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Enhancing the online learning experience of Chinese college students: an investigation of facilitation strategies and their mixed association with student satisfaction

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Facilitation strategies play a critical role in helping instructors teach effectively in an online environment. However, there is a lack of research on how different facilitation strategies impact the online learning experience. To address this gap, our study surveyed 5980 college students from two universities in China and analysed the associations between facilitation strategies and student satisfaction using multivariate and logistic regression analyses. Our findings reveal that facilitation strategies aimed at managerial and technical purposes have different effects on student satisfaction with instructors compared to their satisfaction with their own achievement and engagement. Additionally, we found that student group discussion had a negative association with student satisfaction, potentially due to a preference for hierarchical learning in Confucian-heritage culture. In contrast, after-class learning materials were positively associated with student satisfaction. These findings offer important implications for pedagogical practices that aim to enhance the online learning experience for Chinese students on a large scale.

Keywords: China; online learning; college students; facilitation strategies; higher education

Introduction

Facilitation strategies hold significant research significance within the domain of online learning due to their pivotal role in fostering interaction and establishing a sense of connectedness between instructors and students. With the continuous emergence of novel technologies, tools, and pedagogical practices, a diverse array of facilitation strategies has been devised to cater to the evolving demands of online education. However, existing studies examining the efficacy of these strategies in promoting student engagement and enhancing learning achievement have exhibited limitations, such as restricted by small and homogeneous sample sizes, or focusing solely on asynchronous interactions (e.g. Muir et al., 2020). Consequently, there is a pressing need for further exploration of facilitation strategies. Such investigations have the potential to not only assist instructors in

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designing and implementing effective online learning experiences on a larger scale but also augment the overall quality of online resources within higher education institutions.

The present study aims to investigate the relationship between online facilitation strategies and college student satisfaction in China, a context that has received limited attention in previous research on online learning (Yunusa & Umar, 2021). The study's findings hold practical significance, as they contribute to a better understanding of how effective facilitation strategies can enhance student satisfaction in online learning. This knowledge can inform higher education institutions and instructors on the future design and operation of online classes for East Asian students on a larger scale, thereby improving the quality of online education.

Literature review

Student satisfaction

Student satisfaction is widely recognised as a crucial measure of how effective an online class is, and this is supported by research conducted by various scholars (Kauffman 2015; Rahman et al., 2017; Yukselturk & Yildirim, 2008). Measuring student statisfaction allows instructors to receive valuable feedback directly from students, which in turn helps them make improvements and optimise their online classes (Levitz 2016; Reinhart & Schneider 2001). Therefore, monitoring student satisfaction is vital for enhancing the quality of online education and improving the overall learning experience.

Student satisfaction can be complex and multifaceted, encompassing their perceptions of instructors, themselves, and the different evaluation standards may lead to varied ratings proposed in the literature (Gopal et al., 2021). While overall satisfaction ratings provide a useful summary, they may not fully capture the class's quality due to the many factors influencing students' online experiences. For example, research suggests that student ratings may be influenced more by instructors' personal charisma rather than their actual teaching effectiveness (Shelvin et al., 2000). Thus, students may rate instructors highly but still express dissatisfaction with the entire online class. On the other hand, students may be satisfied with their own engagement and learning achievement but disappointed with their instructors' teaching effectiveness. Student satisfaction scores can vary across different dimensions and aspects, and some studies have attempted to identify these dimensions when evaluating online classes (Stewart et al., 2004). However, there is limited research that compares student satisfaction with themselves versus their satisfaction with their instructors. Therefore, the current study aims to assess student satisfaction with both themelves and their instructors, aiming to provide a more comprehensive understanding of the online learning experience.

Despite Chinese students representing a significant proportion of the global college student population, their satisfaction with online learning has received limited attention in the existing literature, which predominantly focuses on Western populations (Yunusa & Umar, 2021). However, it is essential to acknowledge that Chinese students' satisfaction with online classes may differ from their Western counterparts due to the prevalent Confucian-heritage culture in China, which potentially gives rise to distinct learning preferences and attitudes (Chan, 1999; Sit, 2013). In Chinese culture, teachers are typically regarded as authoritative figures of knowledge, and students tend to prefer guided learning rather than independent exploration or peer interaction (Chan, 1999; Liu et al., 2010). The expression and perception of how knowledge may be enhanced through various facilitation strategies may also vary

between Eastern and Western cultures, potentially influencing students' rating of satisfaction. Consequently, the present study aims to investigate Chinese college students' evaluations of themselves, their instructors, and their overall learning achievement using a large sample, with the goal of gaining a comprehensive understanding of the specific factors that influence Chinese students' satisfaction with online learning.

