dimensions: optimism, innovativeness, insecurity, and discomfort. Optimism refers to a positive view of technology and a general belief in its benefit, including enhanced control, flexibility, and efficiency in people’s lives; innovativeness concerns one’s tendency to be a technological pioneer. Opposed to these two dimensions are insecurity, which derives from skepticism about the technology’s ability to work properly and concerns about its negative consequences, and discomfort, which is the perception of lack of control over technology and feeling overwhelmed [19]. The dimensions of optimism and innovativeness contribute to TR as “motivators”, while insecurity and discomfort are considered to be “inhibitors” [19]. Depending on the researchers using the index, TR can be conceptualized as a four-dimensional, two-dimensional, or one-dimensional (overall composite) construct. The TRI showed a positive correlation with technology use tendencies [17], and further studies showed that it had a positive influence on the quality evaluations of online services and online behavior [20]; however, existing findings on the relationship between TR and technology use are inconsistent [21], which calls for further empirical evidence.

As can be seen by the original intent for developing the TRI, studies have used this scale mainly to investigate consumer choice. These types of studies are often conducted to confirm consumer perceptions on matters such as the formats of digital transformation in the market: for example, Internet banking [21–24]. Although relatively scarce, education researchers also emphasized TR in the education context since the success of any system hinges not only on the learners’ acceptance but also their state of technology readiness [25,26]. Studies on the relationship between TR and education have investigated the factors that influence students’ choice of e-learning [9], the effect of demographics on TR, the qualifications of teachers who integrate technology into their teaching processes [27], and whether TR determines students’ readiness for online classes after COVID-19 [28]. El Alfy, Gómez, and Ivanov found that TR also influences instructors’ behavioral intentions [29]. As there is currently no empirical evidence supporting the relationship between TR and students’ behavioral intentions, we developed the following hypothesis, based on a view of TR as a robust predictor of technology-related behavioral intention [19] and the above findings.

Hypothesis 1. *TR is positively related to the sustained use intention of education using a virtual meeting platform.*

Presenting the TRI version 2.0, Parasuraman and Colby proposed further exploration of the dynamics involved in technology adoption; they also argued that the TRI may function as a key psychographic variable in decision-oriented research within the context of technology-based innovation [19]. To predict students’ intention of sustained technology use, even after the end of the pandemic, we focused on SP and satisfaction as the key mediators in the relationship between TR and sustainability, considering that students’ impression of SP is determined by their perception of the use of the medium for education, rather than the medium itself [30], as well as evidence supporting the strong relationship between SP and satisfaction (e.g., see meta-analysis by Richardson et al. [31]). More

specifically, TR not only directly affects sustainability but also leads to different levels of psychological experiences, such as SP, among students; such experiences determine their satisfaction with technology-enabled classrooms, which ultimately leads to sustained use intentions of virtual meeting platforms in learning.

SP was first discussed by Short, Williams, and Christie [32], who defined it as the “degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationship” (p. 59, [15]). According to Gunawardena and Zittle, SP is associated with intimacy and immediacy [33]. Ultimately, this indicates that SP is related to how the user perceives a subject through different media and can thus be defined in diverse ways. Various definitions of SP include the degree to which one feels about the presence of another in communication [34], “the sense of being with others” (p. 456, [35]), the “level of awareness of the co-presence of another human, being or intelligence,” and “feeling that one has some level of access or insight into the other’s intentional, cognitive or affective states” [36]. Combining these definitions, this discourse not only involves the level upon which one perceives the presence of another in a mediated communication situation but also the degree to which the emotional awareness of others in an online environment is similar to awareness of them in an in-person environment. This is an important indicator for measuring the effects of communication today, at a time when various media environments are unavoidable. As such, several tools to measure SP have been developed [32,37–39], from which we used Kim’s [37] work that presented four sub-factors of SP: mutual attention and support, affective connectedness, sense of community, and open communication. This scale is particularly suitable, as it was developed to measure SP in the environment of distance education, similar to the setting of this study.

