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+Exploring the Effectiveness of Kindergarten Students' Online Learning During the COVID-19 Pandemic

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Online teaching was adopted in Hong Kong and many other places worldwide due to lockdown policies during the COVID-19 pandemic. This research explores the effectiveness of kindergarten students' online learning as measured by parents' reports of their child's satisfaction with learning, engagement in learning, effective teaching strategies, and an environment conducive to online learning. Parents of 392 students from 40 randomly selected kindergartens in Hong Kong completed questionnaires in March 2022, a few months after the end of online teaching. A questionnaire was designed for this study, with reliability and validity supported by Confirmatory Factor Analysis (CFA). Structural Equation Modeling (SEM) was used to test hypotheses. The findings show that effective teaching strategies and an environment conducive to online learning positively affected student learning. It can cast light on the issue of whether online teaching is suitable for kindergarten students, the appropriate teaching strategies, and the kind of learning environment needed to enhance online learning processes and outcomes.

Keywords: online learning, student engagement, effective teaching, conducive environment, satisfaction, kindergarten

INTRODUCTION

Online Teaching and Learning during COVID-19

Online teaching was adopted in Hong Kong and many other places around the world due to lockdowns during the COVID-19 pandemic. The transition from face-to-face teaching in kindergartens, primary and secondary schools introduced a range of challenges for teachers and students. These challenges have been identified and discussed extensively in the literature. There is broad agreement that particular aspects

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of online learning need improvement: students' discipline (Gurung, 2021; Wang et al., 2021), poor motivation (Fernando et al., 2020; Gurung, 2021; Spadafora et al., 2023), teachers' competency in using new technology (Andarwulan et al., 2021; Martins et al., 2022; Safrizal et al., 2021), students' interactions with teachers and peers (Ferri et al., 2020; Muhdi et al., 2020), and access to the internet and technological support (Ferri et al., 2020; Huang et al., 2023; Spadafora et al., 2023).

Research studies specifically related to online teaching in kindergartens show that the following aspects need attention and improvement: interaction among students and teachers (Dong et al., 2020; Stites et al., 2021), students' ability to learn independently (Spadafora et al., 2023), teachers' knowledge and ability in conducting online teaching (Muhdi et al., 2020; Saxena, 2021), motivation and engagement in learning (Maimun & Bahtiar, 2022; Saxena, 2021), poor learning environment and atmosphere (Dong et al., 2020), the need for hardware and facilities support (Maimun & Bahtiar, 2022; Safrizal et al., 2021), collaboration with parents (Maimun & Bahtiar, 2022; Safrizal et al., 2021), and students not achieving learning outcomes effectively (Abu-Rabba' et al., 2021; Maimun & Bahtiar, 2022; Safrizal et al., 2021).

Context and Review of Literature

Factors Affecting the Effectiveness of Online Learning in Hong Kong Kindergartens

This study sets out to study various factors affecting the effectiveness of online learning in Hong Kong kindergartens. The term "kindergarten" in Hong Kong refers to schools offering formal education to children from 3 to 5 years old. Online teaching in kindergarten was conducted from September 2020 to June 2021. The challenges discussed in the literature may be broadly classified as technical support, teaching effectiveness, learning environment, student engagement, and student satisfaction. Since almost every young child in Hong Kong has easy access to the internet and technology (Digital Around the World — DataReportal – Global Digital Insights, 2023), access to the internet and technical support seems not to be a severe challenge to kindergarten students in Hong Kong. Therefore, this study focuses on four factors: effective teaching strategies, learning environment, student satisfaction, and student engagement to understand what constitutes effective online learning in Hong Kong kindergartens. A questionnaire was developed for this study, and forty kindergartens in Hong Kong were randomly selected to participate in the survey. This study will cast light on the relationships among the four factors and indicate ways to improve online learning effectiveness.