The term 'facilitation strategies' encompasses a range of techniques and approaches employed by instructors to enhance the online learning experience, which may involve the utilisation of diverse technological tools and pedagogical practices (Martin et al., 2018). Berge's (1995) theoretical model offers a framework that categorises 12 facilitation strategies into four dimensions, namely, managerial, social, pedagogical, and technical, based on their primary functions. Each facilitation strategy can belong to multiple categories depending on the specific teaching practices and objectives. For instance, group discussions can be classified under both pedagogical and social categories. Scholars have utilised Berge's model to assess the effectiveness of facilitation strategies in various studies. For instance, Martin et al. (2018) identified 12 beneficial facilitation strategies from prior research, and they classified and tested these strategies according to Berge's (1995) model. Their findings revealed that the ability to contact instructors was the most advantageous facilitation strategy, while interactive visual syllabi were deemed the least helpful in the context of online learning.

In this study, the selection of facilitation strategies was based on the practices and needs of instructors and students during the large-scale online learning period in China amidst the COVID-19 pandemic. Building upon Berge's (1995) and Martin et al.'s (2018) models, we reconfigured the categories of facilitation strategies into two groups: social/pedagogical and managerial/technical. The four categories were merged into two groups because the facilitation strategies selected in our studies have multiple functions, which could be fit into more than one category. The social/pedagogical group focused on aspects such as pedagogy, intellectual engagement, and interactive elements within online classes. On the other hand, the managerial/technical group included strategies related to organisational aspects, procedures, and administrative functions.

To assess the interactive nature and effectiveness of the social/pedagogical facilitation strategies, we drew upon Moore's (1989) theory of three types of interaction and applied it to interpret Chinese students' perceptions of facilitation strategy effectiveness within the Eastern cultural context, in comparison to the Western culture. Moore (1989) classified interaction into three types: instructor-student interaction (ISI), student-student interaction (SSI), and student-content/material interaction. ISI involves two-way communication between instructors and learners within the class (Moore & Kearsley 2005). SSI refers to the two-way communication among students, which may occur both in the presence or absence of the instructor. Lastly, student-content/material interaction represents the process by which learners actively engage with the subject matter or class content through reflection and elaboration (Moore, 1989).

Although facilitation strategies for interaction are intended to promote the quality of online learning, researchers have debated the levels of effectiveness of different types of interaction. Some researchers argue that ISI is a better predictor of student satisfaction, and SSI may not be as helpful as the former (Battalio, 2007; Bolliger & Martindale, 2004; Irons et al., 2002; Rodriguez, 2006; Swan, 2001; Thurmond, 2003). Conversely, another group of researchers maintains that SSI is a better predictor of student satisfaction than ISI (Irons et al., 2002; Rodriguez, 2006). Student interaction can foster online community building and connection among students, which can

alleviate the isolation caused by the absence of physical contact (Abrahamson, 1998; Palloff et al., 2001).

The controversy surrounding the effectiveness of different types of interaction in online learning can be attributed to two factors. Firstly, the design of activities and the level of instructor involvement in the process, which are related to the social and pedagogical aspects of facilitation strategies, may have a greater impact than the specific types of interaction. Secondly, cultural differences in learning preferences may also contribute to this debate. Students from a Confucian-heritage culture tend to prioritise learning from instructors rather than peers (Chan, 1999), whereas Western students may value both types of interaction if appropriately designed and guided. Therefore, it is imperative for this study to investigate how facilitation strategies incorporating different types of interactions can influence student satisfaction, thereby addressing the existing research gap.

Facilitation strategies and student satisfaction

Most studies agree that facilitation strategies that promote interactive learning lead to higher student satisfaction. For instance, a scoping review focusing on online classes identified instructors' behaviour and interactions as critical factors determining student satisfaction (Yunusa & Umar, 2021). Further research emphasised the significance of instructors' responsiveness and attitudes, which influence students' satisfaction with the classes (Sun et al., 2008). In line with this, a study involving 100 instructors found that timely feedback was considered the most beneficial facilitation strategy (Martin et al., 2020). Additionally, instructors' competence and course design were identified as key predictors of student satisfaction and improved performance in online learning (Gopal et al., 2021). In light of these findings, it becomes evident that the presence and interaction of instructors play a significant role in facilitating online classes and explaining student satisfaction.

Thus, our study aims to assess students' subjective evaluations of the effectiveness of each facilitation strategy and explore their relationship with student satisfaction at the conclusion of the semester. Despite the existing body of research, several limitations need to be addressed. Firstly, previous studies have often failed to compare the effectiveness of different facilitation strategies, making it challenging to rank each strategy based on its association with student satisfaction. To address this gap, our study will measure and compare the most commonly utilised facilitation strategies. Secondly, Chinese students, who possess unique learning preferences, have received limited attention in these studies. Therefore, our study specifically focuses on Chinese students to gain insights into their perspectives. Lastly, many previous studies were constrained by small sample sizes, limiting the generalisability of their findings to large-scale online learning settings. To overcome this limitation, our study utilises a dataset with a large sample size, providing a more comprehensive and representative depiction of the online learning experience.