Existing studies on the relationship between TR and SP are scarce; they do, however, include a study on individuals’ sharing of knowledge [40]. However, this study did not examine the direct relationship between TR and SP; instead, it examined how each dimension of TR and SP influenced the knowledge sharing intentions of its participants, based on the technology acceptance model (TAM) [41]. The TAM is a psychological theory used to explain individuals’ technology acceptance intention or, in other words, behavioral intentions toward technology [41]. As such, there are existing studies that confirm the technology-related characteristics of participants through the relationship between TR and the TAM [42–46]. Furthermore, there are studies that have affirmed the relationship between technology acceptance and SP [47,48], but the context is limited to e-learning or distance learning. These existing studies, which integrate the TAM and TR perspectives, indicate that a positive attitude toward the technology of virtual meeting platforms leads to stronger experiences of ease of use and usefulness, stronger engagement with the course, and a stronger experience of SP during the course. Based on these existing findings, the following hypothesis can be established.

Hypothesis 2. *TR is positively related to SP.*

In the context of distance learning using virtual meeting systems, the relationship between SP and course satisfaction and that between course satisfaction and sustained use intention are both confirmed by existing studies on e-learning. Stacey observed that SP increased because of messages sent between the students, which led to intimacy between them; this, in turn, strongly induced learning motivation [49]. Furthermore, Gunawardena and Zittle studied the relationship between SP and course satisfaction among college students and found that SP was an important variable predicting satisfaction [30]. Furthermore, Richardson and Swan verified a correlation between SP and instructor satisfaction [39] and considered how such satisfaction was related to learning outcomes. Richardson, Maeda, and Caskurlu also identified factors mediating the relationship between SP and course satisfaction in online learning settings [31]. Based on the existing evidence, we propose the following hypothesis.

Hypothesis 3. *Social presence is positively related to course satisfaction.*

Marketing research has examined how satisfaction with a certain product can positively influence the intention to use the product again [50–52]. As such, exploring the factors that affect individuals' degree of satisfaction has been an important research area. Consumers' repurchase behavior is related to service satisfaction, because repurchase is a direct compensatory behavior resulting from satisfaction. In the same vein, students' course satisfaction can predict the "same choice" for future courses. In this regard, the same choice refers to repeated choices regarding several aspects, such as the same instructor, same learning method, same group, or same classmates. However, given that academic achievement is an important yardstick in education, studies on academic achievement have measured whether learning objectives have been met. For example, existing research on problem-solving methods in distance learning includes an investigation on the influence of a method that encourages interaction between small groups of students on academic satisfaction [53] and studies on the influence of technology intimacy or learning environment on distance learning satisfaction [54]. These studies mainly explored factors influencing satisfaction, rather than sustained use intentions toward learning methods, because satisfaction with online learning is expected to influence not only academic outcomes but also sustained use intentions. While there is insufficient research on the effect of academic satisfaction on choosing the same learning methods later, we propose the following hypothesis, based on existing marketing research on the influence of emotional satisfaction on behavior.

Hypothesis 4. *Course satisfaction is positively related to the sustained use intention of courses on virtual meeting platforms.*

2.2. Mediating Roles of Social Presence and Course Satisfaction between Technology Readiness and the Sustained Use Intention

Using cultural comparisons, Rojas-Méndez, Parasuraman, and Papadopoulos [55] discovered that demographic characteristics and cultural differences are associated with the adoption of new technologies. They reported that individual traits associated with technology are related to the individual's use of technology. However, research on technology use intentions in education revolves around the issue of technology acceptance [56,57]. This is because an attitude of not rejecting technology as the medium is one of the most important preliminary factors for technology-enabled education. In confirming the technology use intentions through the TAM model, some studies determined the influence of users' emotional attitudes, such as negative emotions toward technology, on technology adoption [32,56]. However, it is also possible that TR may not directly predict the technology use intentions; this is confirmed by studies that indicate that negative emotions, such as a fear of technology, do not have a negative influence on technology use intentions [58].

Based on existing evidence on the sense of community created during conferences and how it influences how participants consider computer-mediated communication (CMC) as a "social medium" [30], it is reasonable to expect that SP could play a mediating role in an online education environment. Additionally, among two widely accepted mediating mechanisms (TAM and quality-value-satisfaction; QVS) in the relationship between TR and technology use, the QVS includes satisfaction [59]. Blut and Wang [59] argued that satisfaction may function as a key mediator, as people with favorable disposition toward technology are more easily satisfied because they tend to focus on the positive aspects of employing a given technology. Therefore, the hypotheses for mediating effects are proposed as follows.