Student Satisfaction during Online Learning

Student satisfaction is one measure of the effectiveness of online learning (Zhu, 2012). Many studies have shown a significant relationship between student satisfaction and teaching effectiveness (Bangert, 2005; Gopal et al., 2021; Nortvig et al., 2018; Tharapos et al., 2022). Student satisfaction is essential to students' emotional engagement (Fredricks et al., 2004).

Online learning during COVID-19 has created many difficulties for students (Zhu et al., 2022). A study in Hong Kong on online learning in primary schools found that 47% of parents were dissatisfied with their child's online learning (Lau et al., 2021). A study in China involving more than 28,000 students aged six to eight found that most parents were unhappy with online learning, and 53% of students felt tired by the experience (Zhu et al., 2022). Most students in the study showed negative feelings toward online learning.

Kindergarteners might encounter more difficulties than primary school students, leading to negative feelings towards online learning. A study of parents' perceptions of kindergarten students' online learning found that parents in China were not satisfied with online learning. They had a negative impression of the learning atmosphere, students' social interaction, and online learning outcomes during COVID-19 (Dong et al., 2020). 46% of parents of children in the USA were dissatisfied with online learning (Stites et al., 2021). In a quantitative survey of 216 parents of pre-school children, parents were not satisfied with the quality of online teaching (Karavida & Tympa, 2021). A qualitative study involving 50 kindergarten students found that 45 were dissatisfied with online learning and preferred to return to face-to-face learning (Khales, 2022). The above studies show that kindergarten students' satisfaction with online learning is an important issue.

Kindergarten students' satisfaction with online learning, social interaction, communication, and emotional support might be factors related to the satisfaction of parents (Stites et al., 2021). Social interaction, social influence, and social support significantly affect students' satisfaction during online learning (Alenezi, 2022).

Early childhood education teachers observed that children's low participation levels and limited social interaction are some of the challenges found in online teaching (Ford et al., 2021). Social interactions, students' motivation in learning, and distraction in online learning during COVID-19 are some challenges observed by kindergarten and primary school teachers in another study (Kundu & Bej, 2021).

The above studies showed that parents and kindergarten students were generally dissatisfied with online learning. Challenges of social interactions and social factors may be associated with the satisfaction of students with online learning (Dong et al., 2020; Khales, 2022; Stites et al., 2021). As student satisfaction is related to learning effectiveness, there is a need to investigate the satisfaction of online learning by kindergarten students and its relationships to effective teaching and learning environment. Hence, this study proposes that kindergarten students have low satisfaction with online learning as Hypothesis 1 in this study.

Teaching Effectiveness

Teaching effectiveness is one of the most critical factors leading to effective learning in traditional classrooms (Darling-Hammond, 2000; Stronge, 2018). Teaching effectiveness positively affects student engagement, satisfaction, and learning achievement (Brophy, 1986b; Kemp & Hall, 1992). By conducting a four-year experiment with students from kindergarten to third grade, Nye et al. (2004) found that

teaching influences students' achievement. Teacher effectiveness is a multi-dimensional concept that may include the teacher's general competence, presentation, instructional skills, questioning techniques, classroom management, and behaviour management (Kemp & Hall, 1992; Stronge et al., 2011). In a study of pre-kindergarten programmes, teacher attributes predicted observed learning quality in the classroom (Pianta et al., 2005). Mohamed & Barakat (2023) found that effective instruction by using digital drama-based methodology can lead to better receptive and expressive language outcomes of kindergarten children.

For online classes, teaching effectiveness positively affects students' success (Nambiar, 2020; Tharapos et al., 2022; Tsang et al., 2021)**.** Teachers' knowledge and ability to conduct online teaching were challenging for online kindergarten learning (Muhdi et al., 2020; Saxena, 2021). Poor teaching knowledge and skills inhibit learning (Cothran & Kulinna, 2008). Teaching effectiveness is proposed as an essential factor in the effectiveness of online learning of kindergarten students during the COVID-19 pandemic.