The study aims to address the following two main research questions:

1) Patterns of college student satisfaction in online learning:

    a. How do students perceive the effectiveness of different types of facilitation strategies?

b. How satisfied are students with instructors' engagement, students' own engagement, and learning achievement?

c. What is the likelihood of students recommending the online classes to other students?

2) Associations of online facilitation strategies with college student satisfaction: specifically, would receiving different online facilitation strategies predict higher or lower student satisfaction?

d. Are different facilitation strategies associated with student satisfaction with instructors'engagement?

e. Are different facilitation strategies associated with student satisfaction with their own engagement?

f. Are different facilitation strategies associated with student satisfaction with their own learning achievement?

g. Are different facilitation strategies associated with students' intention to recommend online classes to others?

Methods

Research procedure

The present study utilised data obtained from the 'Chinese University Course Evaluation (CUCE)' project, which aimed to evaluate the quality of general education classes offered at universities in China. General education classes, also referred to as common core classes, were designed to equip students with a diverse range of skills and knowledge, enabling them to lead more enriching lives as well-informed citizens. These courses cover a wide array of subjects and aim to provide students with a solid foundation of knowledge and competencies. Students were required to earn a specific number of general education credits based on their individual preferences and academic requirements.

To collect data for the CUCE project, an online survey was administered to students at the conclusion of each semester. Participation in the survey was voluntary, and students were sent emails containing a survey link. To enhance response rates, the academic affairs office sent multiple reminder emails until the response rate for each class reached a minimum threshold of 50%.

The data utilised in this study was obtained from the spring semester of 2020, a period when the COVID-19 pandemic necessitated the transition of all classes to online platforms. While synchronous instruction was mandatory for all classes, instructors employed varied approaches. Some instructors provided pre-recorded lectures as learning materials, while others played self-created videos during class sessions to simulate an asynchronous learning experience within synchronous courses. The majority of instructors utilised a combination of synchronous and asynchronous methods, with classes typically lasting 90 min.

Participants

The present study utilised evaluation data from general education classes obtained from two public universities participating in the CUCE project. Specifically, the sample consisted of 5980 undergraduate students, with 4029 students from University

A and 1951 students from University B. The sample included a total of 2418 female students and 3562 male students, spanning across four class levels. Additionally, there were 20 fifth-year students who had deferred their graduation. These details are summarised in Table 1.

Measures and instruments

The comprehensive class evaluation survey comprised over 150 items, which were developed by the researchers based on insights gained from pilot interviews. These pilot

Table 1. Student demographic information by universities.

| | | University | | |
		A	B	Total
Gender	Female	1733	685	2418
	Male	2296	1266	3562
Total		4029	1951	5980
Class levels	Freshman	3084	1143	4227
	Sophomore	534	459	993
	Junior	380	227	607
	Senior	30	103	133
	Fifth-year	1	19	20
Total		4029	1951	5980
Father's education levels	Junior high school or lower	1026	269	1295
	High school	750	222	972
	Secondary technical school	308	130	438
	Technical college	575	293	868
	Undergraduate	1039	731	1770
	Graduate school	212	274	486
Total		3910	1919	5829
Mother's education levels	Junior high school or lower	1286	332	1618
	High school	623	206	829
	Secondary technical school	443	217	660
	Technical college	574	317	891
	Undergraduate	855	648	1503
	Graduate school	123	200	323
Total		3904	1920	5824
High school location	Eastern area	1033	951	1984
	Central area	2203	540	2743
	Western area	793	460	1253
Total		4029	1951	5980
Major	Humanities	63	219	282
	Social science	665	229	894
	Natural sciences	1193	303	1496
	Engineering technology science	2108	1200	3308
Total		4029	1951	5980

interviews involved conducting semi-structured interviews with various stakeholders, including administration officers, instructors, and students, to gather practical insights and identify their specific needs. During the pilot interviews, administration officers were consulted to ascertain their requirements for the understanding of the quality of general education courses and future curriculum design and reform. Instructors were interviewed to gather feedback on the types of information they needed for course evaluations. Additionally, students were engaged in discussions to understand their perspectives, feelings, and experiences, which helped shape the design of each survey item. For the current study, only specific sections of the survey were adopted, focusing on students' demographic information, online facilitation strategies, student satisfaction, and the likelihood of recommending the class to others. These sections were deemed most relevant to the research objectives and aligned with the study's focus.