Hypothesis 5. *SP mediates the relationship between TR and sustained use intention of courses on virtual meeting platforms.*

Hypothesis 6. *Course satisfaction mediates the relationship between TR and sustained use intention of courses on virtual meeting platforms.*

Hypothesis 7. *TR is positively related to sustained use intention of courses on virtual meeting platforms via the chain of SP and course satisfaction.*

3. Materials and Methods

3.1. Participants and Procedure

We recruited 552 college students from a South Korean crowdsourcing website similar to MTurk (<http://www.embrain.com>, accessed on 30 April 2021). Since the onset of the pandemic, the Ministry of Education in Korea recommended universities to turn all classes online, and among several options, the most widely chosen teaching method was real-time online classes using a virtual meeting platform. Therefore, Korean students were considered adequate research sample for the current research aims. The research participants were students who voluntarily participated in surveys on the survey platform as a research participant pool and were paid for participation. We restricted our recruitment to only those who meet the following two criteria: participants must be currently enrolled in a four-year course at a university located in Korea; they must have experience in attending classes administered on a virtual meeting platform, such as Zoom, a popular meeting platform that supports meetings involving up to 1000 participants. Among those who completed the survey, we excluded the data of 13 participants whose ages exceeded 28 years and data of 14 participants whose reaction period was either too short or too long. Of the remaining sample ($N = 525$), 233 were male (44%), and the average age was 21.63 ($SD = 2.26$). Participants were evenly distributed across grades (1: $n = 126$; 2: $n = 138$; 3: $n = 114$; and 4 or above: $n = 147$). Informed consent was obtained from all participants involved in the study. The institutional review board of Chung-Ang University in Seoul, Korea (1041078-202104-HR-112-01), approved our study and confirmed that no further review is necessary, due to the use of anonymized data.

3.2. Measurements

3.2.1. Technology Readiness

We measured participants' TR using the TRI 2.0 [17]. The TRI 2.0 consists of 16 items and originated from the 36-item TRI 1.0 scale [17]. The scale is intended to measure "people's propensity to embrace and use cutting-edge technologies." An example item is: "other people come to me for advice on new technology" [19]. Similar to the TRI 1.0, the TRI 2.0 comprises four dimensions—optimism, innovativeness, discomfort, and insecurity—and each dimension includes four items. Parasuraman and Colby [16] reported acceptable results for factor analysis, reliability, and discriminant validity. Two Korean–English bilingual translators independently translated the items from the original English to Korean; when there were disagreements, they reached consensus by editing those items together. Following Parasuraman and Colby [19], we reverse coded the scores on discomfort and insecurity and computed the average score on the four dimensions. The TRI 2.0 uses a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The overall reliability (Cronbach's α) was 0.73, and the reliabilities of each dimension varied from 0.65 to 0.75.

3.2.2. Social Presence

Kim's [37] SP scale was used to measure participants' experience of SP while attending courses using a virtual meeting platform. The scale follows a four-factor model with the following factors: mutual attention and support (6 items), affective connectedness (5 items), sense of community (4 items), and open communication (4 items). As the instrument was originally developed in Korean, translation was not necessary. The SP scale was also rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Following Kim [37], we computed a single reliability index (Cronbach's $\alpha = 0.90$), and the reliabilities of each dimension varied from 0.72 to 0.85.

3.2.3. Course Satisfaction

To measure participants' overall satisfaction with their chosen course, we created a single item: "Please indicate the extent to which you are satisfied with the virtual teaching method." The participants indicated their overall satisfaction using a 5-point scale ranging from 1 (not at all) to 5 (very much).

3.2.4. Sustained Use Intention

Sustainability was also measured using a single item that was developed for the current research objective. The item was: "Imagine that the COVID-19 pandemic came to an end. If you are given a choice between face-to-face lectures and live lectures on a virtual meeting platform, such as Zoom, how likely are you to choose the latter?" The 5-point scale ranged from 1 (very unlikely) to 5 (very likely).

3.2.5. Control Variables

We collected demographic variables to clean the data and utilize as control variables. We asked participants to report their gender (1 = male, 2 = female), student enrollment status (1 = enrolled, 2 = leave of absence), experience in attending courses using virtual meeting platforms (yes or no), age (in years), and grade (based on the number of semesters completed). The following analyses included two control variables: gender and grade.

