



Enhancing teacher–student interactions and student online engagement in an online learning environment

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Abstract

Online teaching and learning has become more prominent and prevalent with digital platforms becoming the only means of communication in lessons. The resulting limited teacher–student interactions can be an important contributing factor in the rise of ineffective learning. Therefore, it has become necessary to enhance these interactions during online lessons. This mixed-methods study investigated students' online learning experiences, social needs, and teacher–student relationships. It explored effective teaching strategies used in online classrooms with 99 secondary two students. The surveys used in this study were adapted from the Online Learning Environment Survey, Online Student Engagement Scale, and Questionnaire on Teacher Interaction.

Keywords Engagement · Online learning · Teacher–student interactions

Introduction

Ideally, students should achieve greater academic success and engagement with an increased teacher–student interaction (TSI) in a technology-enhanced learning environment, where communication can be more efficiently and effectively conducted for online teaching and learning (Gecer, 2013; Harper, 2018). During COVID-19, schools were forced to switch to online teaching with the incorporation of more student-centred, innovative, and flexible teaching strategies. However, most teachers faced challenges of engaging students effectively during online lessons because they are not physically present to monitor student learning. Teachers face limited resources and support to create an effective environment to motivate students' learning (Upton, 2006). We investigated students' perceptions of online learning challenges and social and learning needs. We also identified aspects of teaching and learning that teachers can potentially address pedagogically to promote student engagement during online lessons.

If this issue of ineffective online learning were to persist, it would hinder students' learning aspirations. Also students would miss out on experiences to learn using online learning strategies that might help them to become effective self-directed and collaborative learners

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in the long run. The rationale of the study was to contribute to teachers' understanding of students' perceptions as they experience the online learning environment. It also aimed to provide a big picture for teachers to gain insights into students' perceived needs when they design online learning tasks and engaging activities for interacting with students.

Literature review

The literature review below includes empirical studies on online learning environment, TSI, and online engagement.

Online learning environment

Online learning refers to the use of technologies for communication, including the Internet, to deliver lessons to students who are not physically in the same location (Tallent-Runnels et al., 2006). Online learning can be categorised into asynchronous and synchronous modes. Asynchronous online learning refers to flexible media-facilitated learning activities that do not require teachers and students to be online at the same time (Hrastinski, 2008). Such learning is typically supported by learning management system (LMS) and other online applications to deliver lessons flexibly to students in their own time (Hutton, 2020). Synchronous online learning refers to learning that requires teachers and students to be present at the same time to interact during video conferencing (Hrastinski, 2008). Zoom and Google Meet are video conferencing tools used for the delivery of synchronous online lessons (Hutton, 2020).

Literature has shed light on the advantages of online learning in providing opportunities to engage learners in the social and cognitive processes of knowledge construction (Quek, 2007). This can be achieved through the interactions and collaboration (Choy & Quek, 2016) afforded by the technologies, such as Google Workspace. Despite these advantages, some literature has also identified challenges related to online learning. Teachers highlighted issues regarding students' lack of focus during online lessons (Raja & Nagasubramani, 2018). Teachers face a dilemma in teaching their classes when they are forced to accept and adopt online teaching as part and parcel of their teaching. Because of Covid-19, teachers had to redesign lessons to incorporate technologies within a short period of time (Dhawan, 2020). Teachers were also overwhelmed by many digital tools available on the Internet, making it a struggle to differentiate and select appropriate tools for their lessons (Sabarinath & Quek, 2020). Such experience has caused teachers to rethink their pedagogies, selection of tools, lesson designs and classroom interactions. Students also face challenges in their online learning in that they often find it boring and unengaging, especially when their social needs are neglected in the online environment (Dhawan, 2020).

Thus far, there is limited literature found on the topic of online learning in the secondary schools. Studies were mainly conducted in higher education.

Teacher–student interaction in the online learning environment

Teacher–student interaction (TSI) refers to the way in which teachers and students communicate in their classrooms (Englehart, 2009). Because of the mutual nature of relationships, interactions are the fundamentals of relationship formation (Schaffer, 1984). Classroom environment and TSI largely contribute to relationship formation and how well the

teacher–student relationship develops in a healthy fashion (Lampi, 2006). Positive TSI is essential for high-quality teaching and learning, building a sense of community (Liberante, 2012; Wubbels & Levy, 1993), and to promoting the motivation to learn. In the online learning environment, there is limited physical interaction, which can pose challenges to teachers for building rapport and personalising interactions with students. This is an important aspect in human interaction and communication because it helps students to perform better and achieve greater academic success (Harper, 2018). It is also important to ensure that students feel comfortable and confident in online classrooms for effective learning to take place (Englehart, 2009).

As facilitators in the online classrooms, teachers facilitate student learning by assuming different roles, such as designing the lessons, teaching the lessons and managing the processes of student interactions in the online environment (Garrison, 2003). To function effectively, teachers must understand the concerns, challenges and needs of their students in the online learning environment. Therefore, TSI must be prioritised. From literature review, there are limited studies conducted on secondary school TSI in online classrooms in Singapore.

Student engagement in the online learning environment

Research on student engagement has received attention not only in the physical classroom, but also in the online learning environment. Student engagement refers to students' cognitive investment, active participation in their learning and emotional commitment to it (Suharti et al., 2021; Zepke et al., 2009). Student engagement is dependent on the learning activities designed by the teachers in the online environment. According to Martin and Bolliger (2018), the more engaged that students are, the more satisfied they become and the more motivated they are to learn and improve their performance in the online learning environment. To boost student engagement, teachers should strategise in their lesson design and provide positive learning experiences for their students. To design effective online lessons and activities, teachers should first understand their students and consider what would engage them, and then plan deliberately to meet their learning needs (Dixon, 2010).

It has been highlighted that studying students' perceptions can allow more-accurate prediction of their learning outcomes compared with using external observations and teachers' perceived teaching behaviour (Maulana et al., 2015). Students' attitudes and behaviours can be accurately determined by their perceptions of their learning environment, which has the greatest influence on their academic performance and learning behaviours (Tootoonchi, 2016). Furthermore, students' social, psychological, and pedagogical experiences affect their perceptions of their learning environment (Fraser, 1998), which then influence their approaches to learning and thus the quality of learning outcomes (Trigwell & Prosser, 1991). There is a lack of past studies reported literature of students' perceptions of online engagement in the secondary school context.