Independent variables

All the facilitation strategies collected from pilot-interviews of students regarding their learning experience and received teaching methods. In the survey, types of facilitation strategy were presented in the question 'do you think the following online facilitation strategies used by the instructor are effective?' All items in this question used three-point scales with 'yes, it was used and effective', 'yes, it was used but not effective', and 'no, it was not used'. To facilitate data analysis, the study transformed these items into dummy variables, with 'it was used' coded as 1, indicating this strategy was employed in this class, and 'not used' coded as 0, indicating this strategy was not utilised. Each facilitation strategy was treated as a separate item in the multivariate regression or logistic regression models, as each strategy holds distinct practical significance. Therefore, validity and reliability testing of the facilitation strategy items were not conducted. Categorising the facilitation strategies into distinct groups was done for the convenience of interpreting the results.

The facilitation strategy items were divided into two categories, as presented in Table 2: six pedagogical and social items, and four managerial and technical items. Additionally, within the pedagogical and social category, the items were further classified into three subgroups based on Moore's (1989) interaction model: ISI, SSI, and student-material interaction (SMI). The managerial and technical category included four items: 'live-streaming', 'watching videos or listening to audio recorded by the instructor', 'screen-sharing', and 'taking attendance'.

Dependent variables

Student satisfaction was operationalised as a multidimensional construct encompassing four variables: (1) student satisfaction with the instructor's engagement, (2) student satisfaction with their own engagement, (3) student satisfaction with their own learning achievement, and (4) the likelihood of recommending the class to others. The second and third variables aimed to capture students' subjective evaluations of their performance within the online classes. Specifically, student satisfaction with their engagement assessed their perception of their level of dedication to the classes. On the other hand, satisfaction with learning achievement measured the extent to which they believed they had acquired knowledge and skills from the classes. These four variables were treated as dependent variables in subsequent multivariate regression

Table 2. Student-reported effectiveness of each online facilitation strategy for instruction and interaction.

		Ineffective	Effective	Not used	Ineffective ratio (%)
Managerial and technical	Live-streaming	254 4.25%	5494 91.87%	232 3.88%	4.62
	Screen-sharing	243 4.06%	5175 86.54%	562 9.40%	4.70
	Watching videos or listening to audio recorded by the instructor	223 3.73%	2923 48.88%	2834 47.39%	7.63
	Taking attendance	244 4.08%	4997 83.56%	739 12.36%	4.88
Pedagogical and social	Giving comments or feedback on assignments online	218 3.65%	4192 70.10%	1570 26.25%	5.20
Instructor-student interaction (ISI)	Online text/voice discussions hosted by instructors	279 4.67%	5088 85.08%	613 10.25%	5.48
	Online voting or answering questions in class	246 4.11%	4408 73.71%	1326 22.18%	5.58
Student-student interaction (SSI)	Group discussion among students	372 6.22%	4247 71.02%	1361 22.76%	8.76
Student-material interaction (SMI)	Providing materials for review after class	285 4.76%	4992 83.48%	703 11.76%	5.71
	Frequent assignments	273 4.57%	3740 62.54%	1967 32.89%	7.30

analysis, allowing for a comprehensive examination of their relationships with other study factors.

Student satisfaction with the instructor's engagement, their own engagement, and learning achievement was assessed using three separate questions. Specifically, students were asked to rate their satisfaction with the instructor's engagement in the classes, their own engagement in the classes, and their satisfaction with their learning achievement. A five-point Likert scale ranging from '1 = not satisfied' to '5 = very satisfied' was employed for these questions. Higher scores on the scale indicated higher levels of satisfaction. In addition to the aforementioned variables, the final dependent variable focused on whether students would recommend the class to others. This variable was measured using a three-point scale, with response options of 'no = 1', 'not sure = 2', and 'yes = 3'. This question aimed to gauge students' inclination to recommend the class to their peers, providing insights into their overall satisfaction and perception of the class.

Control variables

The current study also incorporated the following control variables: the university, represented as a dummy variable (University A = 0; University B = 1); class level, treated as a continuous variable; majors, which were taken into account using three

dummy variables: humanities (Major1 = 0), social science (Major2 = 1), natural science (Major3 = 1), and engineering (Major4 = 1); gender, represented as a dummy variable (female = 0); both parents' education levels, treated as continuous variables with categories ranging from middle school or below (0) to high school (1), technical secondary school (2), community college (3), Bachelor's degree (4), and Master's degree or above (5); and weekly study time, treated as a continuous variable.

Data analysis plan

The current study employed three statistical methods. Firstly, descriptive statistics were utilised to address the initial set of research questions (questions a, b, c). The percentage of students who perceived a particular strategy as ineffective was calculated through dividing the number of students who considered the strategy as used but ineffective by the number of students who reported it as used and effective. This calculation yielded the ineffective ratio for each facilitation strategy, providing insights into its efficacy (Table 2). This analysis aimed to provide insights into the subjective ratings regarding the effectiveness of each strategy and answer research questions a, b, and c.