3.3. Data Analyses

First, we conducted a confirmatory factor analysis (CFA) to ensure factor structures of the two scales—TRI 2.0 and the SP scale—using AMOS 21.0. Next, SPSS software 21.0 was used to obtain descriptive statistics, reliabilities, and correlations. We then tested our research hypotheses by performing hierarchical regressions and using model 6 of the PROCESS macro [60]. Following the recommendations of Preacher and Hayes [61], we analyzed the serial mediation effect by employing a bootstrapping technique involving 5000 resamples to calculate 95% confidence intervals (CIs).

4. Results

The second order two-factor model was tested using AMOS 21.0 software, and the CFA indicated a mixed global fit, ranging from acceptable to modest levels: $\chi^2/df = 3.29$ ($p < 0.001$), goodness of fit index = 0.82, comparative fit index (CFI) = 0.82, Tucker–Lewis index (TLI) = 0.81, and root mean square error of approximation (RMSEA) = 0.07. Although the results failed to reach the recommended cutoffs [62] for RMSEA (<0.06), TLI (>0.95), and CFI (>0.95), we confirmed that the current second order model outperformed alternative models such as first order one-factor, two-factor, and eight-factor models. Moreover, based on claims that measures with many observed indicators and latent factors often show only a modest to poor model fit [63], we decided to perform further empirical analyses.

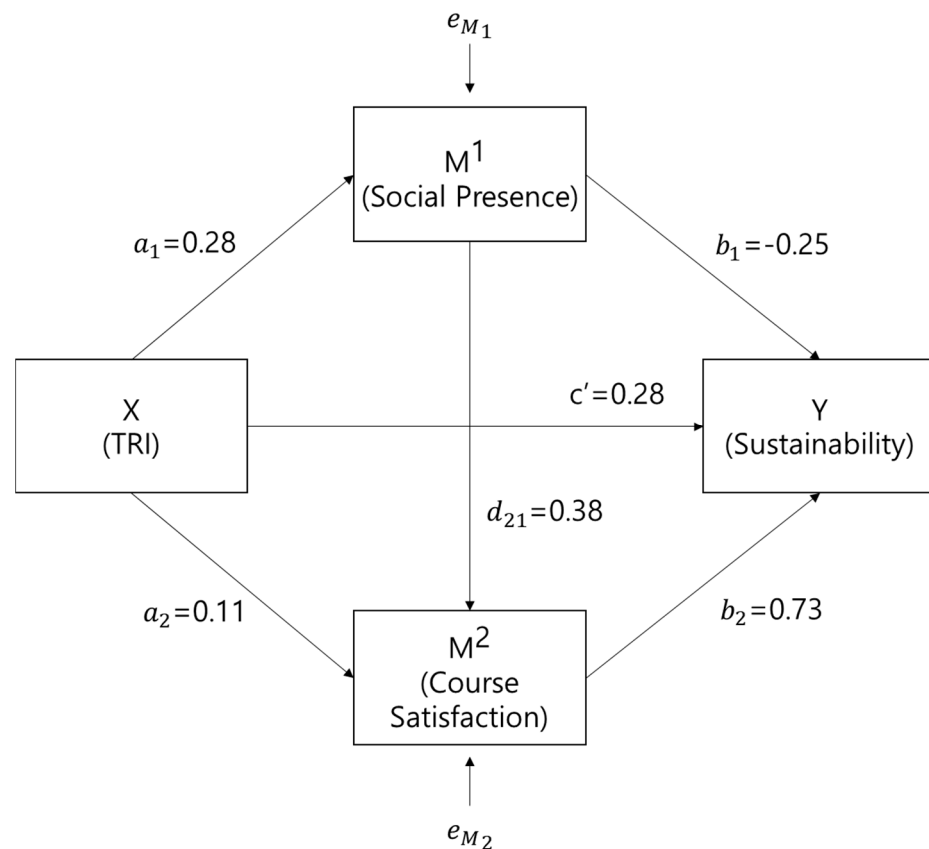
Table 1 illustrates the means, standard deviations, and correlation coefficients of the research variables. Gender is correlated with TR ($r = -0.18$, $p < 0.01$), indicating that male participants tend to have higher TRI scores than female participants. Furthermore, participants in higher grades are more likely to rate the sustainability of attending classes on a virtual meeting platform positively ($r = 0.12$, $p < 0.01$). The significant positive correlations between TR and SP ($r = 0.19$, $p < 0.01$) and between SP and course satisfaction ($r = 0.26$, $p < 0.01$) provide initial support for Hypotheses 1 and 2, respectively.

