Acceptance of and self-regulatory practices in online learning and their effects on the participation of Hong Kong secondary school students in online learning

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Abstract

This study investigated how the acceptance and use of self-regulatory strategies in online learning affected Hong Kong secondary school students' participation in online learning. A self-reported questionnaire was distributed to 1381 students from six secondary schools. Findings of the descriptive analysis indicated that students did not frequently use most types of online self-regulatory strategies. Although they agreed that the online learning methods were easy to use and facilitated learning, they did not actively participate in online learning activities and showed a low tendency to continuation. Further, structural equation modeling indicated that the effect of strategy use on actual participation was stronger than that of user acceptance. The former had a significant indirect effect on actual participation through the strong effect it had on user acceptance. Consequently, suggestions have been made for improving the instructional design of online learning and increasing students' willingness and readiness to participate in online learning.

1 Introduction

Online learning has become a popular alternative learning mode in recent years owing to the growing use of technology in education (Beetham & Sharpe, 2019). During the COVID-19 outbreak, online learning significantly replaced face-to-face classroom teaching due to the temporal closure of schools (Hong et al., 2021; Li et al., 2022). However, the effectiveness of online learning in the extant eLearning

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literature remains controversial (Azevedo et al., 2004; Kramarski & Gutman, 2006; Sun et al., 2018). Compared to traditional classrooms, online learning has many potential benefits, such as flexibility, interactiveness, and adaptability to individual needs (Kramarski & Gutman, 2006; Narciss et al., 2007; Ng, 2018); however, students find it more demanding than traditional classroom learning (Lee & Tsai, 2011; Narciss et al., 2007; Wang, 2011). Therefore, many researchers have emphasized that self-regulated learning (SRL) plays a critical role in ensuring successful online learning (Jansen et al., 2020; Lee & Tsai, 2011; Winters et al., 2008). Furthermore, students' acceptance of online learning affects their willingness and actual use of this new mode of learning (Aguilera-Hermida et al., 2021; Venkatesh et al., 2003). Studies conducted during the pandemic have revealed that not all students are equipped with sufficient self-regulatory skills for online learning (Bao, 2020; Guo et al., 2022; Hong et al., 2021), and most of them prefer face-to-face instruction (Aguilera-Hermida, 2020; Aguilera-Hermida et al., 2021; Blizak et al., 2020; Marković et al., 2021).

This study investigated the interrelations among the use of self-regulatory strategies, acceptance, and participation of Hong Kong secondary school students in online learning during the COVID-19 lockdown. Previous studies report how students—even at the university level—often struggle to successfully regulate their online learning progress (Bol & Garner, 2011; Jansen et al., 2020). Younger students, who are less mature in SRL, may find it more challenging when their mode of learning suddenly changes from face-to-face to online. While user acceptance and self-regulation are major topics of discussion in extant online learning studies on university students and adult learners, this study extended the current research by investigating the relations among and the simultaneous effects of the above-mentioned factors on younger students' participation in online learning. Online learning is expected to be increasingly integrated with formal teaching on account of its extensive use during the pandemic. Thus, understanding students' acceptance of and skills in this context will provide useful insights on how to promote students' willingness and readiness toward future online experiences.

2 Literature review

2.1 Students' acceptance of online learning

In contrast to traditional face-to-face teaching, not all students accept or adapt to the new mode of learning, that is, online learning (Blau & Shamir-Inbal, 2017; Bond, 2020; Moos & Azevedo, 2009). A major stream of studies on eLearning has focused on examining how "user acceptance of technology"—defined as users' readiness to employ a specific technology for tasks it intends to support (Davis, 1989)—affects students' intention and actual use of that technology. The Technology Acceptance Model (TAM) proposed by Davis and his colleagues (Davis, 1989; Venkatesh & Davis, 2000) is a well-known and widely validated model that explores user acceptance (King & He, 2006; Scherer et al., 2019). In the basic TAM, perceived usefulness and perceived ease of use, that is, users' estimations of whether the technology

will improve their performance and its ease of use, have been posited as the two core determinants of users' behavioral intention to use the technology. Additional studies on TAM have proposed other factors as well that may affect technology acceptance, such as perceived enjoyment (Moon & Kim, 2001; Padilla-MeléNdez et al., 2013), users' self-efficacy (Teo, 2019), subjective norms (Scherer et al., 2019), and social influence (Venkatesh et al., 2003). In addition to users' internal use of technology, some studies have proposed users' actual use of technology to further improve the model (Edmunds et al., 2012).