It is not easy to define or measure teaching effectiveness in relation to online teaching for kindergarten students because it may be affected by contextual factors such as the age and background of students, the type of school, and the learning environment (Lewis & Sugai, 1999). In a study of the effectiveness of fifth-grade teachers, Stronge et al., (2011) suggested four dimensions of teacher effectiveness: instructional delivery, student assessment, learning environment, and personal qualities. In a study to equip kindergarten students with prerequisite learning skills (Brigman & Webb, 2003), teachers adopted five specific teaching strategies. Results showed that students achieved effective learning skills with teachers using the teaching strategies.

Since no existing studies investigate effective teaching strategies for kindergarten students' online learning, this study attempts to identify the specific teaching strategies needed to enhance online learning. Parents of kindergarten students held negative views on the learning atmosphere, students' social interaction, and online learning outcomes during COVID-19 (Dong et al., 2020; Stites et al., 2021). Lack of motivation and participation are challenges for online learning at the kindergarten level (Khales, 2022). Primary students had difficulties completing tasks during online learning, and parents' satisfaction significantly correlated to students' competence in independent learning (Lau et al., 2021).

In the online context, effective teaching strategies require special attention be given to supporting students in overcoming learning barriers encountered in the specific online learning situation, as found by studies reviewed in this study. Therefore, this study proposes that effective teaching strategies are needed to improve kindergarten students' online learning. The strategies include giving attention to appropriate teaching arrangements in meeting the needs of students, such as competence to finish learning tasks which are considered both entertaining and educative by students; motivating students to learn with creativity, interacting with others, and sharing experiences and relevant knowledge; and technological applications and content of teaching appropriate for online learning.

With the above literature review, Hypothesis 2 proposes that effective teaching strategies positively affect student satisfaction in online learning.

Environment Conducive to Online Learning

Research studies showed that classroom environment and management are essential to effective learning for face-to-face teaching (Borich, 1996; Brophy, 1986a; Lampert, 1988; Rahimi & Karkami, 2015; Secada, 1992). Instructional and emotional environments significantly influence learning engagement for kindergarten students (Aydoğan et al., 2015). A study on learning outcomes of primary mathematics students in Singapore found significant relationships between these two aspects of the classroom learning environment with better achievement and student attitudes (Goh & Fraser, 1998). The above studies show that the learning environment is an essential factor affecting students' learning outcomes in face-to-face teaching.

Although there is no physical classroom during online learning, a virtual classroom or online learning environment is essential in achieving online learning effectiveness (Goldspink et al., 2008). A learning environment conducive to online learning is found to be a challenge for kindergartens (Dong et al., 2020). Therefore, this study investigates what factors contribute to a learning environment conducive to online learning.

A classroom is a place where the teacher and students interact so that students can engage in learning activities and achieve desired learning outcomes (Adeyemo, 2012). An effective traditional classroom has five characteristics: security, open communication, mutual liking, shared goals, and connectedness (Kimberly, 2001). Management of the classroom by a teacher is related to designing an environment conducive to learning, establishing rules to minimise disruption to learning, and creating opportunities for students to engage in mutual interaction to participate actively in the learning process (Borich, 1996; Brophy, 1986a; Lampert, 1988; Secada, 1992).

During online teaching, students usually attend lessons at home. A conducive online learning environment will be different from the environment in a traditional classroom. However, some critical characteristics conducive to learning in a traditional classroom are expected to apply to the environment for online learning. Giving instant feedback in monitoring and evaluating the teaching process can enable students' participation (Bayır et al., 2022). Easy access to learning materials and online resources is perceived to be beneficial for online learning (Torres & Cruz, 2022). Social factors, including social interactions, social support, and feeling connected to others, are related to an environment conducive to online learning (Alenezi, 2022; Tharapos et al., 2022). The effects of two essential dimensions in kindergarten classrooms, emotional support and instructional support, were found to be related to kindergarten students' engagement in learning (Aydoğan et al., 2015).