Table 1. Means, standard deviations, and correlation coefficients of the research variables.

Variables	Means	SD	1	2	3	4	5	6
1. Gender	1.56	0.50						1
2. Grade	2.54	1.14	−0.70					
3. TR	3.41	0.41	−0.18 **	0.03				
4. SP	3.30	0.60	0.04	−0.08	0.19 **			
5. Satisfaction	3.11	0.89	0.01	0.02	0.10 *	0.26 **		
6. Sustainability	2.81	1.18	0.01	0.12 **	0.04	0.01	0.52 **	

Notes: Gender (1 = male, 2 = female); Grade (1 = 1 to 2, 2 = 3 to 4, 3 = 5 to 6, 4 = 7 or more semesters completed); $N = 525$; * $p < 0.05$, ** $p < 0.01$. TR: technology readiness, SP: social presence, SD: standard deviation.

This study calculated all path coefficients simultaneously, while controlling for participant gender and grade. As our model involved two mediators—SP and course satisfaction—we used model 6 of the PROCESS macro of SPSS [52] to test the serial multiple mediator model with three specific indirect effects (Hypotheses 5–7) and one direct effect. The output of the serial mediator model can be seen in Figure 1, and the model coefficients and other statistics are summarized in Table 2.

**Figure 1.** Statistical diagram of the serial multiple mediator model.

The bootstrap results of the direct effect of TR on sustainability do not support Hypothesis 1, as the bootstrap CIs include zero (BootLLCI = −0.13; BootULCI = 0.36). However, the results of the serial mediation analysis show that the path from TR to SP is positive and significant ($b = 0.28$, $t = 4.39$, $p < 0.001$), supporting Hypothesis 2. Furthermore, the influence of SP on course satisfaction is also positive and significant ($b = 0.38$, $t = 5.87$, $p < 0.001$), and therefore, Hypothesis 3 is supported. Finally, the influence of course satisfaction on sustainability is positive and significant ($b = 0.72$, $t = 14.31$, $p < 0.001$), supporting Hypothesis 4.

Table 2. Regression coefficients, standard errors, and model summary information for the serial multiple mediator model depicted in Figure 1.

Antecedent	M ₁ (SP)			M ₂ (CS)			Y (Sustainability)		
	Coefficient	SE	<i>p</i>	Coefficient	SE	<i>p</i>	Coefficient	SE	<i>p</i>
X (TR)	0.28	0.06	<0.001	0.11	0.09	0.26	0.03	0.11	0.79
M ₁ (SP)	--	--	--	0.38	0.06	<0.001	−0.25	0.08	0.001
M ₂ (CS)	--	--	--	--	--	--	0.73	0.05	<0.001
Gender	−0.02	0.05	0.69	0.05	0.08	0.55	0.02	0.09	0.82
Grade	−0.04	0.02	0.05	0.03	0.03	0.33	0.10	0.04	0.01
Constant	2.49	0.25	<0.001	1.35	0.40	<0.001	0.98	0.46	<0.05

Notes: SE: standard error, CS: course satisfaction.

Finally, the bootstrap CIs generated by the PROCESS macro for all indirect effects are reported in Table 3. The first indirect effect, labeled “Ind1,” is the specific indirect effect of TR on sustainability, through SP perception ($X \rightarrow M_1 \rightarrow Y$). Unexpectedly, we find a negative and significant indirect effect (lower-level CI = −0.12; upper-level CI = −0.02). Although this indirect effect is statistically significant, we consider this unexpected relationship to be an artifact, due to the possible statistical suppression effect that arises when the overlapping variance between two predictors is large [64]. The following evidence supports our inference on the results for “Ind1”: first, the correlation coefficients between TR and SP and between SP and sustainability are 0.19 ($p < 0.01$) and 0.01 (n.s.), respectively; second, conducting a single mediator model (PROCESS macro model 4) did not produce any significant results (Direct effect = 0.11, SE = 0.13, $p = 0.41$ [LLCI = −0.15, ULCI = 0.36]; Indirect effect = 0.01, Boot SE = 0.03 [BootLLCI = −0.04, BootULCI = 0.07]). The second indirect effect, labeled “Ind2,” is the indirect effect of TR on sustainability through course satisfaction ($X \rightarrow M_2 \rightarrow Y$). Unfortunately, the bootstrap result again does not support Hypothesis 6, as the bootstrap CI includes zero (BootLLCI = −0.06, BootULCI = 0.23). Finally, the third indirect effect, labeled “Ind3” ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$), is the indirect effect of TR on sustainability through perception of SP and course satisfaction in serial. The bootstrap results of the third indirect effect support Hypothesis 7 (BootLLCI = 0.03, BootULCI = 0.13). Therefore, consistent with Hypothesis 7, TR predicts sustainability only through serial mediators. More specifically, TR benefits sustainability only, as it enhances perception of SP when participants attend classes on a virtual meeting platform, and SP increases the likelihood of feeling satisfied with the virtual teaching method.