Research purpose

This study aimed to contribute to the education field through offering a comparison between students' preferred and actual online learning, engagement, and TSI. This could help inservice and preservice teachers to align their teaching pedagogies to students'

preferences, and then plan for their teaching enactment to be closer to their students' expectations. This would bridge the expectation-reality gap of teacher and student interaction in the online learning environment. Teachers also would be able to improve their online teaching strategies and behaviour for more effective online learning. To that end, this study explored students' perceptions of online learning, TSI and engagement with the following three research questions:

RQ1: What are the students' perceptions of their online learning environment and online teacher–student interaction?

RQ2: To what extent do the students' perceived online learning environment and teacher–student interaction affect their engagement during online lessons?

RQ3: What are the students' perceptions of favourable and unfavourable strategies used by teachers during online lessons?

Methodology

Research design and procedure

This study adopted a mixed-methods explanatory research design, consisting of two stages of data collection: a quantitative survey followed by a qualitative interview (Creswell & Guetterman, 2018). Because schools were concerned about their students' safety during the ongoing pandemic, schools were hesitant about face-to-face interaction between their students and the research team. Thus, all stages of the study were conducted online.

In Stage One, an online survey comprising of 115 questions (five-point Likert scale) and four short-structured questions were administered to students within one month, from April 2021 to May 2021. The online survey forms were sent to teachers in schools through email to be administered by teachers. The purpose was to gather students' perceptions of their prior online learning experiences facilitated by their teachers. In Stage Two, 10 students were randomly selected by their teachers for a Focused Group Interview (FGI) session via an online video conferencing platform ("Appendix 3") in May 2021. The purpose was to gain deeper insight to students' survey responses in Stage One. The unit of analysis used was the individual.

Sample

The criterion used for selecting student participants was prior online lesson experience during the Covid-19 period. Two schools participated in the study upon invitation. In School A, 50 secondary two students (aged 13 to 14 years) and, in School B, 49 students participated, totalling 99 students. Following the surveys, 10 students were randomly selected by their teachers for the FGI. Consent for participation was granted by the local education authority and the participating schools. Student participants were briefed by the researcher on the purpose of the research, the research methods used to record their responses, and how their responses would be analysed and reported. Student participants were assured of the confidentiality of the study and their anonymity.

Instruments

Because of the lack of an all-encompassing instrument to measure effective online learning, TSI, and engagement, there was a need to carefully assemble existing scales into a three-part survey for use in this study. Three established instruments were used: Online Learning Environment Survey (OLES) (Pearson & Trinidad, 2005; Trinidad et al., 2005), Questionnaire on Teacher Interaction (QTI) (Wubbels & Levy, 1993), and Online Student Engagement Scale (OSE) (Dixon, 2015).

OLES was used to study students' 'actual' and 'preferred' perceptions towards their online learning environment. The researchers modified OLES by choosing only eight out of nine scales. Enjoyment (EN) was excluded because there were overlaps in the questions with the interview component after content validation. OSE measured student engagement by correlating self-reports of students with the tracking of student behaviours from an online course management system (Dixon, 2015). The original QTI measures teacher behaviour and is used to study the interaction between teacher and students, with the teacher's behaviour and style of communication influencing students' learning-related behaviour (Mellor & Moore, 2003; Sivan & Chan, 2022) in different cultural contexts. The researchers modified the QTI by changing "classroom" to "online classroom". The QTI was also modified to provide the Actual and Preferred forms for the data collection of this study. Sample items from each instrument are provided in "Appendix 4".

Psychometric property of OLES, QTI and OSE

A test was conducted to ensure that the instruments used were reliable (refer to "Appendix 5"). The adapted OLES scale reliabilities ranged from 0.83 to 0.94 for different scales. The reliability of modified QTI scales ranged from 0.83 to 0.91, except for Student Responsibility/Freedom, Admonishing and Strict, which had a lower a range of 0.65 to 0.68, suggesting that further examination and revision would be desirable for future study. The Strict scale had the lowest reliability in this study, which is similar to previous research in the context of Singapore for which the reliability for Strict was the lowest of all QTI scales at 0.53 (Quek et al., 2005). The reliability of OSE scales ranged from 0.85 to 0.87.

The discriminant validity for the OLES data ranged between 0.01 and 0.83, for the QTI data ranged from 0.59 to 0.89, and for the OSE data ranged from 0.39 to 0.78. These values of the discriminant validity could be attributable to the small sample size used and to the similar profiles and less heterogeneity of student participants.

Analysis of data

All the online survey responses were downloaded into Excel and calculations were performed using SPSS version 21. The individual mean was used as the unit of analysis for the quantitative survey. The qualitative responses (from the free-response items in the survey and FGI) were coded. The FGI session was recorded with the students' permission. The recording was transcribed verbatim and analysed. The unit of analysis used for qualitative responses was based on the textual meaning.

Descriptive data analysis and *t* tests were applied to answer RQ1 for OLES. Effect sizes were calculated to evaluate the magnitude of the difference between the students'

preferred and actual scores. Multiple regression was used to answer RQ2 about the ‘actual’ results from OSE, OLES and QTI.

Students’ qualitative interview data were analysed using content analysis. The unit meaning of data was used. In the process, the researchers quantified and analysed the meanings of words, themes and concepts within the qualitative data. In this mixed-methods study, three instruments were used for the first part of the quantitative study, with the follow-up qualitative interview data being analysed based on the Engagement and Interaction in the Online Learning Environment. In the analysis of the qualitative data, the researchers coded the transcribed interview data. For the content analysis, the researchers were guided by references from Weber (1985). The FGI was conducted through an online video conferencing application. The recordings for the two sessions were transcribed verbatim and the texts were divided into units of meaning, which were then condensed and labelled with codes. The codes were compared, looking for similarities, and then sorted into subcategories and two broad categories (refer to Table 4).

Results

Students’ perceptions of their teachers’ online learning strategies

To answer RQ1, a quantitative descriptive statistical analysis was conducted for the OLES scale.