Studies on TAM in the context of online learning have emphasized the importance of students' acceptance in enhancing their engagement and participation in online learning (Aguilera-Hermida et al., 2021; Edmunds et al., 2012; Scherer et al., 2019; Venkatesh et al., 2003). While TAM has been extensively examined in different areas, most studies have focused on teachers' technology acceptance. Scherer et al.'s (2019) meta-analysis on teachers' technology adoption identified over 100 relevant studies; however, TAM studies centered on students are limited and focus primarily on university students (e.g., Costa et al., 2018; Park, 2009; Zacharis, 2012). However, regardless of teachers' readiness, technology adoption will not be effective if students remain reluctant. Due to the different developmental stages and learning contexts, the concerns of secondary school students may differ from those of university students. Thus, exploring the former's perceptions of online learning will extend the current TAM research.

2.2 Self-regulation in online learning

SRL represents an effective form of learning, wherein learners systematically activate and regulate their cognition, motivation, and behaviors to attain their goals (Schunk & Greene, 2018; Zimmerman, 2000). According to Zimmerman's (2000) SRL model, the process generally consists of three cyclical phases: the forethought phase, wherein learners engage in goal-setting and strategic planning; the performance phase, wherein learners employ strategic actions and self-monitoring while actively engaging in learning activities; and the self-reflection phase, wherein learners evaluate the processes and outcomes of their learning based on their personal goals or standards.

SRL has long been viewed as a critical factor in facilitating student learning performance (Dignath & Büttner, 2018; Dignath and Büttner, 2008). As online learning has become increasingly popular in recent years, research on the importance of SRL in online learning has correspondingly increased. Based on the SRL model in the general domain, studies in online learning have found that the core components of SRL, including cognitive, metacognitive, and motivational components, are critical in the online environment as well (Broadbent & Poon, 2015; Guo et al., 2022; Lee & Tsai, 2011; Lin et al., 2017). Successful online learning also requires students to employ various self-regulatory skills, such as setting clear goals, allocating learning time, arranging a non-disturbing venue, and selecting and applying effective strategies, during the different phases of SRL (Blau & Shamir-Inbal, 2017; Narciss et al., 2007). Considering the differences

between online and traditional classroom learning, researchers posit that SRL is even more important in the online learning mode than in the traditional learning mode (Barnard et al., 2009; Broadbent & Poon, 2015; Jansen et al., 2020; Winters et al., 2008). While online learning overcomes the time and space limitations of traditional classroom learning and allows students to learn at their own pace, students may easily feel isolated and frustrated when they encounter problems in the online learning process due to the lack of direct teacher guidance (Bond, 2020; Wang, 2011). Further, they tend to lose focus easily and become distracted in the face of the extensive amount of online learning materials and their non-linear structure (Narciss et al., 2007). Therefore, to ensure effective learning, it is critical for students to utilize the resources and adopt effective cognitive, metacognitive, and motivational strategies to self-direct their learning process in the highly autonomous online learning environment (Anderton, 2006; Hong et al., 2021; Johnson & Davies, 2014; Lai & Hwang, 2016).

Studies have revealed that students' level of SRL competence is a significant factor influencing the effectiveness of online learning. For example, according to Rasheed et al.'s (2020) systematic review, students in a blended learning environment find "self-regulation-related challenges" the most difficult to overcome. Thus, students with high self-regulatory skills can significantly benefit from online learning than those without them (Aguilera-Hermida, 2020; Azevedo et al., 2004; Lee & Tsai, 2011). Nevertheless, studies have also shown that online learning can sometimes be less beneficial than traditional classroom teaching, especially when students do not have the ability or the motivation to learn without teacher supervision (Blau & Shamir-Inbal, 2017; Kramarski & Gutman, 2006; Narciss et al., 2007; Sletten, 2017).

Considering the importance of SRL in online learning, students' SRL competence may also affect their acceptance of this new learning mode. Indirect evidence from extant literature supports this postulation. For example, Hong et al. (2021) found that university students with higher levels of self-regulation held positive views on the effectiveness of online learning experiences. Li et al. (2022) found that SRL significantly predicted college students' online learning behaviors and motivation. However, no existing study has so far investigated the relation between students' SRL skills and their acceptance of online learning.