Table 3. Bootstrap confidence intervals for all direct and indirect effects.

Paths	Coefficient	95% CI	
		LL	UL
TR→social presence→sustainability	−0.07	−0.12	−0.02
TR→course satisfaction→sustainability	0.08	−0.06	0.23
TR→social presence→course satisfaction→sustainability	0.08	0.03	0.13
Direct effect	0.03	−0.19	0.24
Total indirect effect	0.08	−0.05	0.24

Notes: CI: confidence interval, LL: lower limit, UL: upper limit.

5. Discussion

Virtual classrooms adopted due to the COVID-19 pandemic and the use of virtual meeting platforms that enabled virtual classes brought into focus the advantages of this system especially for those who travel long distances to work or school [65]. However, as distance and time are not the only important variables for purposeful communication at work or in school, it is necessary to carefully examine the variables that lead to intention to continue to use this system, even after the pandemic.

Considering that the virtual meeting platform was implemented as an emergency measure due to the pandemic, this study sought to explore important antecedents that predicted students' intention to continue to use the system even after the pandemic. Drawing from previous research, we developed seven hypotheses explaining the relationship between students' TR and their intentions regarding the sustained use of virtual meeting platforms for academic courses and empirically tested each. The results of our analysis indicated that whereas TR, SP, and course satisfaction were related as hypothesized in Hypotheses 2 to 4, respectively, Hypothesis 1, which claimed the positive relationship between TR and the sustained use intention, was not supported. Furthermore, among Hypotheses 5 to 7, which postulated the mediating effects of SP and course satisfaction, respectively and in series, only Hypothesis 7 was supported. To be more specific, the technology propensity of individuals (i.e., TR) affected their perception of partners (i.e., SP), which, in turn, influenced their satisfaction (i.e., course satisfaction). These factors finally affected their sustained use intention. Regarding failure to support the main effect (Hypothesis 1), the following reasons may provide an alternative explanation on the relationship between TR and sustainability. First, although it was beyond our expectation, our result was consistent with existing studies, which found that negative emotions toward technology do not lead to negative influences on technology use intentions [58]. Second, the result could be affected by the wording of the measurement, as well as the unique characteristics of the current situation. The item used to measure sustained use intention was developed for the current purpose, and it included a hypothetical situation where the students are given an option to choose between in-person or virtual classes after the pandemic. Responses to such a hypothetical situation could yield unexpected influences by confounding variables, such as students' longing to go back to in-person classes or their wish to return to their pre-pandemic lifestyles. This interpretation aligns with Paechter and Maier's [66] work which showed a preference for face-to-face classes, rather than online classes, for interpersonal relationships among students who have not yet experienced face-to-face classes. Similarly, in the current research, we found a negative and statistically significant correlation between grade and sustainability, as shown in Table 1. This could reflect students' longing for situations that they have not yet experienced due to the pandemic, irrespective of their individual attitudes toward technology. This, in part, explains why our results differed from those of previous studies that report an inverse correlation between age and TR [59].