Online Learning Environment Survey (OLES)

Table 1 shows students’ perceived actual and preferred mean scores for OLES. The scores for the scales are generally high (above 3 out of 5). The perceived actual mean scores were mostly higher than the preferred experiences, except for Teacher Support (TS). Student Autonomy (SA) has the highest actual and preferred mean scores, while Student Interaction

Table 1 Item mean (M) and standard deviation (SD) and difference (effect size and *t*) between students’ actual (A) and preferred (P) scores on the adapted OLES for their online geography lessons

OLES scale	M			SD		Difference	
	A	P	Diff	A	P	Effect size	<i>t</i>
Computer usage (CU)	3.80	3.26	– 0.54	0.72	0.74	– 0.48	– 5.71**
Teacher support (TS)	3.76	4.00	0.24	0.69	0.60	0.26	2.76**
Student interaction & collaboration (SIC)	3.72	3.22	– 0.50	0.88	0.84	– 0.48	– 4.21**
Personal relevance (PR)	3.84	3.77	– 0.07	0.75	0.67	– 0.07	– 0.73
Authentic learning (AL)	3.95	3.94	– 0.01	0.73	0.74	– 0.01	– 0.18
Student autonomy (SA)	4.19	4.07	– 0.12	0.69	0.68	– 0.15	– 1.12
Equity (EQ)	4.08	3.96	– 0.12	0.68	0.70	– 0.14	– 1.24
Asynchronicity (AS)	3.83	3.79	– 0.04	0.77	0.64	– 0.04	– 0.36

** $P < 0.01$, $n = 99$, Average item mean = scale mean divided by the number of items in that scale

Effect size = difference between means divided by the pooled SD

The individual student score was used as the unit of analysis

and Collaboration (SIC) has the lowest actual and preferred mean scores. The difference the mean scores is significant for CU, TS and SIC ($p < 0.01$). The effect sizes for the statistically-significant difference in actual and preferred for CU, TS and SIC on the OLES scales are of reasonable size, ranging from 0.26 to 0.48 standard deviations, suggesting a degree of importance for actual-preferred differences. The effect size for the remaining scales is less than 0.2, signifying a negligible difference.

Computer usage (CU)

The mean score for actual computer usage (CU) experiences was significantly higher than preferred CU experiences, suggesting that students prefer to have less CU (Table 1). Despite the high average mean scores for both actual and preferred, the difference between scores is significant. This implies that students' experiences with CU is not as ideal as expected by their teachers. It is difficult for teachers to guide students on how to use the different digital platforms that are newly introduced to them. Furthermore, students lacking the technical capabilities to navigate online platforms might become frustrated when technology complicates their learning process (Abuhassna et al., 2020).

The significant difference can be accounted for by students' CU experiences. Students acknowledged the efficiency and convenience of CU, but they highlighted in the FGI that technical difficulties often hinder their online learning experiences. The lower preferred mean score could reflect the concerns and frustrations raised by several students. Schools have increased CU during the pandemic because it became the main mode of teacher–student communication. Therefore, teachers need to engage in platforms that are user-friendly and easily accessible to students.

Teacher support (TS)

Students prefer to have more teacher support (TS) (Table 1) so that they can receive more support from teachers in the online environment. Although there is high TS overall, the mean scores for their actual TS were significantly lower than their preferred scores. High actual TS suggests that teachers can continue to provide sufficient support to students in the online environment. Students observed that sufficient TS is aided by improved inbuilt functions on video-conference platforms, such as Zoom and Google Meets during live lessons. This allows teachers to identify students who require help. Students are also able to contact their teachers after their online class via email for further clarifications, replacing FTF consultations.

However, online TS is still insufficient. During the FGI, students described the struggle in seeking help from their teacher despite the ease of communication through online platforms. There is a lag time in getting help and it is difficult to raise questions in the middle of live lessons. Furthermore, there is a lack of allocated time for questions and answers after lessons. To enhance students' online learning experiences, teachers should provide them with support to overcome the challenges of online learning (Abuhassna et al., 2020).

Student interactions and collaboration (SIC)

Students prefer to have less online Student Interactions and Collaboration (SIC) (Table 1). The mean score for their actual SIC was significantly higher than their preferred SIC. Overall, their preferred mean scores are above average, indicating that students enjoy

collaborating and interacting more than in the physical classroom. Some students explained that activities and discussions are better facilitated FTF. In the online classroom, teachers are unable to facilitate discussions effectively.

Students generally perceived SIC to be favourable and enjoyed online collaboration with greater peer participation and teacher involvement. Teachers play important roles in facilitating interactions and discussions between students in the online environment (Kasandrinou et al., 2014). Advanced technology has made online synchronous lessons possible through video-conferencing, allowing real-time teacher–student communication. Thus, SIC is only feasible when teachers create these opportunities for students to discuss and exchange ideas through suitable platforms.

Predictors of students' online engagement

To answer RQ2, stepwise multiple regression analysis was conducted for OLES, QTI and OSE. This helped to identify the significant predictors from the OLES and QTI scale to predict students' online engagement outcome.

Questionnaire on Teacher Interaction (QTI)

Table 2 shows the students' perceived actual and preferred mean scores for QTI scales. These scale scores are generally high (above 3 out of 5) for the positive categories of Leadership, Understanding, Helpful/Friendly. The exception is Student Responsibility/Freedom for which actual positive interaction is lower than the preferred positive interaction. The

Table 2 Item mean (M) and standard deviation (SD), and difference (effect size and *t*) between students' actual (A) and preferred (P) scores on QTI and OSE for online geography lessons

Scale	M			SD		Difference	
	A	P	Diff	A	P	Effect size	<i>t</i>
QTI							
Leadership	3.92	4.24	0.32	0.72	0.54	0.34	3.54**
Understanding	4.03	4.39	0.36	0.67	0.52	0.42	4.12**
Helpful/friendly	4.01	4.43	0.42	0.69	0.58	0.50	5.12**
Student responsibility/freedom	2.62	3.09	0.47	0.58	0.72	0.39	5.20**
Uncertain	1.72	1.83	0.11	0.66	0.89	0.11	0.94
Admonishing	2.09	1.92	−0.17	0.53	0.74	−0.13	−1.73
Dissatisfied	1.58	1.60	0.02	0.68	0.81	0.02	0.19
Strict	2.58	2.44	−0.14	0.57	0.83	−0.13	−1.41
OSE							
Skills (SE)	3.69	4.18	0.49	0.79	0.66	0.49	4.51**
Emotions (EE)	3.95	4.27	0.32	0.72	0.65	0.38	3.22**
Participation (PTE)	3.82	3.84	0.02	0.76	0.77	0.02	0.21
Performance (PFE)	3.47	4.70	1.23	0.94	0.60	1.46	10.95**

** $P < 0.01$, $n = 99$, Average item mean = scale mean divided by the number of items in that scale

Effect size = difference between means divided by the pooled SD

The individual student score was used as the unit of analysis

effect sizes for the statistically-significant difference in actual and preferred scores for these scales are of reasonable size, ranging from 0.34 to 0.50, suggesting a degree of importance in the differences between the actual and preferred behaviour of teachers perceived by students. However, students' actual and preferred mean scores are relatively low, below the average of 3, for the negative QTI categories of Uncertain, Admonishing, Dissatisfied and Strict. The effect size for actual-preferred differences scales is less than 0.2, signifying a negligible difference.