2.3 Purpose of the study

Due to the COVID-19 lockdown, most Hong Kong secondary schools had less than one-third face-to-face classes in the academic year 2020–2021. Distance learning approaches became the norm in most local schools. Since online learning constituted a large proportion of students' learning time in this academic year, it is important to understand whether they were equipped with sufficient SRL skills to cope with the new learning mode. Consequently, this study explored Hong Kong secondary students' use of online SRL strategies, their acceptance of online learning, and whether
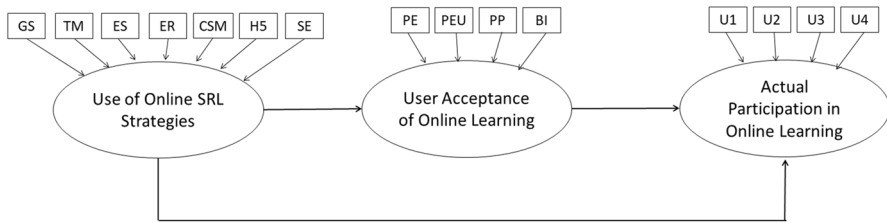
Fig. 1 The hypothetic model of the study

these factors affected their participation in online learning during the COVID-19 lockdown. Specifically, the study addressed the following research questions.

RQ1: How frequently did students use different types of SRL strategies during online learning?

RQ2: What was the level of acceptance of students toward online learning?

RQ3: Did students' online SRL strategies and their acceptance of online learning significantly affect their participation in online learning?

Based on the literature reviewed above, it is hypothesized that students' use of SRL strategies and acceptance of online learning significantly affects their participation. Furthermore, the acceptance of online learning mediates the effect of the use of self-regulatory practices on students' perceptions about online learning (see Fig. 1).

This study addressed several unexplored issues in the extant literature on online learning. First, most studies have examined the effects of SRL on online learning using an experimental design to provide SRL training to students (e.g., Lee and Tsai, 2011; Narciss et al., 2007; Wang, 2011). By contrast, this study used a naturalistic context to determine the importance of SRL in online learning. Second, most studies have examined SRL and TAM in the context of online learning, but none have explored the relations between the two. The current study addressed this research gap by including these two important constructs in the same model to assess their relations and their effects on students' participation in online learning. Third, most studies on online learning have been conducted among tertiary-level students (e.g., Aguilera-Hermida et al., 2021; Bol & Garner, 2011; Jansen et al., 2020; Li et al., 2022); this study, however, focused on secondary school students—who are less mature in terms of SRL and face more challenges in online learning—and on how their SRL skills and acceptance affect their participation in online learning.

3 Method

3.1 Participants

A total of 1381 students (713 boys, 623 girls, and 45 of unreported gender), aged 13 to 18 years (mean = 14.95 years, SD = 1.52) from six schools voluntarily participated in the study. Since students' ability and age are critical in the development of SRL, two schools from each band[1] type were chosen. To ensure a similar number of students with different levels of academic abilities and grade, students from one junior and one senior grade were invited to participate in the study. A total of 486, 441, and 454 students from high-, moderate-, and low-achieving schools, respectively, were included in the sample. Among them, 716 were junior secondary students and 665 were senior secondary students. Informed consent was obtained from all the participants and the study design was approved by the ethics review board of the author's university.

3.2 Instrument

Online self-regulated learning questionnaire: This questionnaire was adapted from the online self-regulated learning questionnaire (OSLQ) developed by Barnard et al., (2008, 2009). The English OSLQ was translated into Chinese and then back-translated into English to check whether the meaning of the two versions were identical. Wording of a few items was revised slightly to fit secondary school students' online learning context. The original OSLQ comprises the following six types of self-regulatory strategies students use in the online learning environment: goal setting, environment structuring, time management, task strategies, help seeking, and self-evaluation. Since most items under task strategies are efforts rather than cognitive and metacognitive strategies, the label was revised to effort regulation, and a new cognitive/metacognitive strategy subscale was added in the Chinese version (COSLQ). The complete questionnaire comprised 28 items rated on a 5-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (5). Higher scores indicated frequent use of the strategy. The COSLQ was previously piloted in another study by the Lau (2022), and the seven types of online SRL strategies were supported by the findings of confirmatory factor analysis (CFA). The results of internal consistency estimates indicate that all subscales of COSLQ display high internal consistency in the study, ranging from 0.76 to 0.88 (see Table 1). Item/total correlation coefficient for each subscale is greater than 0.40, indicating that the reliability of the questionnaires is satisfactory. The findings of CFA indicate that the second-order measurement model of the COSLQ provides a good fit for the data (see Table 2). Factor loadings of most indicators of the seven subscales are high (see Fig. 2), suggesting that the items are effective in defining each subscale of the questionnaires