The contributions of the current study are as follows. This study was the first to provide empirical evidence of the relationship between TR and SP. Rather than examining how a specific methodology or a technology device determines SP, this study adopted the perspective of the user or student, keeping in mind that SP experience may change, based on the user's tendencies. Existing studies on CMC showed that, compared with face-to-face communication, a technology environment yields more difficulty in achieving social functions, as non-verbal information cannot be easily attained [67]. This indicates that non-verbal information plays an important role in SP [32]. As such, video—which can transmit more non-verbal information—has a higher degree of SP than audio; in this case, SP becomes an indicator of the psychological distance between people who communicate with one another [32]. Under the COVID-19 pandemic, students are exposed to the controlled situation where education involves CMC. However, some students experience a high level of SP in the same context while others do not. We identified TR as an important individual difference and supported that TR is positively associated with students' experience of SP while they attend classes utilizing virtual communication. Second, contradictory to existing studies that showed mixed results on the relationship between TR and technology use [59], this study confirmed that TR was not directly related to sustained use intention but that the relationship was mediated through SP and course satisfaction. These mediating effects confirmed a long history of emphasis on the impact of course satisfaction on various behavioral intentions (e.g., intentions to recommend [68]). Finally, the current approach highlighted the value of investigating the sustainability of the educational environment

from a learners' perspective. Exploring the environmental factors that create subjective experience is not only important for learners who may either choose or change their learning environment but also for policy makers who aim to ensure a quality educational environment despite the limitations that the pandemic produces. Further research is needed to understand how students navigate their experience given the variation in their technology readiness and what can be done to help enhance their experience, quality of learning, and sense of belonging.

As such, this study is meaningful as it adopts a student-centric perspective of the education environment and the use of virtual meeting platforms. However, it has a number of limitations. First, we were unable to determine specific problems that users experience in the communication environment when using virtual meeting platforms. Future studies should therefore examine the limitations regarding the transmission of non-verbal communication, as well as the direct differences between CMC and face-to-face communication. These considerations can supplement the negative factors related to communication and human relationships that are inherent to virtual meeting platforms, which will be used more often in the future. Second, the research was performed cross-sectionally. Pandemic-related administrative orders and country-wide constraints on the educational system provided special value in investigating students' experience and intentions regarding the methodology that was adopted as an emergency measure. However, as a cross-sectional research design limits causal inference, future research should involve an experimental or longitudinal design to have better control over the environment. Third, in the current study, the second mediator, course satisfaction, was measured with a single item. Several researchers have proposed the multi-dimensionality of course satisfaction. For example, Endres et al. [68] proposed the multidimensional nature of online course satisfaction, including satisfaction with instructors, course materials, learning practices, student-to-student interaction, and online tools. Future research should employ a more elaborate measurement of this mediator to replicate and develop the current research findings. Finally, the virtual learning environment model [69,70] proposed that human dimensions (administrators, students, and instructors) influence design dimensions (organizational, learning, and teaching practices) that affect educational success. As the current study adopted a student-centric perspective, we were unable to include other important predictors of students' evaluation of courses on a virtual meeting platform.

6. Conclusions

This study aimed to identify factors that influenced sustained use intention of virtual meeting platforms, which were introduced in the education environment abruptly due to the COVID-19 pandemic. The continuous development of technology fostered the employment of various methodologies in education. The introduction of remote learning was not simply to overcome the spatial limitations presented by distance; there has been ongoing research on online learning to secure flexibility in information access and to network with more information. The limitations created by large classrooms have also been presented as a problem. Furthermore, the development of a communication medium that enabled CMC involved attempts at developing a medium that resembles face-to-face communication. The virtual meeting platform developed for this purpose has overcome the limitations of other CMCs in terms of non-verbal information through video systems, as well as the limitations of geographical distance, by using online remote devices. While this system shares features with face-to-face communication, it has some limitations, as communication participants often fail to fully perceive SP as they communicate through media. Furthermore, depending on the users' perception of technology devices, technology-mediated communication may disturb their perception of the communication environment being natural, which may influence communication satisfaction.

This study aimed to identify the effects of individuals' tendencies in terms of technology and the perceived SP in the communication environment that utilizes technology on communication satisfaction and sustained technology use intention. The results indicated

that TR, which is an individual trait, did not directly influence individuals' sustained use intentions of virtual meeting platforms. Rather, it had a positive influence mediated by SP and course satisfaction. Ultimately, these findings supported the findings of existing studies, which show that higher communication satisfaction has a positive influence on media use intentions. It also confirmed the influence of TR and SP, which affected satisfaction. Unlike reports of an inverse correlation between TR and age, this study found that students in higher grades had higher sustained use intentions of virtual meeting platforms, compared with students in lower grades. As the students were forced to use technology due to the pandemic, rather than choosing to use it of their own volition, the intention to use virtual meeting platforms after the pandemic reflected the desire for the in-person classrooms experienced in pre-pandemic times and the longing for human relationships on college campuses.

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