Concerning the challenges found in the literature on online learning and the learning environment, this study proposes that an environment conducive to online learning for kindergarten should provide emotional support (Aydoğan et al., 2015; Kurnia et al., 2022) to enhance social interactions, build students' confidence through caring and trust

atmosphere (Aydoğan et al., 2015; Bucholz & Sheffler, 2009; Dong et al., 2020; Goh & Fraser, 1998; Hamre & Pianta, 2005; Stites et al., 2021). Hence, Hypothesis 3 proposes that an environment conducive to online learning positively affects kindergarten students' satisfaction during online learning.

Student Engagement

Engagement is essential for students to learn effectively (Gunuc, 2014; Hughes et al., 2008; Martins et al., 2022). Numerous studies have found that elementary students' engagement significantly affects academic achievement (Darensbourg & Blake, 2013; Galla et al., 2014; Martins et al., 2022). Student engagement was associated with effective teaching in elementary schools (Stronge et al., 2011), learning environments for primary schools (Opdenakker & Minnaert, 2011), and middle schools (Ryan & Patrick, 2001).

Student engagement has received attention from researchers for decades as an essential factor in improving students' learning (Fredricks et al., 2004; Martins et al., 2022; Rashid & Asghar, 2016; Schaufeli et al., 2002). Student engagement has different definitions and interpretations (Fredricks et al., 2004; Martins et al., 2022; Rashid & Asghar, 2016; Schaufeli et al., 2002). According to various researchers, student engagement is a multi-dimensional construct, and the dimensions of student engagement vary among the studies. Frederick et al., (2004) suggested that there are three dimensions of student engagement, namely, behavioural, emotional and cognitive. Schaufeli et al., (2002) proposed that vigour, absorption, and dedication are the three essential dimensions of student engagement. Reeve and Tseng (2011) proposed four dimensions by adding one agentic engagement dimension to the three dimensions Frederick et al., (2004) suggested.

In the present study, the engagement of kindergarten students during online learning is defined as students' effort, persistence, attention, participation, interaction with teachers and peers, following rules, and the absence of disruptive behaviours. Fredricks et al., (2004) may classify it as behavioural engagement. From the literature related to conducive environment mentioned above, it can be seen that conducive environment will affect students' engagement. Without engagement, learning outcomes will be negatively affected (Stronge et al., 2011). Hypothesis 4 proposes that an environment conducive to online learning positively affects kindergarten students' engagement during online learning.

Student engagement was found to be a problem for kindergarten students in online learning (Ford et al., 2021; Maimun & Bahtiar, 2022; Saxena, 2021). Hence, Hypothesis 5 proposes that kindergarten students have low engagement during online learning.

Many studies have found that online teaching effectiveness correlates with student engagement and satisfaction (Alenezi, 2022; Bangert, 2005; Gopal et al., 2021; Nortvig et al., 2018; Tharapos et al., 2022). Teachers' effective engagement pedagogies in the classroom can affect students' engagement (Pedler et al., 2020). Hence Hypothesis 6 proposes that effective teaching strategies positively affect kindergarten students' engagement during online learning.

Hypotheses

To sum up, the hypotheses proposed according to the literature review are as follows:

Hypothesis 1: Kindergarten students have low satisfaction with online learning.

Hypothesis 2: Effective teaching strategies positively affect student satisfaction in online learning.

Hypothesis 3: An environment conducive to online learning positively affects kindergarten students' satisfaction during online learning.

Hypothesis 4: An environment conducive to online learning positively affects kindergarten students' engagement during online learning.

Hypothesis 5: Kindergarten students have low engagement during online learning.

Hypothesis 6: Effective teaching strategies positively affect kindergarten students' engagement during online learning.