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[1] Under the Secondary School Place Allocation system in Hong Kong, all secondary schools are categorized into Band 1, 2, and 3, which mainly admit the highest, middle, and lowest 33.3% of the students, respectively.

Table 1 Sample items, descriptive statistics, and reliability estimates for the questionnaires used in the study

Questionnaire/Subscale	No. of items	Mean	SD	Cronbach's alpha
Online Self-regulated Learning Questionnaire	28	3.21	.67	.95
Goal setting: I set standards for my online assignments	5	3.09	.80	.87
Time management: I try to distribute my online studying time evenly across days	3	3.10	.83	.77
Environment structuring: I choose the location where I study to avoid too much distraction	4	3.55	.82	.81
Effort regulation: I work extra problems in addition to the assigned ones to master the subject content	3	2.86	.86	.76
Cognitive/Metacognitive Strategy: I use my own words to summarize the main ideas of the learning materials	6	3.25	.77	.88
Help seeking: I find someone who is knowledgeable in subject content so that I can consult with him or her when I need help	4	3.41	.82	.79
Self-evaluation: I summarize my learning in online lessons to examine my understanding of what I have learned	3	3.13	.78	.86
Technology Acceptance Questionnaire	11	3.01	.83	.93
Perceived usefulness: E-learning activities help me improve my CC reading performance	3	3.07	.90	.92
Perceived ease of use: It is easy to use e-learning activities to learn CC reading	3	3.11	.97	.83
Perceived enjoyment: E-learning activities stimulate my curiosity for learning CC reading	3	2.89	.97	.91
Behavioral intention: I will continue to use e-learning activities to learn CC reading	2	2.98	1.01	.76
Participation in online learning				
How often did you watch the teaching videos assigned by your teacher?	4	2.84	.70	.69

Note: The original questionnaires were written in Chinese. Sample items given in the table are the English translations of the items

Table 2 The goodness of fit for the measurement models and structural equation model of the student questionnaires

Measurement Model	Goodness-of-fit index					
	χ^2	df	CFI	TLI	SRMR	RMSEA
Online Self-regulated Learning Questionnaire	1181.66	343	.94	.94	.044	.041
Technology Acceptance Questionnaire	247.15	40	.97	.95	.064	.037
Participation in online learning	35.62	2	.95	.84	.012	.032
Structural Equation Model	335.88	74	.96	.95	.053	.033

Note. CFI = Normed comparative fix index; TLI = Tucker–Lewis index; SRMR = Standardized Root mean square residual; RMSEA = Root mean square error of approximation
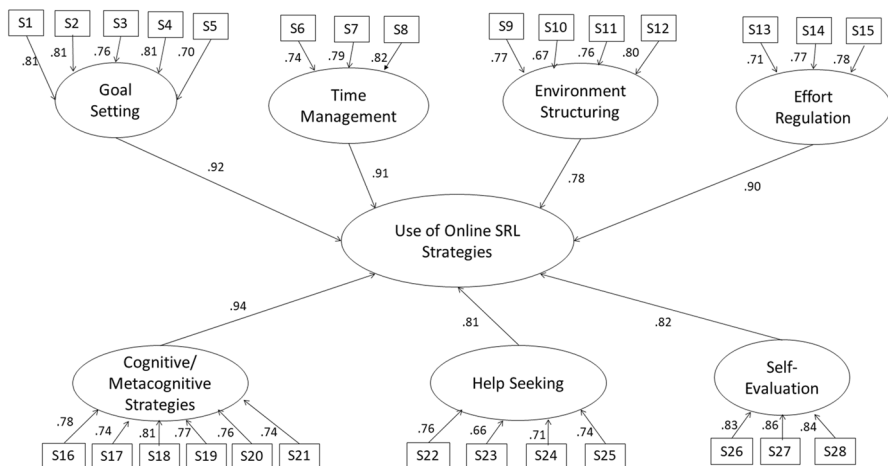
Fig. 2 The standardized factor loadings in the CFA model of the Chinese Online Self-regulated learning Questionnaire

and the factor distributions are similar to the original COSLQ. All factor loadings of the subscales in the second-order latent variable are higher than 0.70, suggesting they are effective in representing students' overall online strategy use.