Online Student Engagement Scale (OSE)

Table 2 shows students' perceived actual and preferred mean scores for OSE. Scale means are generally high (above 3 out of 5). The perceived mean score for actual engagement is lower than the preferred engagement. Also, the difference in the mean scores was significant for Skills, Emotional, and Performance Engagement (SE, EE and PFE) ($p < 0.01$). The effect sizes for the statistically significant difference in actual and preferred scores for SE, EE and PFE on the OSE scales are of reasonable size, ranging from 0.38 to 1.50, suggesting a degree of importance. The effect size for the Participatory Engagement (PTE) scale is less than 0.2, signifying a negligible difference.

The simple correlation (r) analysis in Table 3 shows that certain positive scales on the QTI, along with online learning strategies on the OLES, have a statistically-significant positive correlation ($p < 0.01$) with students' online engagement outcome. Teacher support (TS) and asynchronicity (AS) in the online learning environment have a positive correlation with students' online skills engagement (SE). Teachers' Understanding and Helpful/Friendly behaviour also has a positive correlation with students' online SE. Personal relevance (PR) and Student Autonomy (SA) in the online learning environment have a positive correlation with Emotional Engagement (EE). Similarly, Teachers' Understanding behaviour correlates with the students' EE. However, Dissatisfied behaviour of the teacher has a

Table 3 Simple correlations (r), multiple regression (R), standardized regression coefficients (β) between the scales of OSE and significant predictors of OLES and QTI

OSE scale	Significant predictors	β	t	r	R	R^2	Adjusted R^2	F
Skills	Teacher support	0.38	2.81**	0.61**	0.70	0.49	0.47	22.39**
	Asynchronicity	0.26	2.43*	0.58**				
	Understanding	0.51	3.45**	0.56**				
	Helpful/friendly	-0.32	-2.43*	0.34**				
Emotions	Personal relevance	0.41	5.14**	0.72**	0.81	0.66	0.65	45.45**
	Student autonomy	0.17	2.01*	0.59**				
	Understanding	0.51	5.72**	0.64**				
	Dissatisfied	0.24	3.03**	-0.21*				
Participation	Personal relevance	0.41	5.02**	0.73**	0.82	0.68	0.67	65.85**
	Student interaction and collaboration	0.32	5.03**	0.70**				
	Computer usage	0.21	2.49*	0.65**				
Performance	Authentic learning	0.67	6.01**	0.52**	0.52	0.27	0.26	36.13**

** $P < 0.01$, * $P < 0.05$

The individual student score was used as the unit of analysis

significant negative correlation with students' EE ($p < 0.05$). PR, SIC and Computer Usage (CU) in the online learning environment significantly correlated with students' Participatory Engagement (PTE). Interestingly, Authentic Learning (AL) had a positive correlation with students' online Performance Engagement (PFE).

Stepwise multiple regression analysis was conducted to determine the extent to which teachers' online teaching strategies and students' perceived TSI significantly predicted students' online engagement outcome. The results of the multiple regression identified the significant predictors (Table 3) that can explain the variance. The multiple regression analysis showed that the multiple correlation between online SE and TS, AS, Understanding and Helpful/Friendly was 0.70. The R^2 value further implies that 48.8% of the variance in students' SE could be due to their experiences in the online learning environment and their perceived online TSI.

Similarly, there is a multiple correlation of 0.81 between online EE and PR, SA, Understanding and Dissatisfied. The R^2 value also implies that 65.9% of the variance in students' EE could be predicted by their experiences in the online learning environment and their perceived online TSI. The multiple regression analysis also showed that there is a positive correlation of 0.82 between online PTE and PR, SIC and CU. The R^2 value in this case suggests that 67.5% of the variance in students' PTE can be predicted by their perceived online learning environment.

There is also an association between students' PFE and AL in their online learning environment. The R^2 value shows that 27.1% of the variance in students' PFE can be determined using AL in their online classroom. To further identify which individual OLES and QTI scales contributed most to justifying the variance in students' engagement outcomes, the standardized coefficients were also studied. The analysis showed that Understanding on the QTI scale surfaced two times, indicating that it made a significant contribution to the variance in students' SE and EE outcomes. Similarly, PR on the OLES scale also surfaced two times, indicating that it made a significant contribution to the variance in students' EE and PTE outcomes.

Skills engagement (SE) outcome

Students feel more engaged and willing to learn independently when the online learning environment supports their learning (Table 3). Teacher support (TS) and asynchronicity (AS) enhances students' online learning experiences, which in turn improve their skills engagement (SE) outcome. For instance, when students have questions, they expect their teachers to be available to guide and help them to get back on track. Through online consultations, teachers can help to identify students' learning problems and provide them with appropriate study techniques for more-effective asynchronous learning. During online learning, teachers use platforms such as SLS and Google Classroom to upload and share lesson materials with students. These platforms can be accessed by students during their own preferred time, allowing them to use the materials meaningfully before the following online lesson. Some students mentioned during the FGI that these materials enhance their learning.

When teachers demonstrate their understanding towards students, they feel more comfortable to approach teachers. In turn, the students develop positive attitudes towards their teachers, which can help to promote interactions during online lessons (Russo & Benson, 2005). This could possibly explain the relationship between teacher understanding and students' EE and SE outcomes.

Emotional engagement (EE) outcomes

Students' personal relevance (PR) in the online learning environment can impact their emotional engagement (EE) (Table 3). For example, the students mentioned that teachers using case studies in the teaching of geography had helped them to develop their inquiry skills. They were encouraged to think critically and to think of ways to apply their concepts and skills into their daily lives. On the other hand, when students get disengaged in non-interactive and impersonal online classes, teachers need to intervene by drawing relevance to their daily lives.

Students' Autonomy (SA) affects their Emotional Engagement (EE) (Table 3). When students are given autonomy, they should exercise greater responsibility and self-management. Giving students autonomy can potentially promote their intrinsic motivation (Abuhassna et al., 2020; Ryan & Deci, 2020). During the FGI, students highlighted that their self-discipline improved when they are held accountable for their own learning.

Teachers' behaviour was also found to be a predictor of student engagement in the online classrooms (Table 3). From the FGI, students appreciate their teachers making an effort to pause for check their understanding and patiently clarify their doubts. When students grow more comfortable in communicating online, participation and social bonds develop due to a shift in perceptions. Hence, students put in more effort to achieve higher-quality learning outcomes through their online engagement. Additionally, students are likely to have EE in the online lesson when the teacher is perceived to be understanding. Because the changing perceptions from exclusively FTF to online learning could be a huge jump for students, teachers need to be patient and give students more time to adapt as blended learning integrates into the curriculum.

