



Student motivation and engagement in online language learning using virtual classrooms: Interrelationships with support, attitude and learner readiness

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Received: 22 August 2023 / Accepted: 23 January 2024

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Abstract

Online language learning with virtual classrooms (OLLVC) is becoming a reality to a large number of students across contexts. Yet students' motivation and engagement in OLLVC remains underexplored. The current study evaluated 6364 university students' motivation and engagement in OLLVC and its interrelationships with environmental support, learner attitude and readiness in the Chinese higher education context. This study employed the adapted motivation and engagement scale and adopted purposive sampling to recruit a sample of undergraduate students, who were engaged in online English learning using VC. The data were examined using structural equation modeling via Mplus 7.4. Results showed that students were generally motivated and engaged in OLLVC and there were significant individual differences across age, English proficiency, gender, academic ranking, and major. Moreover, student evaluation of their readiness for OLLVC mediated the relationships between support and attitude for online learning and student motivation and engagement in OLLVC. These findings call for attention to the importance of taking student readiness as a mediating mechanism in students' motivation and engagement in OLLVC. Implications for supporting virtual-classroom-mediated online language learning are also discussed.

Keywords Student motivation and engagement · Virtual classroom · Support · Attitude · Online learning readiness

1 Introduction

Online language learning with virtual classrooms (OLLVC) used to flourish mainly in the private education sector (Manegre & Sabiri, 2022) but now is becoming a reality for a massive number of students around the world after a prolonged period of online teaching due to the COVID-19 pandemic (Tao & Gao, 2022). Virtual classrooms refer to online teaching and learning environments where teachers and learners engage and

Extended author information available on the last page of the article

interact synchronously and asynchronously with learning materials and other members in a learning community (Copur-Gencturk et al., 2022; Manegre & Sabiri, 2022). According to International Association of Universities and UNESCO (2020), over two-thirds of higher education institutions among 185 countries have experienced a massive shift from classroom teaching and learning to online teaching using virtual classrooms (VC) during the pandemic (Pham & Ho, 2020). As a result, over 1.5 billion university students in 185 countries have the experience of OLLVC (Moser et al., 2021). In the current post-pandemic era, given the affordances of flexibility, accessibility and efficiency in constructing a personalized and interactive learning environment when compared to other education tools (Berry, 2019; Carbajal-Carrera, 2021), OLLVC has become an essential part of the new normal in higher education across the globe.

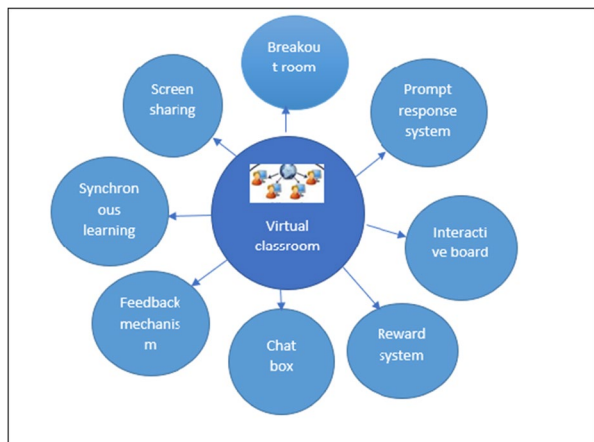
Underlying the growing popularity of OLLVC, there is an assumption that often takes contemporary language learners as someone familiar with digital technologies and hence would be motivated towards using OLLVC (Burnett & Merchant, 2018; Moorhouse, 2023). Such assumption is rooted in an uncritical portrait of contemporary learners as “digital natives” (Prensky, 2001) and risks ignoring the possible interrelationships of motivation and engagement with other factors such as environmental support, learner attitude and preparedness for OLLVC. Yet to date, although there is no lack of studies reporting the benefits of OLLVC (Berry, 2019; Carbajal-Carrera, 2021; Manegre & Sabiri, 2022), whether and how students are motivated and engaged towards OLLVC remains underexplored. Such research inadequacy makes it difficult for us to understand whether and how students’ OLLVC can be better facilitated for more effective use of OLLVC. Moreover, prior studies (Jiang et al., 2024; Martin, 2007, 2012; Yu et al., 2019) show that motivation and engagement are interconnected, and they need to be examined as an integrated entity with multifaceted dimensions. Nevertheless, prior studies (e.g., Lin et al., 2017) on online language learning, motivation, and engagement tend to examine these constructs in isolation, with scant attention to the interrelationships among them. It is also unclear whether and how student motivation and engagement (ME) in OLLVC may be related to factors such as environmental support, individual attitude and learner readiness. Considering the importance of motivation and engagement in predicting students’ OLLVC success, research on OLLVC motivation and engagement and relationships with other factors is much needed. To address the gaps, this study conceptualizes OLLVC motivation and engagement as integrated and multifaceted and explored Chinese undergraduate students’ ME in OLLVC and how their ME relates to both external (i.e., support) and internal factors (i.e., attitude, readiness). This study contributes a validated OLLVC ME model and reveals the mediating mechanism of learner readiness, shedding new light on the characteristics of OLLVC motivation and engagement in the increasingly digitalized higher education landscape.