Technology acceptance questionnaire: This questionnaire was adapted from a validated Chinese technology acceptance questionnaire (CTAMQ; Lau & Keung, 2021), which was designed based on the TAM questionnaires used in previous studies (Davis, 1989; Moon & Kim, 2001; Teo, 2019; Venkatesh & Davis, 2000). The original CTAMQ was used to measure students' acceptance of using out-of-class eLearning activities to facilitate Chinese language learning. Wording of some items was revised slightly to fit the online learning context. The questionnaire comprised 11 items measuring students' acceptance of the use of the online mode to learn Chinese language based on their perceptions of the following four dimensions: perceived enjoyment, perceived ease of use, perceived enjoyment, and behavioral intention. All items were rated on a 5-point Likert scale ranging
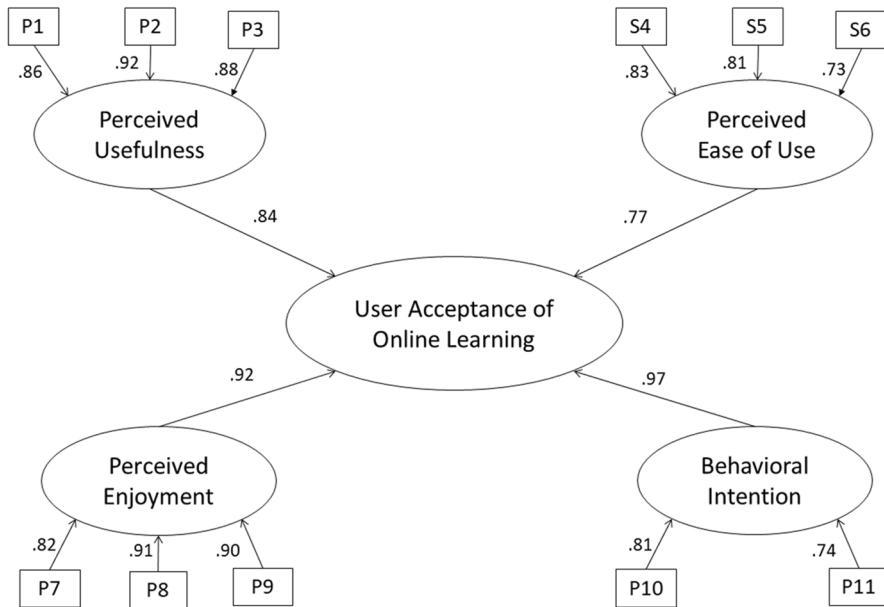
Fig. 3 The standardized factor loadings in the CFA model of the Chinese Technology Acceptance Questionnaire

from "strongly disagree" (1) to "strongly agree" (5). Higher scores indicated positive perceptions about online learning. The results of internal consistency estimates indicate that all subscales of CTAMQ display high internal consistency in the study, ranging from 0.76 to 0.92 (see Table 1). Item/total correlation coefficient for each subscale is greater than 0.40, indicating that the reliability of the questionnaires is satisfactory. The findings of CFA indicate that the second-order measurement model of the CTAMQ provides a good fit for the data (see Table 2). Factor loadings of most indicators of the four subscales are high (see Fig. 3), suggesting that the items are effective in defining each subscale of the questionnaires and the factor distributions are similar to the original CTAMQ. All factor loadings of the subscales in the second-order latent variable are higher than 0.70, suggesting they are effective in representing students' overall acceptance of online learning.