In contrast, if a teacher exhibits dissatisfied behaviour, such as showing frustration when students do not understand the lesson, students tend to lack the motivation to learn, which translates into unfavourable EE.

Participatory engagement (PTE) outcomes

Students' participatory engagement (PTE) can be significantly predicted by their perceived online learning environment, namely, personal relevance (PR), student interaction and collaboration (SIC) and computer usage (CU) (Table 3).

As mentioned, PR piques students' interests in a subject and hence increases their participation in the online classroom. SIC is another significant predictor of the participation of students. Many students suggested that they enjoy interacting and engaging through group work and discussions. They also pointed out that they enjoy having conversations with their teacher during lessons. However, there are fewer opportunities for such interactions in online lessons.

For students' online participation to take place, CU must be present. With ease of CU and enhanced technology, students are able to easily communicate with their teachers and peers through in-built chat functions on Zoom and Google Meets, thus increasing their participation. With effective online platforms, probably there will be higher PTE.

Performance engagement (PFE) outcomes

The emphasis on education has shifted from memorisation to problem-solving skills (Gulikers et al., 2005) and students' Performance Engagement (PFE) can be predicted by

an Authentic Learning (AL) environment. When students are engaged in real-life events, their learning is enhanced. Students explained that this helps them in retrieving concepts during tests, which contributed to their academic performance.

However, the findings are not congruent with existing literature. A study by Gulikers et al. (2005) concluded that an AL environment fails to improve student performance. This misalignment could arise because existing studies focus on the context of higher education, where there is less guidance from instructors. The lack of assistance could result in the failure to improve student performance. The educational approach taken is often adapted from the constructivist model of learning, which involves student-centred collaboration and challenging students to investigate within authentic contexts (Brickell & Herrington, 2006). Teachers should plan a suitable learning sequence and scaffold its development through online support to encourage the development of critical thinking skills through an AL environment.

Students' experiences for online learning strategies during their classes

To address RQ3, students have suggested some ways in which their teacher can enhance their online learning experience. These include interactive games and activities in the lesson, as well as more TSI and learning resources for students as formative assessment to allow them to gauge their own learning. It is crucial for students to receive feedback and be informed of their learning progress. More group work and increasing participation can also enrich their online learning experiences.

Student-perceived favourable strategies used by teachers

Based on students' interviews, Table 4 shows the favourable strategies perceived by students. Most students highlighted that they enjoy online games and activities, together with the interactions with their teacher. Thus, teachers need to take note of their online interaction with students because it affects their learning and engagement. Game platforms such as Kahoot! surfaced many times when students were asked for their favourite online platforms. They explained that using Kahoot! as a form of game-based learning keeps them focused and engaged because they want to be among the top three players in the Kahoot! game. One of the students commented that "it motivates us and pushes us to do our best to try and get on that podium". Students also gave positive feedback regarding their teacher's teaching, when the lesson ended with a game of Kahoot! as a strategy to check understanding of the lesson.

Nearpod is also popular among students because it allows their teacher to provide them with interactive activities to check their understanding after every topic. One student shared that their teacher provides them with such activities to check their understanding after every subtopic, such as matching the causes and consequences of a particular phenomenon. These two applications are favourable because of the interactions and gameplay involved, which engage the students. Some students noted that they enjoy exploring new and interesting tools, which enhance their learning experiences. For example, Canva was used to showcase students' creativity. Platforms such as Padlet also expose them to new ways of collaboration and group discussions. Cole et al. (2021) have also found that student contributions and student–student interaction are important aspects of students' online

Table 4 Students’ perceived favourable online learning strategies used by teachers

Main categories	Categories	Code	Examples of tools and/or strategies
Engagement	Checking understanding	Using games to challenge students	Quizziz, Kahoot!
		Using interactive activities as formative assessment	Nearpod
	Content & case studies	Creating opportunities for questions	Q&A Session
		Making the content interesting and relatable	Making reference to students’ daily lives
		Use of real-life examples to spark curiosity	News articles, natural disaster events
Interactions	Meaningful digital tools	Application of content	Real-life problem solving scenarios
		Tools that are straightforward and simple to use	Zoom, Whatsapp to aid in communication
	Teacher–student connection	Tools that can allow students to showcase creativity	Canva, BandLab
		Positive relationship formation	Chit-chat session
		Creating a pleasant and enjoyable learning environment	Incorporating humour into online lessons
Student–student connection	Peer activities and discussions	Padlet for collaborative learning	
	Positive classroom culture	More comfortable to ask questions in the online classrooms	Teacher support and understanding

engagement. Johnson et al. (2016) suggested that teachers have become facilitators of pacing the learning process for students while educational technological tools play a more central role in allowing active student learning activities. Therefore, teachers should make use of interesting learning platforms to engage students online.

Furthermore, students want to form closer relationships with their teachers, which help to create a more-positive classroom culture. Students suggested that they would appreciate some time to be set aside for a chat-session with their teacher to improve the bond between them. This is often possible for FTF lessons, but there is still room for such improvement for TSI in the online setting. Students hope for stronger teacher–student bonds and peer communication so that they can be more comfortable in clarifying doubts in the online classroom. Some students shared similar sentiments:

Student D: More interactions will help a lot more in [our] learning.

Student G: The more we interact and know more about the teacher, the more interested we will usually be in the lesson.

Student H: Engagement between the students and Teachers allows a bond to be created, so it's not going to be so tense during the class and the class won't be so quiet. It allows the class to be livelier, and in a way, you will start to like the class more than others because you know the teacher personally.

Through the FDI, it is evident that online engagement and positive interactions result in enjoyable learning for students.

Student-perceived unfavourable strategies used by teachers

Students generally felt that asynchronous lessons lack interaction. Online platforms such as SLS, despite their great potential, were perceived as repetitive, with teachers rarely embedding apps or including interactive media and games in their lessons to allow students to interact and be involved. Students feel disengaged when teachers provide them with asynchronous one-way lesson materials, such as videos. Students felt that recorded lessons lack interaction and that one-way communication limits their ability to ask questions immediately. Concerns regarding the number of platforms used have also been raised by students, who find it a hassle to alternate between different platforms used by different teachers for their lessons. Hence, they suggested that it might be better for all their teachers to agree on one platform.