1.1 Virtual classrooms (VC) and OLLVC: Literature review

1.1.1 Prior studies on VC: Definition, example, and rationales

Virtual classrooms have been defined as online environments that enable learners and teachers to communicate synchronously and asynchronously through means of audio, video, chat box, interactive whiteboard, instant response systems, and online learning management systems (Al-Nuaim, 2012; Manegre & Sabiri, 2022; Parker & Martin, 2010). Compared to other stand-alone learning technologies such as Moodle, virtual classrooms integrate multiple online interaction and learning management technologies and resemble physical classrooms by supporting online real-time interaction, immediate feedback, just-in-time response, and group discussions (Manegre & Sabiri, 2022). Specifically, as learning platforms, VC are web-based systems designed by education agents or digital companies such as *LearnCube* and *ICourse*. The systems are often embedded with a real-time classroom that contains video conferencing tools (e.g., Zoom, Tecent Meeting), which allow students to hear and see their teachers. At the time of class, each student can access his/her registered classroom using their personal computers or mobile devices with an individual account created on the platform websites (Manegre & Sabiri, 2022). While some features may vary, most virtual classroom systems contain an attendance checking system, a chat-box where students and teachers can exchange messages, a feedback system, and a lesson recording function that allows for lesson recording and replay at a later time. The recording and replay function also add an asynchronous mode to virtual classrooms. In virtual classroom systems for young learners, other features include a reward system (e.g., point/token system, digital badges, leaderboards, ranking system) and an automatically loaded textbook, on which both students and teachers can use the whiteboard function to annotate or draw with a pen function. Rationales of using VC include interactivity, synchrony, ease of use, and developing a sense of community (Al-Nuaim, 2012; Parker & Martin, 2010). A diagram of a typical virtual classroom is presented in Fig. 1.

Fig. 1 An example of a virtual classroom



1.1.2 Prior studies on OLLVC: Benefits and perceptions

Previous research has mainly examined the benefits of OLLVC, including flexibility, interaction, and assistance for those in under-resourced areas or those of limited mobility (de Oliveira et al., 2021; Hampel & Stickler, 2012; Hartwick, 2018; Vo et al., 2017). The video and text features of virtual classrooms often afford flexibility for OLLVC to be integrated into the flipped instruction model that engages students with MOOCs or digital resources prepared by teachers (Erbil & Kocabaş, 2020; MacIntyre et al., 2020). Moreover, although the classrooms are virtual, there are opportunities for students to have direct interactions with teachers and peers and get immediate feedback, and these interactions and feedback can facilitate student motivation and engagement with OLLVC (Berry, 2019). In addition, OLLVC can bring classes to those students with limited access to educational resources, with a positive impact on solving the imbalance of education.

Driven by these benefits, prior studies (e.g., Manegre & Sabiri, 2022) reported that many language teachers recommended OLLVC as an alternative to traditional classroom language teaching. These teachers believed that teaching English online in VC created a positive learning environment where they get to know students better than in other teaching environments, and that students in VC learn at the same rate or faster than in traditional language classrooms. A recent study on UAE university students' experiences of VC learning also reported positive responses from students (Islam et al., 2023). Underlying these positive perceptions is an assumption that students would naturally be motivated and engaged in OLLVC. Yet more empirical evidence is needed to examine such assumptions. There is also limited attention to the interrelationships between OLLVC motivation and engagement with other factors such as individual attitude, learner preparedness, and environment support and hence the important mediating mechanisms, if any, remain to be further explored. To further reveal the characteristics of OLLVC motivation and engagement, and its relationships with other factors, the next section presents an integrated framework of OLLVC motivation and engagement, as well as a hypothesized model that guides the study.