Secondly, to address the subsequent set of research questions (questions d, e, f, g), a series of multivariate regression analyses were conducted. These analyses aimed to examine the association between each facilitation strategy and student satisfaction with the instructor's engagement, students' own engagement, and learning achievement. Furthermore, multinomial logistic regression was employed to explore the relationship between each facilitation strategy and students' likelihood of recommending the class to others. The data analysis process was carried out using IBM SPSS 26, ensuring adherence to the assumptions of multivariate and logistic regression. Heteroskedasticity was accounted for by utilising robust standard error estimation.

Results

Descriptive statistics

Table 2 presents the results of the descriptive statistics and the ineffective ratio for the facilitation strategy items. The findings indicate that among the managerial and technical strategies, 'watching videos or listening to audios recorded by the instructor' had the highest ineffective ratio at 7.63%. Conversely, 'live-streaming' emerged as the most favoured facilitation strategy, with only 3.88% of students reporting its ineffectiveness. Regarding the ISI items, all three strategies had ineffective ratios around 5%. However, the SSI item 'group discussion among students' had the highest ineffective ratio among all 10 facilitation strategies at 8.76%. Despite this, it was still a widely used strategy, with only 22.76% of students reporting that their instructors did not employ it. The third most ineffective strategy was 'frequent assignments' with an ineffective ratio of 7.30%. Interestingly, it was also the least commonly used strategy, as reported by 32.89% of students who stated that their instructors did not utilise it in online classes.

For student satisfaction (Table 3), all three satisfaction items had mean scores above four, indicating that students were generally satisfied with the online classes. Specifically, students gave the highest rating of satisfaction with the instructor's engagement (Mean = 4.60, SD =0.62), and the lowest rating for their own engagement

Table 3. The mean and standard deviation of student satisfaction.

	Very dissatisfied		Dissatisfied		Neutral		Satisfied		Very satisfied		M	SD
	N	%	N	%	N	%	N	%	N	%		
Instructor's engagement	15	0.25	39	0.65	238	3.98	1720	28.76	3968	66.36	4.60	0.62
Student's engagement	30	0.50	246	4.11	902	15.08	2713	45.37	2089	34.94	4.10	0.84
Student's learning achievement	35	0.59	137	2.29	612	10.23	2674	44.72	2522	42.17	4.26	0.78

(Mean = 4.10, SD = 0.84). There were 80.30% of students willing to recommend the online classes they took to other students; 16.74% were uncertain, and 2.96% said no.

Regression analyses

A series of multivariate regression models revealed different patterns of associations between facilitation strategies and student satisfaction (Table 4). First, it found that most facilitation strategies had significant associations with student satisfaction with instructors' engagement, except 'screen-sharing' and 'taking attendance' (Model 1). The three items for ISI were all positive and significant. However, 'watching videos or listening to audio recorded by the instructor' (Beta = –0.09, SE= 0.02, $p < 0.001$), 'group discussion among students' (Beta = –0.10, SE =0.02, $p < 0.001$), and 'frequent assignments' (Beta = –0.06, SE = 0.02, $p < 0.01$) had negative associations with student satisfaction. These results suggested that when instructors used these facilitation strategies, students' satisfaction scores with instructors' engagement decreased.

Another regression model examined the association between each facilitation strategy and students' engagement (Model 2). Results showed that among four managerial and technical items, 'watching videos or listening to audios recorded by the instructor' had a significantly positive (Beta = 0.11, SE = 0.02, $p < 0.001$) association with students' engagement, while 'live-streaming' showed a negative association (Beta = –0.13, SE = 0.07, $p < 0.05$). The other two items were not significant.

All three ISI items had significant and positive relationships with students' engagement [(Beta = 0.09, SE = 0.05, $p < 0.05$); (Beta = 0.12, SE = 0.03, $p < 0.001$); (Beta = 0.11, SE = 0.03, $p < 0.001$)], while the SSI item 'group discussion among students' was not significant. For two SMI items, only 'providing materials for review after class' was significantly and positively associated with students' engagement (Beta = 0.15, SE = 0.04, $p < 0.001$).

For student satisfaction with learning achievement (Model 3), among the four managerial and technical items, only 'watching videos or listening to audios recorded by the instructor' had a significantly positive effect (Beta = 0.06, SE = 0.02, $p < 0.01$). The three ISI items all showed significantly positive associations with student satisfaction with learning achievement, with standardised coefficients ranging from 0.11 to 0.12 [(Beta = 0.11, SE = 0.04, $p < 0.05$); (Beta = 0.12, SE = 0.03, $p < 0.001$); (Beta = 0.11, SE = 0.03, $p < 0.001$)]. However, the SSI item 'group discussion among students' had a significantly negative association with the dependent

Table 4. Multivariate and multinomial logistic regression models of each facilitation strategy on student satisfaction and the likelihood of a recommendation.