Limitations

Despite these findings, the study might not represent the whole Secondary Two student population. The pandemic limited the participation of more students in this study and time constraints limited the possibility of selecting a suitable sample size to conduct a pilot test for the online survey. If a pilot test was conducted, it would increase the validity of the research. Given more time, follow-up qualitative interviews could be undertaken to cross-check the validity of the quantitative data. Because the study involved convenience sampling, the researcher had no control over the selection of participants because this was decided by the participating schools. Future studies could consider increasing the sample size and involve more schools to ensure that responses are not skewed. Similar studies should be conducted for students of different demographics; for example, contrasts

between students' actual and preferred perceptions could be investigated separately for different genders and academic streams.

Conclusion

This study achieved its aim in answering three RQs by exploring students' perceptions of online learning, TSI and engagement. Overall, computer usage (CU) is crucial together with the necessary Teacher Support (TS) in place to facilitate learning through Student Interaction and Collaboration (SIC). This would close existing gaps between teachers' current strategies used and students' expectations of their online learning environment. Teachers can consider guiding students through the features of newly-introduced platforms to avoid discouraging students who are learning to engage in technology for their learning. This would help students to gain the computer self-efficacy needed for online learning (Hiltz & Shea, 2005). As much as SIC is important, it must be noted that the implementation of a constructivist online learning environment can be difficult because of the limitations of meeting the individual needs of each student and juggling multiple objectives (Ravitz et al., 2000) when conducting online lessons.

Students' perceived online learning environment and TSI can significantly predict their online engagement outcomes, which largely can be predicted by their online learning environment (i.e. TS, AS, SA, SIC, CU), especially personal relevance (PR). Understanding on the QTI scale also predicted online engagement among students. To help students to acknowledge the importance of the subjects, teachers should consider sharing and explaining the relevance of the content to their everyday life.

Insight into the students' preferred teaching and managing strategies used by their teachers during the online lessons was found to be useful for teachers, who can design and focus on areas that students would like to experience. Essentially, schools need to support teachers in online teaching. Many teachers are familiar with pedagogical content knowledge (PCK) but might not be equipped with technological, pedagogical and content knowledge (TPACK). TPACK is a knowledge set that is essential for teaching effectively in an online learning environment with the use of technology (Mishra & Koehler, 2006). Teachers should consider collaborating to share their technological teaching resources and management strategies with each other to enhance the online learning experiences of their students.

Appendix 1: Survey for session 1 (preferred)

Part A: About you

1. What are some online platforms that you have used for your learning? Give example(s).
2. Which mode of learning do you prefer?
 - a. Online learning
 - b. Face-to-face learning
 - c. Blended learning (The mix of both online and face-to-face learning)

3. What are some things that you enjoy about online learning?
4. What are some challenges that you have faced in online learning?
5. What would you like to experience in your next online lesson?

Part B: Your preference for online learning

No.	Preference (1- Almost Never; 2—Seldom; 3—Sometimes; 4—Often; 5—Almost Always)
1	I prefer to submit assignments online (eg. SLS, Google docs, etc.)
2	I prefer to ask the teacher questions online (eg. Email, zoom, chat function, etc.)
3	I prefer to find out information about the lesson online (e.g. Topics, content, syllabus, etc.)
4	I prefer to read teacher's lessons notes online
5	I prefer to access assessment information online (e.g. Assignment requirements, deadline, etc.)
6	I prefer to participate in online discussions with my classmates
7	If I have a question, I prefer the teacher to respond quickly
8	I prefer it when the teacher helps me identify issue areas in my study online
9	I prefer it when the teacher responds immediately to my online questions
10	I prefer it when the teacher gives me valuable feedback and comments on my assignments online
11	I prefer it when the teacher adequately addresses my questions online
12	I prefer it when it is easy to contact the teacher online
13	I prefer it when the teacher encourages my participation online
14	I prefer it when the teacher provides me with useful feedback on my work online
15	I prefer to work with others online
16	I prefer to relate my work to other's work
17	I prefer to share information with other students online
18	I prefer to discuss my ideas with other students online
19	I prefer to collaborate with other students in the class online
20	I prefer to be involved in group work as part of my activities online
21	I prefer to relate what I learn to my life outside of my classes
22	I prefer to pursue topics that interest me online
23	I prefer to apply my everyday experiences in online class
24	I prefer to link class work to my life outside of classes
25	I prefer to learn things about the world outside of my classes
26	I prefer to study real case related to the class activities
27	I prefer to use real facts in online class activities
28	I prefer to work on assignments that deal with real-world information
29	I prefer to work with real examples
30	I prefer to apply real world experience to the topic of study
31	I prefer to make decisions about my learning
32	I prefer to work during times I find convenient
33	I prefer to be in control of my learning
34	I prefer to play an important role in my learning
35	I prefer to approach learning in my own way
36	I prefer it when the teacher gives me as much attention to my questions as to other students' questions
37	I prefer to get the same amount of help from the teacher as do other students
38	I prefer to be treated the same as other students in the class
39	I prefer to receive the same encouragement from the teacher as other students do
40	I prefer to get the same opportunity to contribute to class discussions as other students

No. Preference (1- Almost Never; 2—Seldom; 3—Sometimes; 4—Often; 5—Almost Always)

- 41 I prefer it if my work receives as much praise as other students' work
 42 I prefer it when I get the same opportunity to answer questions as other students
 43 I prefer to access the discussion forum at places and times convenient to me
 44 I prefer to read posted messages at times that are convenient to me
 45 I prefer to take time to think about my messages before I post them
 46 I prefer to write and post messages because it helps me to think
 47 I prefer to have a written record of messages to refer back to
 48 I find that posting messages improves my writing skills
-

Part C: About your preferred online engagement

How well do you do the following behaviours, thoughts, and feelings describe?

No. Ideal (1—Strongly Disagree; 2—Disagree; 3—Neutral; 4—Agree; 5—Strongly Agree)

- 1 I want to study on a regular basis
 2 I want to keep myself well read
 3 I want to look over class notes before attending online lessons to make sure I understand the material
 4 I want to be organised
 5 I want to take good notes over readings, PowerPoints, and virtual lessons
 6 I want to listen and read carefully
 7 I want to put forth effort
 8 I want to find ways to make the course material relevant to my life
 9 I want to apply the contents and concepts to my life
 10 I want to find ways to make the lesson interesting to me
 11 I really want to learn the material
 12 I want to participate actively in small-group discussion. Forums
 13 I want to have fun in online chats, discussions or via email with the teachers and other students
 14 I want to help my peers
 15 I want to engage in conversations online (chat, discussions, email)
 16 I want to post in discussion forums regularly
 17 I want to get to know other students in the class
 18 I want to get good grades
 19 I want to do well on tests and quizzes
-

Part D: About your preferred teacher–student interaction

How often would you like your teacher to behave online in the way described by the sentences below?