1.2 An integrated framework for OLLVC motivation and engagement

To conduct a more integrative examination of OLLVC motivation and engagement, this study draws on the Motivation and Engagement Wheel (MEW), which is multidimensional framework representing cognitive and behavioral dimensions of motivation and engagement developed by Martin (2007). Different from theories (e.g., such as the self-determination theory and the theory of engagement) that conceptualize motivation and engagement as separated constructs, the MEW framework states that motivation and engagement are closely related to each other, with motivation working as an inner factor comprising of private psychological and unobservable activities and engagement as publicly observable factors expressed in behavioral, affective, and cognitive involvements in an

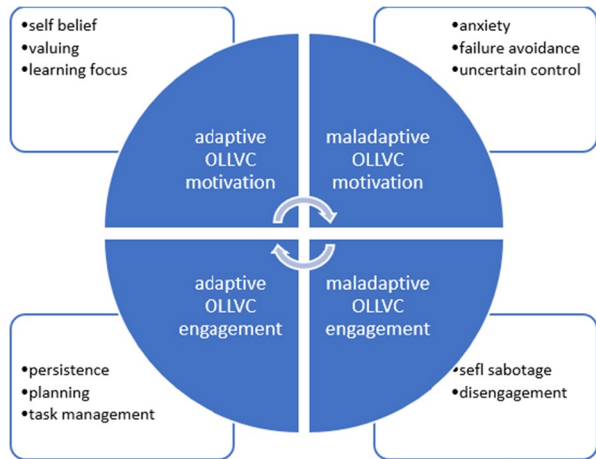
activity (Kahu, 2013). The MEW framework is underpinned by classical motivation theories such as the goal theory, self-worth theory, and the expectancy-value theory. A major contribution is its integration of motivation with engagement, which is further conceptualized in terms of four interconnected factors, including adaptive motivation (i.e., positive orientations toward learning), adaptive engagement (i.e., students' positive behaviors in learning), maladaptive motivation (i.e., orientations that impede learning), and maladaptive engagement (i.e., students' negative behaviors that impede learning; Martin, 2008).

Specifically, adaptive motivation refers to positive motivation and includes self-belief (students' beliefs in their own ability to learn well), learning focus (developing focused strategies in learning), and valuing (valuing the usefulness, relevance and importance of learning tasks/activities); adaptive engagement (positive engagement behaviors) includes persistence (the extent to which students sustain their engaged learning), planning (the extent to which learners plan for their learning), and task management (the ways students manage their learning and tasks); maladaptive motivation (orientations impeding learning) includes anxiety (feeling anxious and worried), failure avoidance (learning in order to avoid failure), and uncertain control (uncertain of how to do well); maladaptive engagement (negative behaviors that impede learning) includes self-sabotage (self-handicapping behaviors) and disengagement (giving up) (Martin, 2007, 2008; Yin, 2018). Overall, the MEW suggests that students' motivation and engagement is an interconnected entity comprising four major components at the higher order level (i.e., adaptive motivation, adaptive engagement, maladaptive motivation, maladaptive engagement) and 11 sub-components (e.g., valuing, learning focus, disengagement) at the second order level. Based on the comprehensive framework of MEW, a measurement tool of motivation and engagement as integrated has been developed, i.e., the Motivation and Engagement Scale (MWS), which has been tested to be a valid measurement for students' ME across multiple contexts including L2 writing in the Chinese EFL contexts (Yu et al., 2019).

This study extends the application of the MEW framework to online language learning that involves virtual classrooms (OLLVC). By centering on students' ME in OLLVC, we conceptualize students' OLLVC ME as interconnected and multi-dimensional, with multiple dimensions and relevance to students' language learning in online environments. The conceptual framework for OLLVC can be seen in Fig. 2.

Aligning with prior research (e.g., Yu et al., 2019) on how students' ME were different across demographic features such as gender, major studies, and university types, the current study extends this line of research into the context of OLLVC in order to present a fuller picture of individual differences in student ME in OLLVC, which is essential in student achievement but so far has gained little research attention. In addition to demographic differences, the current study also explores the interrelationships of OLLVC Motivation and Engagement with other social (environmental support) and individual factors (learner attitude, readiness). A hypothesized model of the interrelationships is presented in the next section.

Fig. 2 An integrated framework for OLLVC motivation and engagement



1.3 Interrelationships between learner attitude, readiness, support and OLLVC motivation and engagement: A hypothesized model

To specify how student motivation and engagement can be better supported, this study also examines the interrelationships among motivation and engagement, environmental support, learner attitude and readiness. As such, this study expands the behavioral and cognitive dimensions of MEW by considering how ME as an integrated entity may be mediated by individual and social factors. The attention to these factors is informed by Dornyei's (1997) works on L2 motivation and motivational factors, which include learner-specific components (attitude, readiness), teacher-specific components (teacher support), and context-specific components (environmental support). Specifically, technological failures or problematic internet connections often result in negative experiences that lead to demotivation and disengagement (Authors, 2021). Researchers also noted that learning is optimal when teachers are physically present because students may pay less respect and attention to teachers in online environments (Jiang et al., 2022; Zhao & McDougall, 2008). Such findings highlight the relevance of learner attitudes to their participation and engagement in OLLVC. Research also suggests that learner motivation and engagement tend to be shaped by their attitudes towards online learning (Ku & Lohr, 2003; Magen-Nagar & Shonfeld, 2018; Zhan et al., 2011) and effective language learners usually have positive attitudes (Alhamami, 2022; Hao, 2016) and are more prepared for OLL (Yilmaz, 2017). It is thus important to examine the role of learners' attitude towards OLLVC in predicting OLLVC motivation and engagement.