Participation in online learning: The design of participation in the online learning scale was based on the measure of a new component, "actual use," of the extended TAM model used in previous TAM studies (Edmunds et al., 2012; Estriegana et al., 2019; Scherer et al., 2019). The scale consists of four items selected from the four most common types of online learning tasks generally performed by Hong Kong secondary students, including online lessons, online activities assigned by teachers, self-selected online learning activities, and online assignments. Students need to report the frequency of their participation in each type of online learning activity in this academic year on a 5-point Likert scale, ranging from "never participate" (1) to "actively participate" (5). The results of

Fig. 4 The standardized factor loadings in the CFA model of student actual participation in online learning activities
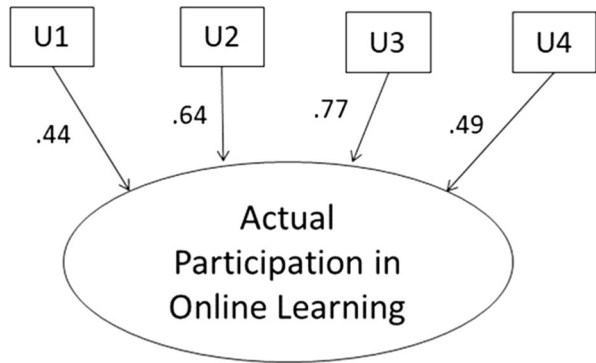
internal consistency estimates indicate that the reliability of this scale is moderate. The findings of CFA indicate that the measurement model of actual participation provides an average fit to the data (see Table 2). The factor loadings of the four indicators range from 0.44 to 0.77 (see Fig. 4). Considering that students might have different levels of participation in the four types of online learning activities represented by the four items, moderate factor loadings of some items are acceptable.

3.3 Data collection and analysis

Data were collected toward the end of the academic year 2020–2021, when face-to-face teaching was resumed. All students completed the paper-based questionnaire during their regular class time. Teachers in the participating schools were responsible for administering and collecting the questionnaires. Standard instructions for administration were prepared for teachers, including the reassurance that all the data were collected for research purposes only. The procedure lasted around 10 min during students' regular class periods. All questionnaires were completed anonymously so that students could respond to the questions honestly and freely. Students who did not wish to participate in the study were allowed to return a blank questionnaire.

Descriptive statistics were used to examine the frequency of students' use of different types of SRL strategies during online learning and the level of their perceived usefulness, ease of use, enjoyment, and behavioral intention toward online learning (RQ1 and 2). Structural equation modeling (SEM) was conducted to examine RQ3. Since the focus of the study was on the effects of SRL strategies and user acceptance on participation in online learning, the subscales of COSLQ and CTAMQ were used as item parcels to represent the two latent variables of "strategy use" and "user acceptance" to simplify the SEM model. The four items of "actual participation" were used as indicators of this latent variable. Before running SEM, the measurement models of the three latent variables were tested using CFA. The CFAs and SEM were performed using Mplus 8.6. The models' goodness of fit was assessed by RMSEA (≤ 0.10), SRMR (≤ 0.10), CFI (≥ 0.90), and TLI (≥ 0.90) (Hu & Bentler, 1999).
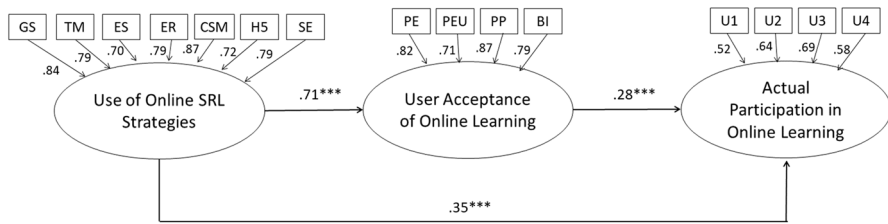
Fig. 5 The completely standardized parameter estimates of the factor loadings and significant paths between the variables in the SEM model

4 Results

4.1 Students' use of online SRL strategies and acceptance of online learning

The mean scores of the three questionnaires and their subscales are as shown in Table 1. The findings reveal that students occasionally used some SRL strategies during online learning. Among the seven types, environment structuring and help-seeking strategies were the most frequently used. The mean scores of cognitive/metacognitive strategy, self-evaluation, time management, and goal setting were around the questionnaire scale's mid-point. Effort regulation was the least frequently used strategy, and its mean score was below the questionnaire scale's mid-point.

As shown in Table 1, the mean score of actual participation is below the questionnaire scale's mid-point, indicating that students did not actively participate in online learning activities. Overall, the students showed a moderate level of acceptance of online learning. Among the different dimensions of TAM, perceived ease of use and perceived usefulness had moderate ratings, while perceived enjoyment and behavioral intention were low. These results indicate that the students found online learning easy and conducive to their learning; however, they did not find online learning interesting and had a low tendency toward its continuation.