Research Aim, Objectives, and Questions

Due to the COVID-19 pandemic, kindergartens have adopted online teaching for the first time. Kindergarten students face many challenges during online learning (Dong et al., 2020; Muhdi et al., 2020; Saxena, 2021; Spadafora et al., 2023; Stites et al., 2021). This study attempts to study various factors related to the effectiveness of online learning and their relationships and answer the following questions:

1. Do kindergarten students feel satisfied with their online learning?
2. Do students show behavioural engagement in online learning?
3. What online teaching strategies are required to achieve effective student learning?
4. What environment is required for students to achieve effective online learning?

Some studies were conducted during the early stage of kindergarten students' online learning in Hong Kong and China (Dong et al., 2020; W. Zhu et al., 2022). This study was conducted in 2022, after Kindergartens in Hong Kong stopped implementing online learning, offering an opportunity to analyse the effects with a more comprehensive view of the whole online learning process from students and parents involved.

Conceptual Model

Concerning the above literature review and proposed hypotheses, a theoretical model is proposed in Figure 1 to describe the relationships among effective teaching strategies, learning environment, student satisfaction, and student engagement.

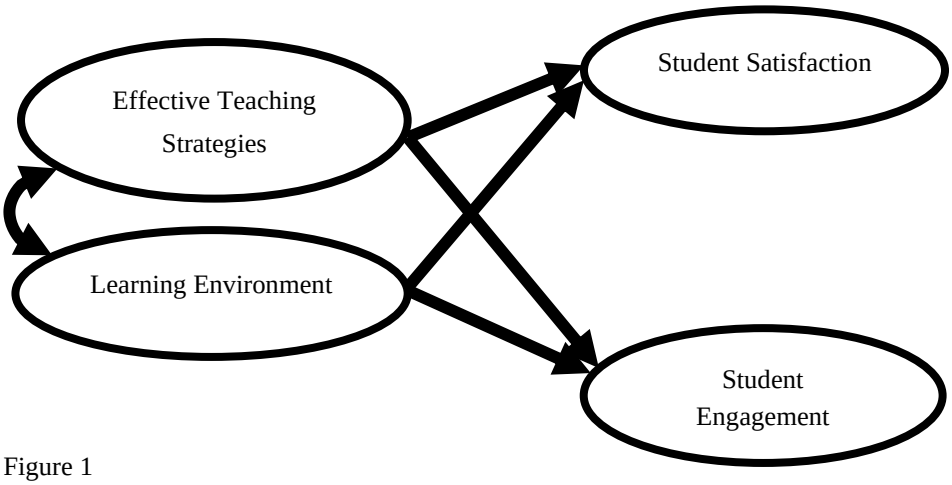

Figure 1
Conceptual model

METHOD

Research Design

This research used a cross-sectional survey with a random sample of 10 students from each of 40 randomly chosen kindergartens in Hong Kong. The parents of the students completed the questionnaire with input from their children. As no similar research had been conducted before, the following four scales were developed to measure the four variables in this study: effective teaching strategies, learning environment, student satisfaction, and student engagement.

The development of the questionnaires went through the following stages: (1) reviewing related literature and instruments already developed; (2) proposing constructs related to this study and defining the constructs to be measured; (3) developing instruments according to the proposed constructs, the situation of kindergartens in Hong Kong, and regarding instruments used in other studies; (4) seeking comments from focus groups and professionals who have relevant experience and expertise to refine the proposed instruments; (5) collecting data to validate the instruments; (6) conducting confirmatory factor analysis to validate the instruments; (7) using structural equation modelling to investigate the relationships among variables as proposed in the conceptual model.

Measures

Effective Teaching Strategies

This study proposes that effective teaching strategies should include appropriate content for online learning, meeting the needs of students, applying appropriate technology in new ways, motivating students with entertaining and educative elements, enhancing students' creativity, and supporting children in sharing experiences and knowledge. A 6-item scale, adopting a 5-point Likert scale with one as strongly disagree to five as

strongly agree, was developed in this study to obtain perceptions of the importance of the following components. Two examples of the six items are "the curriculum is effective for online learning" and "technology applications are appropriate for online learning".