Apart from lacking positive attitudes towards OLL (Doman & Webb, 2017), previous research also showed that online learning failure or dropouts are usually caused by lacking motivation and engagement, which are often the result of lacking various support from others (e.g., schools, teachers, peers) (Cho & Summers, 2012; Authors, 2020; Wardrip, 2021). A considerable number of studies have also shown that school and teacher support can facilitate student engagement in online learning (Cho & Kim, 2013; Cho & Cho, 2014). Yet these findings remain to be

validated in the context of OLLVC as it appears that the notion of support has been uncritically taken as being conducive to motivation and engagement. More research is warranted to examine whether and how environment support for OLL and students' attitudes towards OLL would shape student motivation and engagement in OLLVC.

Moreover, learner readiness is also an important issue to be considered (Authors, 2021). Learner readiness refers to whether students are ready for or capable of learning in online environments (Hao, 2016). While online learning technologies may improve, students may not be prepared for the updated technologies for OLLVC and this could lead to negative learning experiences. Parkes et al. (2015) noted that although students may be familiar with digital technologies, they may not be well prepared for OLL activities, which require being clear and concise in response, participating in online discussions, making arguments, and working with others. Previous studies also showed that a lack of readiness can lead to decrease in student motivation for online language learning (Jiang et al, 2021; Yilmaz, 2017). Therefore, to promote student motivation and engagement, adequate school and teacher support are essential in not only nurturing student attitudes, but also enhancing students' online learning readiness (Authors, 2021; Yu et al., 2019). However, so far, to the best of our knowledge, little empirical research has been conducted in the context of OLLVC and little attention has been paid to how online language learning support and attitudes may be associated with students' ME via OLLVC readiness. In other words, more research addressing the mediation of online learning readiness in the relationships between the above factors is warranted.

To address the research gap, we hypothesize that OLLVC support and attitude predict OLLVC readiness, which, in turn, predicts students' ME in OLLVC. A hypothesized model is constructed to represent the mediation mechanism between OLLVC motivation and engagement, environmental support, learner attitude, and learner readiness (see Fig. 3).

Based on Fig. 3, a set of hypotheses can be developed as follows:

H1: OLLVC support relates positively to OLLVC motivation and engagement.

H2: OLLVC attitude relates positively to OLLVC motivation and engagement.

H3: OLLVC support and attitude predict learner readiness for OLLVC.

H4: The positive relationship between OLLVC support and OLLVC motivation and engagement is mediated by learner readiness.

H5: The positive relationship between OLLVC attitude and OLLVC motivation and engagement is mediated by learner readiness.

To test the hypotheses, we first developed an adapted motivation and engagement scale (see the method section) and tested its construct validity in the researched context. We then examined the demographic differences in ME in OLLVC and explored the interrelationships among motivation and engagement, learner attitude, learner readiness, and support. The specific research questions that guided the study include: (1) What is the validity of the adapted OLLVC motivation and engagement scale in the researched context? (2) What are the demographic differences of students' motivation and engagement in OLLVC? (3) What are the relationships between OLLVC

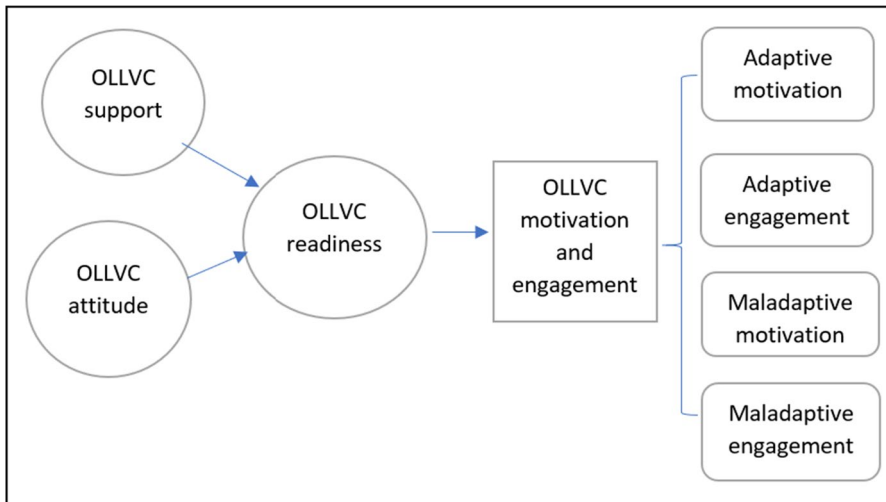


Fig. 3 A hypothesized mode of inter-relationships between support, attitude, readiness, and OLLVC motivation and engagement

motivation and engagement, OLLVC support, and learner attitude and readiness for OLLVC?