4.2 Relationship among SRL, acceptance of online learning, and participation in online learning

SEM was adopted to explore the effects of students' use of SRL strategies and acceptance of online learning on their actual participation in online learning. Second-order CFAs confirmed the factor structure of COSLQ and CTAMQ; thus, the subscales of "strategy use" and "user acceptance" were used as item parcels to represent the two latent variables in the SEM model. Item scores were used as observed indicators for the latent variable, "actual participation." Based on the earlier literature review, the model hypothesized that both strategy use and user acceptance directly affected actual participation in online learning. Strategy use also had an indirect effect on actual participation through its effect on user acceptance.

Findings of SEM indicate an adequate fit for the hypothesized model (see Table 2). As shown in Fig. 5, all hypothesized paths in the SEM model were significant. Consistent with the hypotheses, strategy use showed a strong direct effect on user acceptance and a moderate direct effect on actual participation. User acceptance also had a moderate direct effect on actual participation. In addition, strategy use had a significant indirect effect (0.20, $p < 0.001$) on actual participation through user acceptance. The total effect of online SRL strategies on students' online participation was 0.55 ($p < 0.001$).

5 Discussion

While the critical role of SRL in online learning has been well documented (Broadbent & Poon, 2015), this study found that Hong Kong secondary school students did not frequently use SRL strategies during online learning. Among the different types of online SRL strategies, environment structuring and help-seeking strategies were the most frequently used. During the temporal closure of schools, students have to attend online classes at home on every school day. Thus, it is reasonable that students frequently used environment structuring strategy to arrange an appropriate place for their online learning. The high frequency help-seeking behavior indicate that they usually encountered difficulties during online learning. However, students only occasionally used cognitive and metacognitive strategies, set goals, conducted self-evaluations, and managed learning time during online learning, but seldom made any extra efforts to accommodate the new learning mode. These findings are consistent with the results of international assessments, according to which Hong Kong secondary school students used fewer SRL strategies and demonstrated a lower level of metacognitive awareness than their international counterparts (Ho, 2009; Lau & Ho, 2016). Influenced by the Confucian culture, teacher-centered instruction is still the major instructional approach in Hong Kong secondary schools (Lau, 2020; Ho et al., 2001; Tweed & Kegnab, 2002). Such a learning environment is not favorable for students to learn and practice SRL skills. In addition, since online learning was not popular in Hong Kong before the pandemic (Wong, 2015), students might not have been familiar with strategies that are specifically required for online learning.

The findings of this study indicate that students at the secondary school level in Hong Kong display a moderate level of acceptance of online learning. Among the different dimensions of TAM, students did not find online learning difficult and agreed that it has its benefits; however, they did not find online learning interesting and had a low tendency toward its continuation. These findings are consistent with Wong's (2015) survey study, which found that although eLearning is emphasized in the current Hong Kong curriculum, most students prefer traditional face-to-face learning to eLearning. Since this study was conducted during the COVID-19 lockdown, students' low tendency to participate in online learning might have been further exacerbated by the emergent conditions under which they were forced to adopt online learning methods as both teachers and students were unprepared for the sudden transition (Aguilera-Hermida, 2020; Aguilera-Hermida et al., 2021; Bao, 2020).

In line with their low tendency toward continuation of using online learning, the study found Hong Kong secondary school students did not actively participate in online learning activities despite online learning being their major mode of learning during the pandemic. This finding can be explained by students' infrequent use of online SRL strategies and low acceptance of this new learning mode. Consistent with the results of previous studies (e.g., Jansen et al., 2020; Johnson & Davies, 2014; Lai & Hwang, 2016; Lee & Tsai, 2011; Lin et al., 2017), students' use of online SRL strategies exerted a strong and significant effect on their participation in online learning activities. However, except environment structuring and help seeking, students rarely used other strategies to facilitate their learning in the online context. The lowest rating of effort regulation revealed in the study suggest that they are reluctant to put more efforts into online learning. Online learning is considered more demanding than traditional classroom learning, and studies among university students have revealed that not all students actively participate in online learning (Cranfield et al., 2021; Hong et al., 2021). Since the participants of the study are secondary school students, who are not as mature as university students, without effective SRL strategies, they might have faced more difficulties while undergoing online learning, which would have discouraged them from further participation. Additionally, students' acceptance of online learning was also found to have a significant effect on their participation. While their perception about its usefulness and ease of use of online learning was only moderate, they tended to have a negative perception about the perceived enjoyment of online learning. Compared with adult users, young students are more concerned about whether the online learning activities are interesting and attractive rather than useful or easy to use (Lau & Keung, 2021; Estriegana et al., 2019; Moon & Kim, 2001; Zacharis, 2012). Students' lack of enjoyment in their online learning experiences could be another major reason for their low intentional and actual use of online learning.