Learning Environment

A learning environment is conducive to online learning with characteristics of providing emotional support, encouraging interactions and an atmosphere of caring, trust, and understanding. Six items, adopting a 5-point Likert scale with one as strongly disagree to five as strongly agree, were developed to measure the characteristics of a learning environment conducive to online learning according to the definition in this study. Two examples of the six items are "the environment is caring and building trust" and "the environment establishes good relationships through students' participation and communication".

Student Satisfaction

Student satisfaction is defined as student satisfaction with the learning activities through online teaching. Five items were designed to measure the construct using a 5-point Likert scale, with one as strongly disagree to five as strongly agree. Two examples of the five items are "Satisfied and happy with online learning" and "Satisfied with the time available for learning".

Student Engagement

Student engagement is defined as students' behaviours that enhance effective learning during online teaching. Five items were designed, adopting a 5-point Likert scale with one as strongly disagree to five as strongly agree, to measure students' engagement in learning. Two examples of the five items are "Compliance with rules during online learning" and "Friendly interaction with peers during online learning".

FINDINGS

Data Analysis

Parents filled out the questionnaires after discussing them with their child and their own observations. After cleaning the data by removing a few outliers, 392 completed questionnaires were analysed with IBM SPSS and AMOS version 28.

Descriptive Statistics

There were 201 male and 191 female students, with 135, 160, and 97 students aged 3, 4, and 5, respectively. The mean and standard deviation of the age of students were 3.9 and 0.76, respectively.

Confirmatory Factor Analysis

Confirmatory factor analysis showed a four-factor solution with excellent goodness of fit, consistent with our conceptual model (chi-square: 251.23; Degree of freedom: 203; CFI: 0.990; TLI: 0.989; RMSEA: 0.025). The measurement model with all four constructs also showed discriminant validity and good reliability. The reliability of each

scale was measured using IBM SPSS 28. The Cronbach's alpha coefficients were between .734 and .859 (Table 1). Table 2 shows the correlation coefficients among the four constructs. The correlations between factors ranged from .791 to .886 and were significant at the .001 level. The standardised regression weights of each item on its respective factor range from .531 to .865, and there are no crossing loadings of any item on the two factors (Table 3). The above analyses showed that the four constructs were distinct and had discriminant validity (Taherdoost, 2017). They were also assumed to show content validity, as a review of relevant literature and input from education experts developed the items.

Table 1
Reliability of the four scales

	Effective Teaching Strategies	Learning Environment	Student Satisfaction	Student Engagement
Cronbach's Alpha	.859	.845	.734	.839
Composite Reliability	.864	.855	.735	.845

Table 2
Correlations among the four factors (N = 392)

	Effective Teaching Strategies	Student Engagement	Student Satisfaction
Student Engagement	.845*		
Student Satisfaction	.824*	.791*	
Learning Environment	.886*	.849*	.839*

*p < .001

Table 3
The standardised regression weights of each item on its respective factor

Items	Factor	Standardized Regression Weight
effTeach6	Effective Teaching Strategies	.854
effTeach5		.865
effTeach4		.683
effTeach3		.632
effTeach2		.608
effTeach1		.637
enviro6	Learning Environment	.557
enviro5		.593
enviro4		.865
enviro3		.863
enviro2		.666
enviro1		.645
engage5	Student Engagement	.856
engage4		.677
engage3		.841
engage2		.679
engage1		.533
sati5	Student Satisfaction	.599
sati4		.593
sati3		.622
sati2		.567
sati1		.605

Table 4 reports the means and standard deviations of the four factors measured in this study. Table 5 compares the means of the four factors with the theoretical mean by t-test. Tables 4 and 5 show parents' views about their children's satisfaction with online learning were significantly lower than three, the theoretical mean on a five-point Likert scale. The result supports Hypothesis 1, that kindergarten students had low satisfaction with online learning during COVID-19. The result was in line with the findings of other studies in primary schools and kindergartens (Dong et al., 2020; Khales, 2022; Lau et al., 2021; Stites et al., 2021). The scores for teaching effectiveness, environment conducive to learning, and student engagement are significantly higher than 3. These results showed that students had positive views of teachers' teaching effectiveness, the learning environment, and engagement during online teaching. Hypothesis 4, stating that students had low engagement, is not supported. In the opposite direction of hypothesis 4, students' engagement is satisfactory, as the data reflects.