2 Method

2.1 Contexts

The current study was situated in China, whose educational responses during the COVID-19 pandemic has been proved to be effective (Yang, 2020). Before the pandemic, the Ministry of Education in China has established several online e-learning platforms and certified over 3000 MOOCs at national level (Yang, 2020). Private education brands that use OLLVC such as VIPKIDS or 51Talk are popular in China. The outbreak of the pandemic created an opportunity for China's Ministry of Education to expedite its curricular initiatives. During university closures, thousands of MOOCs were made free to the public and VC technology providers such as *Ketangpai* and *Tecent* offered free OLLVC packages for universities to implement the government-led "suspending class without stopping learning" policy. Universities were swift in acting and teachers were guided through workshops to engage students with OLLVC. Such background offers a unique context for the present study to be conducted.

2.2 Sampling and data collection procedures

Purposive sampling was adopted to recruit a sample of undergraduate students who were engaged in online English learning using VC. The targeted universities across

Table 1 Descriptive statistics for the demographic characteristics of the sample ($N=6364$)

	<i>n</i> (%)	Range	<i>M</i> (<i>SD</i>)
Major ($N=6330$)			
Liberal arts	3226 (50.96%)		
Science	3104 (49.04%)		
Gender ($N=6364$)			
Male	1949 (30.63%)		
Female	4415 (69.37%)		
English proficiency level	3372 (52.99%)	0–5	2.55 (1.06)
Prior English achievement rank	6364 (100%)	1–4	2.42 (.83)
Age	6311 (99.17%)	16–28	19.78 (.91)

China were selected from southern, northeastern, western, and eastern and central China. All the participants attended online English classes using VC supported by *Ketangpai* and *Tecent* when they participated in this study. The targeted curricular context is representative because the English class they attended was *College English* class, which is a nation-wide compulsory English for general and academic purposes course for students not majoring in English in the Chinese higher education.

Data collection began with our email contacts with 10 teachers who had the experience of using VC during the pandemic. Then through snowball method, we managed to get in touch with college English teachers from 30 universities and the survey link was sent to them to administrate the introduction of the study and the online survey. This study was approved by the institutional review board at the first researcher's university. The data collection process lasted two months.

Overall, 7134 students completed the survey, and 770 responses were removed because of repeated submissions, and/or a similar pattern of responses to all the items. Finally, 6364 participants across 11 Chinese universities were retained as the final sample (response rate was 89.21%). There were no differences between the final 6364 participants and the 7134 students on major demographic variables based on a multivariate analysis of variance test with all demographic variables included as dependent variables ($ps < .05$). Among the final 6364 participants, 1949 (30.63%) were females (mean age = 19.78 years old). About half of them were with science majors (3104, 49.04%). The descriptive statistics for the sample are presented in Table 1.

2.3 Instruments/measures

The validity for all the constructs is displayed in Table 2. A bilingual version was used, with instruments stated in both English and Chinese. To guarantee content validity, the English scale was first translated into Chinese by an experienced translator, and then back translated into English by another experienced translator. Any discrepancies were then double checked by the researchers and any disagreements were resolved through discussions.

Table 2 Construct validity for measures based on Confirmatory Factor Analyses ($N=6364$)

	χ^2	df	p	RMSEA		CFI	\sqrt{SRMR}
				Estimate	90%CI		
Support for online learning	34.240	2	< .001	.050	[.036, .066]	.985	.013
Attitude towards online learning	24.536	1	< .001	.061	[.041, .083]	.994	.003
Online learning readiness	71.683	4	< .001	.052	[.042, .062]	.996	.011
OLLVC motivation and engagement	1223.933	38	< .001	.070	[.067, .073]	.961	.033

2.3.1 Support for online learning

Support for online learning was measured with a scale adapted from the Support for online Flipped Teaching scale (Lai et al., 2018). This scale was selected because it was developed in a similar Chinese context with a composite reliability ranged from 0.888 to 0.962. The scale was appropriate for the purpose of examining OLLVC in this study because OLLVC in the researched context was often integrated with a flipped approach to OLL (Jiang et al., 2022). This modified 4-item scale is intended to evaluate how students believe that their school, instructors, and parents support OLLVC (e.g., “the university provides technical and software resources for online learning”). The item was rated from 1 (*strongly disagree*) to 7 (*strongly agree*). The four items were constructed as indicators of the latent variable of support for online learning. Cronbach’s α was .86 in this study.