No. Preferred (1—Never, 2—Seldom, 3—Sometimes, 4—Often, 5—Very Often)

- 1 I would like my teacher to talk enthusiastically about his/her subject
 2 I would like my teacher trusts us
 3 I would like my teacher to seems uncertain
 4 I would like my teacher to get upset unexpectedly
 5 I would like my teacher to explain things clearly
 6 If we don't agree with my teacher, I would like that we can talk about it
 7 I would like that my teacher is hesitant
-

No.	Preferred (1—Never, 2—Seldom, 3—Sometimes, 4—Often, 5—Very Often)
8	I would like my teacher to get upset quickly
9	I would like my teacher to hold our attention
10	I would like my teacher to explain things again willingly
11	I would like my teacher to act as if he/she does not know what to do
12	I would like that my teacher is quick to correct us when we break a rule
13	I would like my teacher knows everything that goes on in the online classroom
14	If we have something to say, I would like my teacher to listen
15	I would like my teacher to let us boss him/her around
16	I would like that my teacher is impatient
17	I would like my teacher to be a good leader
18	I would like my teacher to realise when we don't understand
19	I would like my teacher to be unsure of what to do when we fool around
20	I would like that it is easy to make trouble for my teacher
21	I would like my teacher to be confident
22	I would like my teacher to be patient
23	I would like that it is easy to make a fool out of my teacher
24	I would like my teacher to make unpleasant remarks
25	I would like my teacher to help us with our work
26	I would like if we can decide some things in my teacher's class
27	I would like my teacher to think that we cheat
28	I would like my teacher to be strict
29	I would like my teacher to be friendly
30	I would like if we can influence my teacher
31	I would like my teacher to think that we don't know anything
32	I would like that we have to be silent in my teacher's class
33	I would like my teacher to be someone we can depend on
34	I would like my teacher to let us fool around in the online class
35	I would like my teacher to put us down
36	I would like that my teacher's tests are hard
37	I would like that my teacher has a sense of humour
38	I would like that my teacher lets us get away with a lot in his/her online class
39	I would like my teacher to think that we can't do things well
40	I would like that my teacher's standards are very high
41	I would like that my teacher can take jokes
42	I would like that my teacher gives us a lot of free time in the online class
43	I would like that my teacher seems dissatisfied
44	I would like my teacher to be strict when marking papers
45	I would like my teacher's class to be pleasant
46	I would like my teacher to be lenient
47	I would like my teacher to be suspicious
48	I would like that we are afraid of my teacher

Appendix 2: Survey for session 2 (actual)

Part A: Your actual online learning

No.	Actual (1- Strongly disagree, 2—Disagree, 3—Neutral, 4—Agree, 5—Strongly Agree)
1	I submit assignments online
2	I ask my teacher questions online
3	I find out information about the lesson online
4	I read teacher's notes online
5	I access assessment information online
6	I participate in online discussions with my classmates
7	If I have a question, my teacher responds quickly
8	My teacher helps me identify issue areas in my study online
9	My teacher responds immediately to my online questions
10	My teacher gives me valuable feedback and comments on my assignments online
11	My teacher adequately addresses my questions online
12	It is easy for me to contact my teacher online
13	My teacher encourages my participation online
14	My teacher provides me with useful feedback on my work online
15	I work with others online
16	I relate my work with others online
17	I share information with other students online
18	I discuss my ideas with other students online
19	I collaborate with other students in the class online
20	I am involved in group work as part of my activities online
21	I relate what I learn to my life outside of my classes
22	I am able to pursue topics that interest me online
23	I can apply my everyday experiences in online class
24	I can link my class work to my life outside of classes
25	I learn things about the world outside of my classes
26	I study real case related to the online class activities
27	I use real facts in online class activities
28	I work on assignments that deal with real-world information
29	I work with real examples
30	I apply real world experiences to the topic of study
31	I make decisions about my learning
32	I work during times I find convenient
33	I am in control of my learning
34	I play an important role in my learning
35	I approach learning in my own way
36	My teacher gives me as much attention to my questions as to other students' questions
37	I get the same amount of help from my teacher as do other students
38	I am treated the same as other students in class
39	I receive the same amount of encouragement from the teacher as other students do
40	I get the same opportunity to contribute to class discussions as other students
41	My work receives as much praise as other students' work
42	I get the same opportunity to answer questions as other students

No.	Actual (1- Strongly disagree, 2—Disagree, 3—Neutral, 4—Agree, 5—Strongly Agree)
43	I can access the discussion forum at places and times convenient to me
44	I read posted messages at times that are convenient to me
45	I am able to take time to think about my messages before I post them
46	I write and post messages because it helps me to think
47	I have a written record of messages to refer back to
48	Posting messages improves my writing skills

Part B: About your actual online engagement

How well do you do the following behaviours, thoughts, and feelings describe?

No.	Actual (1—Strongly Disagree; 2—Disagree; 3—Neutral; 4—Agree; 5—Strongly Agree)
1	I make sure to study on a regular basis
2	I keep myself well read
3	I look over class notes before attending online lessons to make sure I understand the material
4	I am organised
5	I take good notes over readings, PowerPoints, and virtual lessons
6	I listen and read carefully
7	I put forth effort
8	I find ways to make the course material relevant to my life
9	I apply the contents and concepts to my life
10	I find ways to make the lesson interesting to me
11	I really want to learn the material
12	I participate actively in small-group discussion. Forums
13	I have fun in online chats, discussions or via email with the teachers and other students
14	I help my peers
15	I engage in conversations online (chat, discussions, email)
16	I post in discussion forums regularly
17	I get to know other students in the class
18	I get good grades
19	I do well on tests and quizzes

Part C: About your actual teacher–student interaction

No.	Actual (1—Never, 2—Seldom, 3—Sometimes, 4—Often, 5—Very Often)
1	My teacher talks enthusiastically about his/her subject
2	My teacher trusts us
3	My teacher seems uncertain
4	My teacher gets upset unexpectedly
5	My teacher explains things clearly
6	If we don't agree with my teacher, we can talk about it
7	My teacher is hesitant
8	My teacher gets upset quickly
9	My teacher holds our attention
10	My teacher is willing to explain things again
11	My teacher acts as if he/she does not know what to do