	Model 1		Model 2		Model 3		Model 4	
	Instructor's engagement		Student's engagement		Learning achievement		Recommendation	
	Beta	S.E	Beta	S.E	Beta	S.E	Beta	S.E
Intercept	4.07***	0.08	3.24***	0.10	3.36***	0.10	1.43	0.75
Universities	0.02	0.02	−0.23***	0.03	−0.08***	0.02	0.85***	0.23
Major2	−0.04	0.04	0.06	0.06	0.03	0.06	0.32	0.49
Major3	−0.02	0.04	0.02	0.06	0.00	0.06	−0.43	0.46
Major4	0.03	0.04	0.06	0.06	0.06	0.05	0.29	0.45
Edu_mo	0.00	0.01	0.04***	0.01	0.03**	0.01	−0.07	0.08
Edu_fa	0.02*	0.01	0.02*	0.01	0.02	0.01	0.05	0.07
Gender	−0.05**	0.02	0.00	0.02	0.03	0.02	0.08	0.17
Class levels	0.01	0.01	0.04**	0.01	0.06***	0.01	0.49**	0.15
Weekly study time	0.05***	0.01	0.08***	0.01	0.07***	0.01	0.17*	0.08
Live-streaming	0.17**	0.06	−0.13*	0.07	−0.02	0.07	−0.64	0.55
Watching videos or listening to audio recorded by the instructor	−0.09***	0.02	0.11***	0.02	0.06**	0.02	0.15	0.17
Screen-sharing	0.06	0.03	0.04	0.05	0.06	0.04	0.16	0.34
Taking attendance	−0.04	0.03	0.05	0.04	−0.03	0.04	−0.06	0.28
Giving comments or feedback on assignments online	0.07**	0.02	0.12***	0.03	0.12***	0.03	0.83***	0.20
Online text/voice discussions hosted by instructors	0.15***	0.03	0.09*	0.05	0.11*	0.04	0.68*	0.27
Online voting or answering questions in class	0.047*	0.02	0.11***	0.03	0.11***	0.03	0.36	0.21
Group discussion among students	−0.10***	0.02	−0.03	0.03	−0.07*	0.03	−0.56*	0.26
Providing materials for review after class	0.11***	0.03	0.15***	0.04	0.17***	0.04	0.40	0.23
Frequent assignments	−0.06**	0.02	0.03	0.03	−0.04	0.03	−0.71***	0.21
Adjusted R2	0.04		0.07		0.05		0.04	
Error df	5799		5799		5799		5799	

Note: Model 1 to 3 are multivariate regression and uses standardised coefficient; *$p < 0.05$; **$p < 0.01$, ***$p < 0.001$; Edu_mo = mother's education levels; Edu_fa = father's education levels; Major2 = Social science; Major3 = Natural science; Major4 = Engineering Technology Science; Model 4 shows the multinomial logistic regression results for the 'yes, I would' group compared to 'no, I would not' group.

variable (Beta = –0.07, SE = 0.03, $p < 0.05$). Regarding the SMI item, 'frequent assignments' did not show an association, but 'providing materials for review after class' had a significant association with student satisfaction with learning achievement (Beta = 0.17, SE = 0.04, $p < 0.001$).

A multinomial logistic model was conducted to examine the relationship between facilitation strategies and whether students would recommend the class to others (Model 4). None of the facilitation strategies in the managerial and technical categories were significant. Among the three ISI items, 'online text/voice discussions hosted by instructors' (Beta = 0.68, SE = 0.27, $p < 0.05$) and 'giving comments or feedback on assignments online' (Beta = 0.83, SE = 0.20, $p < 0.001$) were positively and significantly related to whether the student would recommend the class. However, the SSI item 'group discussion among students' was negatively associated with students' likelihood of recommendation (Beta = –0.56, SE = 0.26, $p < 0.05$). For the two SMI items, 'frequent assignments' (Beta = –0.71, SE = 0.21, $p < 0.001$) was negatively and significantly associated with students' reported likelihood to recommend the class to others.

Discussion

The current study examines the association of facilitation strategies with student satisfaction in a sample of 5980 college students in China. Results revealed that first, managerial and technical facilitation strategies may have different effects on student satisfaction with their own class engagement versus the instructor's class engagement. Chinese college students use different evaluation criteria for themselves and their instructors. Second, students did not favour 'group discussion among students', which contradicted previous literature. Third, giving assignments frequently was likely to diminish student satisfaction, but students preferred to have materials to review after class. It also demonstrates that not all types of SMI are related to higher student satisfaction.

Mixed results of student satisfaction with their own and instructors' engagement

Based on our findings, it appears that the ratings students assign to instructors' engagement can be influenced by the level of direct interaction or presence demonstrated through various facilitation strategies. Our results indicate that certain strategies, such as 'watching videos or listening to audio recorded by the instructor', 'group discussion among students', and 'frequent assignments', were associated with lower student satisfaction scores regarding instructors' engagement. Conversely, strategies such as 'live-streaming' and 'giving comments or feedback on assignments online' were more likely to promote student satisfaction with instructors. These findings are consistent with previous research indicating that students prefer online classes where instructors exhibit a strong social presence and actively interact with them (Kuo et al., 2014; Rodriguez, 2006). It appears that students' evaluations of instructors' engagement are influenced more by the observable workload and instructors' presence in utilising facilitation strategies than by the effectiveness of those strategies in promoting engagement and learning in the classroom (Gursoy & Umbreit, 2005).