2.3.2 Attitude towards online learning

The attitude towards OLLVC scale intended to assess students’ opinions about online learning, which affects students’ thoughts, feelings, and behaviors in their online learning processes (Durak, 2018). A sample item of the 4 items was, “as compared to traditional classes, I prefer online classes.” For each item, students rated ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The four items were used as indicators of the latent variable of attitude towards online learning. Cronbach’s α was .85 in this study.

2.3.3 Online learning readiness

The online learning readiness scale (Hao, 2016; Yilmaz, 2017) has five subscales: online learning self-efficacy (6 items, e.g., “I am able to download the preview materials and in-class courseware from online learning platform”), online learning control (5 items, e.g., “I am able to implement my learning plan according to teachers’ instruction in online classes”), online learning preference (4 items, e.g., “I am fond of learning in online classes”), online class communication self-efficacy (4 items, e.g., “I can confidently engage in online class discussion with teachers”), and

doing previews (5 items, e.g., “I am willing to watch pre-recorded instruction videos ahead of class”). For each item, students rated on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Cronbach’s α s for subscales ranged from .78 to .89.

2.3.4 OLLVC motivation and engagement

The 11-item adapted Motivation and Engagement Scale for University/College Students was used to measure students’ OLLVC ME (Martin, 2008). The items were adapted to refer to OLLVC. Students were asked to rate on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Sample item includes “*If I try hard, I believe I can do my online English learning well.*” The 11 dimensions and the four second-order dimensions were described in the introduction section. Sound reliability and validity have been demonstrated in prior college student samples (Jiang et al., 2024; Lin & Huang, 2017).

As for the factor structure of students’ OLLVC ME, we examined three alternative factor structures, including a first-order 11-factor structure (Model A), a first-order 4-factor structure (Model B), and a second-order 4-factor structure (Model C). These three nested models were compared using chi-square difference tests and differences in CFI ($>.01$ as significant; Chen, 2007; Vandenberg & Lance, 2000). Both chi-square difference tests and CFI differences suggested that Model B fits significantly better than Model A ($\Delta\chi^2 = 4595.385$, $\Delta df = 6$, $p < .001$; $\Delta RMSEA > .01$) and Model C ($\Delta\chi^2 = 1452.115$, $\Delta df = 2$, $p < .001$; $\Delta RMSEA > .01$). Cronbach’s α s were satisfactory (.72 to .89) for the four second-order factors.

2.3.5 Demographics

Students also reported their major, gender (1 = male, 2 = female), English proficiency level (ranging from 0 = junior level to 5 = fifth level),¹ age in years, and prior English achievement rank in the last final exam (1 = rank top 25% in your class; 2 = 25% to 50%, 3 = 50%–75%, and 4 = 75% to 100%). Based on National Specialty Classification, students’ majors were further classified into art or science majors (0 = liberal arts, 1 = science).

2.4 Analytic procedure

Hypotheses were examined using structural equation modeling via Mplus 7.4 (Muthén & Muthén, 1998–2017). The skewness for all variables were between -1 and 1 , and the kurtosis for all variables were between -2 and 2 except for age (2.21). Missing data were only present in students’ age (53, 0.83% missing), major (34, 0.53% missing), and English proficiency level (2992, 47.01% missing). No missing

¹ Junior level, <90 , level 1, 90–99, level 2, 100–109, level 3, 110–119, level 4, 120–129, level 5, >130 . According to students’ scores in English test (total score: 150) in the national matriculation examinations.

data were observed on key study variables. Although results of the Little's Missing Completely at Random (MCAR) test was significant ($\chi^2=206.984$, $df=143$, $p<.001$). Given the normed chi-square of 1.45 was acceptable (i.e., $\chi^2/df<2$; Bollen, 1989), the present study adopted the full information maximum likelihood method to handle missing values (FIML, Acocck, 2005). We tested a model (Fig. 1) in which support for OLLVC and attitude towards OLLVC were simultaneously specified as exogenous variables that predicted online learning readiness, which, in turn, predicted students' motivation and engagement in OLLVC. Students' gender, age, prior English ranking, major, and English proficiency level were included as control variables.