No.	Actual (1—Never, 2—Seldom, 3—Sometimes, 4—Often, 5—Very Often)
12	My teacher is quick to correct us when we break a rule
13	My teacher knows everything that goes on in the online classroom
14	If we have something to say, my teacher will listen
15	My teacher lets us boss him/her around
16	My teacher is impatient
17	My teacher is a good leader
18	My teacher realises when we don't understand
19	My teacher is not sure what to do when we fool around
20	It is easy to make trouble for my teacher
21	My teacher is confident
22	My teacher is patient
23	It is easy to make a fool out of my teacher
24	My teacher makes unpleasant remarks
25	My teacher helps us with our work
26	We can decide some things in my teacher's class
27	My teacher thinks we cheat
28	My teacher is strict
29	My teacher is friendly
30	We can influence my teacher
31	My teacher thinks that we don't know anything
32	We have to be silent in my teacher's class
33	My teacher is someone we can depend on
34	My teacher lets us fool around in the online class
35	My teacher puts us down
36	My teacher's tests are hard
37	My teacher has a sense of humour
38	My teacher lets us get away with a lot in his/her online class
39	My teacher thinks that we can't do things well
40	My teacher's standards are very high
41	My teacher can take jokes
42	My teacher gives us a lot of free time in the online class
43	My teacher seems dissatisfied
44	My teacher is strict when marking papers
45	My teacher's class is pleasant
46	My teacher is lenient
47	My teacher is suspicious
48	We are afraid of my teacher

Appendix 3: Session 3 (online video conference)

Part E: Focused group interview questions

1. Do you enjoy your online learning classes? Please elaborate.
 - a. What makes it interesting for you?
 - b. What do you not like about online classes?
2. Do you like the online interaction with your teacher? Please provide examples.
 - a. Are there a lot of opportunities for you to interact with your teacher?
 - b. If yes, do you like it and why?
 - c. If no, what do you think your teachers can do?
3. Do you find yourself being engaged in learning online? Give examples.
 - a. What are some platforms or apps that your teacher use to make you feel engaged?
 - b. What apps tend to bore you?
 - c. Do you think teacher and student interaction is important to engage you in the online classroom? Why and why not?
4. Do you think teacher and student interaction is important to engage you in the online classroom? Why and why not?

Appendix 4: Scales and sample items for OLES, QTI and OSE

Scales	Description	Sample items
OLES		
Computer Usage (CU) (Six items)	"... students use their computers as a tool to communicate with others and to access information."	2 <i>I prefer to ask the teacher questions online</i>
Teacher Support (TS) (Eight items)	"... the teacher helps, befriends, trusts and is interested in students."	7 <i>If I have a question, I prefer the teacher to respond quickly</i>
Student Interaction & Collaboration (SIC) (Six items)	"... students have opportunities to interact with one another, exchange information and engage in collaboration."	20 <i>I prefer to be involved in group work as part of my activities online</i>
Personal Relevance (PR) (Six items)	"... there is a connection between students' out of school experiences."	25 <i>I prefer to learn things about the world outside of my classes</i>

Scales	Description	Sample items
Authentic Learning (AL) (Four items)	"... students have the opportunity to solve real world problems that are authentic."	27 <i>I prefer to use real facts in online class activities</i>
Student Autonomy (SA) (Five items)	"... students have opportunities to initiate ideas and make their own learning decisions, and the locus of control is student oriented."	35 <i>I prefer to approach learning in my own way</i>
Equity (EQ) (Seven items)	"... students are treated equally by the teacher."	38 <i>I prefer to be treated the same as other students in the class</i>
Asynchronicity (AS) (Six items)	"... the asynchronous nature of the discussion forum promotes reflective thinking and the posting of messages at times convenient to the students."	44 <i>I prefer to read posted messages at times that are convenient to me</i>
QTI		
Leadership (Six items)	"Teacher provides leadership to the online class and holds students' attention"	9 <i>I would like my teacher to hold our attention</i>
Understanding (Six items)	"Teacher shows understanding/ concern/care for students in the online class"	10 <i>I would like my teacher to explain things again willingly</i>
Uncertain (Six items)	"Teacher exhibits uncertainty in the online class"	23 <i>I would like that it is easy to make a fool out of my teacher</i>
Admonishing (Six items)	"Teacher shows anger/temper/ impatience in the online class"	24 <i>I would like my teacher to make unpleasant remarks</i>
Helpful/Friendly (Six items)	"Teacher is friendly and helpful towards students in the online class"	25 <i>I would like my teacher to help us with our work</i>
Student Responsibility/Freedom (Six items)	"Students are given opportunities to assume responsibility for their own activities in the online class"	26 <i>I would like if we can decide some things in my teacher's class</i>
Dissatisfied (Six items)	"Teacher shows unhappiness/ dissatisfaction with students in the online class"	39 <i>I would like my teacher to think that we can't do things well</i>
Strict (Six items)	"Teacher is strict with and demanding of students in the online class"	32 <i>I would like that we have to be silent in my teacher's class</i>
OSE		
Skills (SE) (Six items)	"... using time and energy to learn materials and skills; what students "do.""	2 <i>I want to look over class notes before attending online lessons to make sure I understand the material</i>
Emotions (EE) (Five items)	"... how connected they feel to the course/content, which is especially important in online courses; how applicable they feel it is."	10 <i>I want to find ways to make the lesson interesting to me</i>
Participation (PTE) (Six items)	"... interacting in a meaningful way with others in the class; enjoying the content/course."	13 <i>I want to have fun in online chats, discussions or via email with the teachers and other students</i>

Scales	Description	Sample items
Performance (PFE) (Two items)	“... students’ desire/goal to succeed in the course.”	18 <i>I want to get good grades</i>

Appendix 5: Psychometric property of instruments

Internal consistency (alpha reliability coefficient) for students’ actual (A) and preferred (P) scores on the adapted OLES, QTI and OSE in their online geography lessons.

Scale	No. of items	Alpha reliability
OLES		
Computer Usage (CU)	6	0.83
Teacher Support (TS)	8	0.90
Student Interaction & Collaboration (SIC)	6	0.94
Personal Relevance (PR)	6	0.90
Authentic Learning (AL)	4	0.87
Student Autonomy (SA)	5	0.90
Equity (EQ)	7	0.93
Asynchronicity (AS)	6	0.87
QTI		
Leadership	6	0.88
Understanding	6	0.83
Helpful/Friendly	6	0.88
Student Responsibility/Freedom	6	0.68
Uncertain	6	0.84
Admonishing	6	0.68
Dissatisfied	6	0.91
Strict	6	0.65
OSE		
Skills	6	0.85
Emotions	2	0.87
Participation	6	0.86
Performance	2	0.85

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