Table 4
Means and standard deviations for the four factors as measured by a 5-point likert scale with 1 as strongly disagree and 5 as strongly agree (N = 392)

Factor	Mean	*SD*
Effective Teaching Strategies	4.08	.77
Student Engagement	3.90	.84
Student Satisfaction	1.98	.68
Learning Environment	4.03	.74

Table 5
One sample *t*-test comparisons between the mean of each factor and the mid-point value of 3 on the 5-point likert scale

Factor	t	df
Effective Teaching Strategies	27.80*	391
Student Engagement	22.76*	391
Student Satisfaction	-29.83*	391
Learning Environment	27.75*	391

*p < .001

Tests of the Conceptual Model

Table 2 shows the correlations between the variables with analysis by IBM SPSS 28. The correlations were significant at 0.001, ranging from .79 to .88. Effective Teaching Strategies and Environment Conducive to Online Learning were substantially and significantly related to Satisfaction and Engagement. These results initially supported Hypotheses 2 to 5, but the relationships needed to be tested by Structural Equation Model.

The relationships among the variables were analysed using structural equation modelling with Amos 28. The goodness of fit indices reported in Table 6 showed that the model provided an excellent fit to the data (CMIN=251.2; df= 203; CMIN/df=1.238; CFI = .99; TLI = .989; RMSEA = .025).

Table 6
Goodness of fit indices for CFA and SEM models

	CMIN	*df*	CMIN/*df*	CFI	TLI	RMSEA
CFA	251.2	203	1.238	.99	.99	.025
SEM	251.8	204	1.234	.99	.99	.024

Table 1 reports the reliability of the four scales, as measured by Cronbach's Alpha and Composite Reliability. The results showed that the scales are reliable, with coefficients ranging from .712 to .931. Table 7 shows the standardised direct effects between variables. Effective teaching strategies had a significant standardised direct effect of .789 on students' satisfaction, supporting Hypothesis 2. An environment conducive to learning has a significant standardised direct effect of .445 on student engagement, supporting Hypothesis 4. The results showed the predictive validity of the measurement scales and conceptual model (Taherdoost, 2017). The direct effects between variables align with findings from studies on teaching and learning effectiveness in the literature. Hence the conceptual model also has concurrent validity (Taherdoost, 2017).

Table 7
Standardised direct effects and total effects

	Standardised Direct Effect
Effective Teaching Strategies to Student Satisfaction	.789*
Learning Environment to Student Engagement	.445*
Effective Teaching Strategies to Student Engagement	.529*
Learning Environment to Student Satisfaction	.233

*$p < .01$

Student Satisfaction with Online Teaching

The findings of this study showed that students were not satisfied with the online learning mode. The result aligns with findings from other studies in the literature (Dong et al., 2020; Khales, 2022; Stites et al., 2021). Hypothesis 1 was supported. The results imply that students have negative perceptions of online learning.

Relationships between Student Satisfaction and Effective Teaching Strategies

Based on the SEM findings, effective teaching strategies directly affected student satisfaction. This result supported Hypothesis 2. The result is also in line with numerous studies with primary and secondary students, suggesting that effective teaching and instructional delivery in face-to-face teaching have a significant association with student satisfaction and learning (Bangert, 2005; Gopal et al., 2021; Nortvig et al., 2018; Tharapos et al., 2022).

Effective teaching strategies specifically for kindergarten students' online learning in this study include the following characteristics: appropriate teaching arrangements in meeting the need of students, such as competence to finish online learning tasks which are considered both entertaining and educative by students, motivating them to learn with creativity, interaction, and sharing experience and relevant knowledge; and technological applications appropriate for online learning, content appropriate for online learning. They are positively associated with students' satisfaction in this study. The findings have important implications for effective online learning.