Model fit indices includes (Kline, 2011): Chi-Square statistic (χ^2 ; ideally non-significant but expected significant for most models when sample size is large; Byrne, 2013), the comparative fit index (CFI) $>.90$, the root-mean-square error of approximation (RMSEA) $<.08$, and the standardized root-mean-square residual (SRMR) $<.08$. We used the default missing value handling method, the full-information maximum likelihood method (FIML, Acocck, 2005; Muthén & Muthén, 1998–2017). Bootstrapping was used to assess indirect effects (Preacher & Hayes, 2008) to obtain standard errors and confidence intervals (CIs) based on 5000 resampling. If the 95% bootstrapped CIs around the unstandardized indirect effects do not include zero, the indirect effect is considered as significant.

3 Results

Table 3 displays the descriptive statistics and bivariate intercorrelations.

3.1 Prevalence of OLLVC motivation and engagement

The mean ratings for adaptive motivation and engagement were larger than the mid-point of the rating ($t=60.95$, $p=.001$, 95% CI, [.838, .894] for adaptive motivation; $t=82.05$, $p=.001$, 95% CI, [1.072, 1.125] for adaptive engagement); the average ratings for maladaptive motivation and engagement were smaller than 4 ($t=-35.40$, $p=.001$, 95% CI, [-.556, -.498] for adaptive motivation; $t=-53.08$, $p=.001$, 95% CI, [-.929, -.862] for adaptive engagement). Overall, undergraduate students reported relatively higher levels of OLLVC ME.

3.2 Individual differences in OLLVC motivation and engagement

We examined differences in Chinese undergraduates' OLLVC ME across demographic niches. The model fit the data well (Table 4): $\chi^2=1691.437$, $df=73$, $p<.001$, RMSEA = .059 with 90% CI [.057, .061], CFI = .960, SRMR = .025. Students majoring in science reported lower levels of adaptive motivation ($\beta=-.041$, $p=.019$) and adaptive engagement ($\beta=-.059$, $p=.001$), and higher levels of maladaptive motivation ($\beta=.062$, $p<.001$) and maladaptive engagement ($\beta=.071$, $p<.001$) than did those with a major in art. Male students reported higher levels of

Table 3 The descriptive statistics for the key study variables

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1. SFOL indica- tor1	5.44	1.31	-																						
2. SFOL indica- tor2	5.58	1.18	.79	-																					
3. SFOL indica- tor3	5.46	1.22	.76	.78	-																				
4. SFOL indica- tor4	5.34	1.48	.46	.50	.52	-																			
5. ATOL indica- tor1	3.97	1.56	.25	.26	.26	.12	-																		
6. ATOL indica- tor2	3.91	1.51	.26	.26	.27	.11	.83	-																	
7. ATOL indica- tor3	4.97	1.39	.35	.38	.36	.38	.41	.41	-																
8. ATOL indica- tor4	4.48	1.33	.35	.38	.39	.23	.66	.68	.52	-															
9. Online learn- ing self- effi- cacy	5.61	0.95	.47	.55	.53	.41	.24	.24	.39	.36	-														

Table 3 (continued)

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
10. Online learning control	5.23	0.99	.49	.56	.55	.39	.30	.32	.42	.46	.69	–													
11. Online learning preference	4.67	1.25	.41	.45	.45	.29	.63	.62	.52	.65	.49	.57	–												
12. Perceived behavioral control	4.66	1.15	.44	.47	.50	.32	.39	.42	.40	.50	.53	.63	.61	–											
13. Doing Pre-views	5.12	1.09	.55	.59	.60	.40	.38	.40	.46	.51	.55	.67	.61	.61	–										
14. Self-belief	4.62	1.33	.42	.45	.45	.26	.62	.64	.53	.74	.43	.53	.67	.59	.60	–									
15. Valuing	4.98	1.21	.47	.51	.52	.34	.51	.53	.54	.65	.49	.56	.63	.57	.63	.78	–								
16. Learning	5.00	1.26	.41	.44	.45	.29	.42	.42	.43	.55	.42	.49	.51	.49	.55	.63	.70	–							
17. Planning	4.76	1.25	.43	.46	.48	.29	.45	.48	.43	.58	.43	.59	.55	.59	.64	.69	.69	.66	–						

Table 3 (continued)