One significant aspect of this study was that it explored the simultaneous effects of strategy use and user acceptance on students' participation in online learning. The study's findings clearly indicate that the effect of strategy use on actual participation was much stronger than that of user acceptance. Strategy use also had a significant indirect effect on actual participation through its strong effect on user acceptance. This suggests that students' self-regulation competence is more important than their acceptance in the context of online learning. Several researchers have indicated that due to the highly autonomous nature of online learning and the lack of the direct presence of teachers, students are required to adopt various strategies to efficiently manage their learning environment, study time, effort, and self-regulate the learning processes (Barnard et al., 2009; Blau & Shamir-Inbal, 2017; Lee & Tsai, 2011; Narciss et al., 2007). Without these, students are unlikely to achieve success in online learning (Anderton, 2006; Sletten, 2017). Thus, students' level of SRL is an important factor that affects their perception of the effectiveness of online learning experiences (Hong et al., 2021). Their perception of previous online learning experiences will further affect their intentional and actual participation in similar kinds of activities in the future (Cheng, 2019; Estriegana et al., 2019; Hsieh et al., 2017).

The increasing and extensive use of online learning during the pandemic suggests the possibility of its components becoming integrated into formal teaching post the

pandemic (Aguilera-Hermida et al., 2021). Thus, the study proposes the following suggestions to promote students' willingness and readiness to learn online. First, direct instruction of online SRL strategies should be included in the online learning curriculum considering its importance. Studies have claimed that students' perceptions about and the effectiveness of online learning can be largely improved by integrating SRL training into the intervention (Lai & Hwang, 2016; Lee and Tsai, 2011; Narciss et al., 2007; Wang, 2011). Second, considering students' low perception of enjoyment in online learning, teachers need to adopt more interesting and authentic learning materials, which are more interactive and have attractive features to motivate students to participate in the activities. Third, for students who are less mature and used to traditional teacher-centered instruction, it is important to provide teacher support initially. For example, teachers can provide the requisite knowledge and guidelines and conduct necessary follow-ups during face-to-face class time or synchronous online learning to ensure that students have the ability and responsibility to participate in online learning activities (Lai & Hwang, 2016; Sletten, 2017). Different types of technological tools and constant teacher feedbacks are also useful to scaffold students' development of SRL in the online learning environment (Akçayır & Akçayır, 2018; Azevedo et al., 2004; Steffens, 2008).

6 Conclusion

The importance of SRL and user acceptance in online learning has been widely demonstrated in studies conducted in the higher education environment. However, this study extended the existing research on online learning by investigating the simultaneous effects of the two factors on secondary school students' participation in online learning during the COVID-19 pandemic. In addition to confirming that both factors similarly affect secondary school students' participation in online learning, the findings suggest that students' SRL competence is more important than their acceptance in terms of participation. Students' low tendency to use online learning during the COVID-19 lockdown suggests that the instructional design of online learning must be improved to promote students' willingness and readiness to participate in online learning.

Nevertheless, the study has a few limitations. First, only self-reported questionnaires were used in this study. Consequently, further research should include other forms of instruments, such as interviews and observations, to collect data and verify students' actual use of SRL strategies and acceptance. Second, the causal relations explored in this cross-sectional study should be interpreted with caution. While students' use of SRL strategies was hypothesized as an antecedent of their acceptance of online learning, a few studies have posited the opposite view (Aguilera-Hermida et al., 2021; Sletten, 2017). Thus, future studies should use a longitudinal design to further explore the complicated and perhaps reciprocal causal relations among students' SRL, acceptance of, and participation in online learning. Third, since participation in this study was voluntary, the findings cannot be generalized to all students in Hong Kong. Therefore, future studies must ensure cross-replication with a larger and wide-ranging sample.

Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interest Authors have no competing interests to report.

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