In contrast to the results regarding student satisfaction with instructors, the use of 'live-streaming' decreased while 'watching videos or listening to audio recorded by the instructor' increased student satisfaction with their own engagement. This finding

aligns with previous studies that have shown videos created by instructors to be associated with higher levels of student satisfaction, engagement, and connection with instructors (Draus et al., 2014; Rose, 2009). However, the negative association between 'live-streaming' and student satisfaction with their own engagement was surprising, considering that previous researchers have argued that synchronous online classes would be helpful in promoting communication and instructor presence (Watts, 2016). Our results suggest that while students may be satisfied with the effort instructors put into live-streaming, they may not be satisfied with their own engagement when receiving instructor-centred and one-way lecturing. Live-streaming by instructors may impose time constraints and internet connectivity difficulties for students (Park & Bonk, 2007), leading to decreased satisfaction with their own engagement. Research has shown that synchronous classes require asynchronous learning components to be effective for online learning (Zeng & Wang, 2021). Therefore, facilitation strategies that incorporate both synchronous and asynchronous elements with interactive components may be ideal for enhancing student satisfaction.

We encountered another surprising result in our study, indicating that 'watching videos or listening to audio recorded by the instructor' increases student satisfaction with their own engagement and learning achievement but decreases their satisfaction with instructors' engagement. One possible explanation for this finding is that students perceive these activities as a lack of engagement on the part of instructors. However, an alternative explanation for the positive association with satisfaction with engagement is that videos or audio materials are provided to students as supplementary learning resources or effectively used by instructors to aid students' understanding of new concepts presented in class, particularly if they are instructor-created (Pan et al., 2012). Both explanations suggest that the incorporation of videos or audio materials in the classroom can enhance SMI, resulting in increased satisfaction with their own engagement and learning achievement. Conversely, one-way live-streaming lectures may lead to student disinterest and reduced concentration. However, a brief video or audio clip can recapture students' attention and make online classes more engaging (Stilbore & MacGibbon, 2001). While the use of audio or video materials in online classes may negatively impact student satisfaction with instructors' engagement, if employed effectively, it can facilitate student engagement and improve their learning achievement (Brecht, 2012).

The inconsistent findings regarding student satisfaction with their own engagement and instructors' engagement in our study are consistent with prior literature suggesting that student satisfaction should be assessed using multiple dimensions (Griffiths et al., 2007). Relying solely on a single score may not accurately reflect students' true experiences. This underscores the potential for subjectivity and bias in student reports (Bertrand & Mullainathan, 2001). To enhance future studies and teaching practices, it is recommended to differentiate student satisfaction into various aspects, including satisfaction with engagement, performance, improvement, as well as satisfaction with instructors' efforts, engagement, and effectiveness. Adopting a diversified rating approach can provide a more comprehensive and precise evaluation of online classes.

Group discussion and associated low student satisfaction

Our study has produced unexpected findings regarding students' lower satisfaction with group discussions in online classes, which contradict previous research suggesting that SSI enhances satisfaction in online learning (Sher, 2009). It indicates that

group discussions may require certain preconditions to function effectively in online classes; otherwise, they may have a negative impact. One possible explanation is that student discussions are less effective in the absence of direct instructor participation, which holds particular significance in Confucian-heritage Chinese culture (Sit, 2013). While SSI has been identified as a positive predictor of satisfaction in Western research (Kuo et al., 2014), it may not be perceived as an effective facilitation strategy in Chinese culture. This finding aligns with previous research demonstrating that Chinese students prefer one-way lecturing from instructors and view their instructors as knowledgeable figures who possess all necessary knowledge (Chan, 1999). Interestingly, in our sample, 'online text/voice discussions hosted by instructors' emerged as a significant positive factor in explaining student satisfaction. This suggests that the instructor's presence is crucial for facilitating effective discussions in Chinese culture. Additionally, Gulati (2008) argues that mandatory group discussions may not align with student-centred teaching practices, as some students prefer to learn individually through silent engagement with online lectures and learning materials. In such cases, group discussions may diminish their satisfaction with online learning.