Some of the above strategies, such as meeting the needs of students, motivating and entertaining, creativity, and interactions, are effective strategies for face-to-face teaching. Hence the findings in this study may have concurrent validity. Some strategies in this aspect are specific to online learning, such as arrangements to enhance students' completing tasks with appropriate technological applications and content are specific to online learning. These findings may be relevant to future research.

Relationships between Student Satisfaction and Learning Environment

The learning environment was found to have no significant direct effect on student satisfaction in the SEM analyses, despite the significant correlation between the two variables. Hypothesis 3 was not supported. The significant correlation can be interpreted as due to the intervening variable of effective teaching strategies. This study defined an environment conducive to learning as social and emotional support that encourages interactions and an atmosphere of trust, caring, and student confidence. The social factors in this study include students feeling that they are being taken care of,

perceiving that they are supported in overcoming weaknesses and interacting with others in learning. They are essential for encouraging kindergarten students' engagement in online learning in this study. The significant relationship between learning environment and student engagement found in this study can shed light on how to improve students' engagement during online learning. This result may have implications for future studies on online learning effectiveness.

Student Engagement

Student engagement in this study was positive, with a mean value of 3.96, significantly higher than three on a 5-point Likert scale, despite the relatively low student satisfaction reported for online learning. Hypothesis 4, of low student engagement in online learning, is not supported. The finding shows that students positively engage in online learning in the opposite direction of Hypothesis 4.

Effective Teaching Strategies and Student Engagement

Effective teaching strategies had a significant direct effect on student engagement. Hence, Hypothesis 6 was supported.

The results align with findings in many face-to-face studies that effective teaching strategies positively affect student engagement.

DISCUSSION AND CONCLUSION

In line with other studies (Dong et al., 2020; Khales, 2022; Stites et al., 2021), this study showed that kindergarten students were unsatisfied with online learning. There are many barriers for kindergarten students to overcome in learning in the online mode, such as a lack of interaction, communication, and social support (Dong et al., 2020; Khales, 2022; Stites et al., 2021). The results suggest that online learning effectiveness should be improved for kindergartens as there is always a possibility of another lockdown due to a new pandemic in the future.

The theoretical model of this study proposed a causal effect of effective teaching strategies and learning environments on student satisfaction and engagement. Structural equation modelling analysis finds that effective teaching strategies are significantly associated with students' satisfaction, and an environment conducive to online learning is significantly associated with student engagement. Since this is a cross-sectional quantitative study, no causal effects can be inferred. However, this study is the first to show the significant relationships among effective teaching strategies, learning environment, student satisfaction, and engagement. It may provide insights for kindergarten principals, teachers, parents, and other stakeholders in education because the above significant positive association may apply to improving students' online learning effectiveness through enhancing teaching effectiveness and learning environment.

Classrooms are likely to show an increase in the use of information technology (Ratheeswari, 2018). The findings in this study will aid teachers, parents, and educational stakeholders (such as government officials, non-governmental institutions, and investors) in maximising the benefits of technology for kindergarten learners across Hong Kong. The study may provide insights and directions for future research.

LIMITATIONS AND FURTHER RESEARCH

The sample in this study was from Hong Kong, so the results might not apply to other countries with different cultures and situations. This study did not include other factors affecting students' engagement, such as social, economic background and family support. Further research with longitudinal or experimental designs with additional dimensions of teaching effectiveness, learning environment, and student engagement may cast light on whether there are causal relationships among the variables and an in-depth understanding of the effects of teaching strategies and environment on online learning for kindergarten students.

Because most kindergarten students cannot read or respond to the questionnaire items such as the ones in this study, parents filled in the questionnaires based on their observations and the children's comments about online learning. Further research may be needed to test the validity of this process.

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