Interaction with learning materials versus assignments

One notable finding from our study is that 'frequent assignments' did not significantly contribute to student satisfaction with their engagement and learning achievement, and in some cases, it was associated with lower ratings for both instructors and the class. Conversely, 'providing learning materials for review after class' was found to be a positive factor linked to student satisfaction. This finding is consistent with previous research indicating that students generally do not appreciate mandatory and heavy assignments in online classes, and instructors should offer greater flexibility and guidance in terms of assignments (Hassan et al., 2021; Lee et al., 2011). In contrast, providing learning materials for review allows students more freedom and flexibility in choosing what and how to learn, which is a significant advantage of online learning characterised by convenience and self-regulation. However, this convenience also presents challenges associated with online learning, such as high workload and the need for self-discipline (Mukhtar et al., 2020).

Limitations and implications

The present study has several limitations that should be acknowledged when interpreting the results. Firstly, our focus was limited to general education classes, and the findings may not generalise to other types of classes or disciplines where instructors may employ different facilitation strategies. It is important to consider that students' performance and behaviours could vary across different types of classes. Secondly, we did not collect data on certain important factors that could influence students' experience during emergency remote learning. This includes the demographic characteristics of instructors, the quality of the online learning system, the technology and equipment utilised, and the specific learning environment in which students were situated. These factors could potentially have an impact on students' satisfaction and overall learning experience. Additionally, our study did not involve qualitative interviews with students and faculty members during the COVID-19 pandemic. Qualitative data could have provided deeper insights and additional context to support

the assumptions and explanations presented in our findings. Including interviews could have allowed us to capture the perspectives, experiences, and challenges faced by students and instructors in a more comprehensive manner. Future research should address these limitations to obtain a more comprehensive understanding of students' online learning satisfaction.

The current study's findings have important implications for our understanding of the complex relationships between facilitation strategies, student satisfaction, and learning outcomes in different contexts. Higher education institutions (HEIs) and instructors should consider the influence of culture on student learning preferences when designing and delivering online classes (Lim 2004). While social constructivism emphasises student-centred learning and peer interactions (Amineh & Asl, 2015; Anderson, 2008), our findings highlight the need for instructors to assume a more dominant role in the Chinese context of online learning. The structure and design of online classes based on social constructivism may need to be adjusted to align with the hierarchical approach to teaching and learning valued in Chinese culture. Further research should explore the intersection of social constructivism, Chinese culture, online learning preferences, and their collective impact on student learning outcomes.

From a pedagogical perspective, Chinese instructors should consider implementing more structured and scaffolded interactive activities to ensure that students feel guided and connected with their instructors. Chinese students who are new to student-centred learning activities may require additional time and education on why and how to construct their knowledge independently or through interaction with peers. It is crucial to communicate the goals of course activities clearly to engage students in the learning process (Berry, 2022).

Furthermore, our findings emphasise the need for caution when using student reports as the sole basis for assessing instructors' teaching performance, as they can be subject to bias. A comprehensive assessment of instructors' teaching effectiveness should incorporate multiple sources of evaluation to derive a valid conclusion.

In addition, our research has significant implications for the effective implementation of facilitation strategies in future online teaching applications, particularly in the context of emerging technology-based teaching methods and mediums. Firstly, our findings suggest that instructors should incorporate more student-centred and interactive activities, such as group discussions, with the instructor leading the discussion and providing clear and structured feedback. Secondly, when conducting live-streaming classes, instructors should maintain an interactive and student-focused approach instead of relying solely on one-way lecturing. This can be achieved by introducing activities such as online voting to engage students and solicit their opinions. Lastly, instructors should provide structural guidance and interaction when using videos or audio in online classes to help students understand the relevance of the content to the course. They could lead discussions or pose questions related to the material and even use it as an after-class learning tool by assigning assignments based on video content.

Our research highlights the importance of carefully considering the effectiveness of adding more technology or pedagogical facilitation strategies to online classes. Instructors should focus on selecting the most appropriate and effective strategies that promote student learning behaviours and outcomes. For example, experimental studies could be conducted to investigate the effects of assignment frequency and instructors' feedback on students' satisfaction and learning achievement. Additionally, it is crucial to recognise that using student reports alone to evaluate instructors' teaching

performance may introduce bias, and thus it is essential to use multiple sources of evaluation to generate valid conclusions.

Furthermore, our research has significant implications for the development of online learning and degree programmes, which have been on the rise in China and other developing countries in recent years. The COVID-19 pandemic has altered the attitudes of both instructors and students towards online learning (Adedoyin & Soykan, 2023). While Chinese teachers have shown enthusiasm for innovating online learning, they did not anticipate wide-scale acceptance in the near future (McConnell, 2018). Traditional preferences for face-to-face lecturing and the lack of research and experience in online learning have been major obstacles to the development of online education. Our study sheds light on how to improve the quality of online learning on a large scale by leveraging new technologies and challenging traditional learning beliefs among teachers and students who are new to online education. It provides new incentives for the long-term development of online higher education on a larger scale.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly accessible, but are available from the corresponding author on reasonable request.

Disclosure statement

The authors declare that they have no competing interests.

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