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
18. Task age- man- ment	5.26	1.16	.50	.55	.54	.36	.37	.38	.46	.52	.53	.65	.53	.57	.65	.61	.67	.62	.71	-	-	-	-	-	-
19. Persis- tence	5.28	1.13	.49	.56	.54	.36	.34	.35	.45	.50	.53	.64	.51	.57	.65	.59	.67	.62	.68	.84	-	-	-	-	-
20. Anxi- ety	3.85	1.51	-.17	-.20	-.19	-.22	-.28	-.27	-.39	-.33	-.31	-.32	-.35	-.34	-.30	-.35	-.30	-.24	-.28	-.26	-.24	-	-	-	-
21. Failure avoid- ance	2.97	1.44	-.27	-.32	-.30	-.36	-.17	-.15	-.45	-.28	-.40	-.40	-.32	-.33	-.36	-.32	-.37	-.31	-.32	-.40	-.41	.46	-	-	-
22. Uncer- tain control	3.60	1.48	-.23	-.26	-.26	-.28	-.21	-.22	-.40	-.31	-.37	-.38	-.32	-.37	-.33	-.33	-.32	-.28	-.32	-.31	-.31	.48	.46	-	-
23. Self- sabo- tage	3.27	1.42	-.32	-.35	-.34	-.35	-.33	-.32	-.52	-.43	-.41	-.50	-.45	-.45	-.46	-.48	-.47	-.41	-.46	-.49	-.48	.50	.56	.59	-
24. Disen- gage- ment	2.93	1.44	-.35	-.41	-.38	-.40	-.35	-.34	-.59	-.46	-.46	-.50	-.50	-.44	-.49	-.50	-.53	-.45	-.46	-.53	-.53	.46	.57	.52	.77

N = 6364. All coefficients are significant at *p* < .001. *SFOL* Support for online learning, *ATOL* Attitude towards online learning

Table 4 Differences in the students' L2 online ME across demographic variables ($N=6364$)

	Adaptive motivation	Adaptive engagement	Maladaptive motivation	Maladaptive engagement
Sciences vs. Arts	-.041*	-.059**	.062***	.071***
Male vs. Female	.015	-.012	.066***	.053**
English	.116***	.106***	-.100***	-.095***
Age	-.065**	-.074**	.082***	.069***
Rank	-.104***	-.170***	.125***	.125***
R ²	.033***	.056***	.049***	.045***

$N=6364$. * $p < .05$, ** $p < .01$, and *** $p < .001$ (two-tailed)

maladaptive motivation ($\beta = .066$, $p < .001$) and maladaptive engagement ($\beta = .053$, $p = .002$) than their female counterparts.

Additionally, students who had higher levels of English proficiency demonstrated higher levels of adaptive motivation ($\beta = .116$, $p < .001$) and adaptive engagement ($\beta = .116$, $p < .001$), and lower levels of maladaptive motivation ($\beta = -.100$, $p < .001$) and maladaptive engagement ($\beta = -.095$, $p < .001$). Older students reported lower levels of adaptive motivation ($\beta = -.065$, $p = .002$) and engagement ($\beta = -.074$, $p = .001$), and higher levels of maladaptive motivation ($\beta = .082$, $p < .001$) and engagement ($\beta = .069$, $p < .001$) than younger students. Moreover, students with lower ranking in class reported lower levels of adaptive motivation ($\beta = -.104$, $p < .001$) and engagement ($\beta = -.170$, $p < .001$), and higher levels of maladaptive motivation ($\beta = .125$, $p < .001$) and maladaptive engagement ($\beta = .125$, $p < .001$) than did those with high ranking.

3.3 Support, attitude, and OLLVC motivation and engagement: The mediating role of readiness

We then proceed to examining the mediating model (Fig. 4), which demonstrated a good fit to the data: $\chi^2 = 7966.997$, $df = 315$, $p < .001$, RMSEA = .062 with 90% CI [.061, .063], CFI = .910, SRMR = .050. Controlling for the covariates, support for OLLVC was associated directly and positively with both adaptive and maladaptive motivations and engagements ($\beta = .072$, $p = .001$ for adaptive motivation, $\beta = .062$, $p = .001$ for adaptive engagement, $\beta = .140$, $p < .001$ for maladaptive motivation, and $\beta = .067$, $p < .001$ for maladaptive engagement). H1 was thereby supported. Attitude towards OLLVC was associated directly and positively with adaptive motivation ($\beta = .633$, $p < .001$) and engagement ($\beta = .093$, $p < .001$), and related directly and negatively to maladaptive motivation ($\beta = -.126$, $p < .001$) and engagement ($\beta = -.242$, $p < .001$). H2 was partially supported.

Moreover, both support for OLLVC and attitude towards OLLVC were associated positively with online learning readiness ($\beta = .517$, $p < .001$ for support and $\beta = .488$, $p < .001$ for attitude), which, in turn, was associated positively with adaptive motivation ($\beta = .309$, $p < .001$) and adaptive engagement ($\beta = .734$, $p < .001$), and related negatively to maladaptive motivation ($\beta = -.652$, $p < .001$)

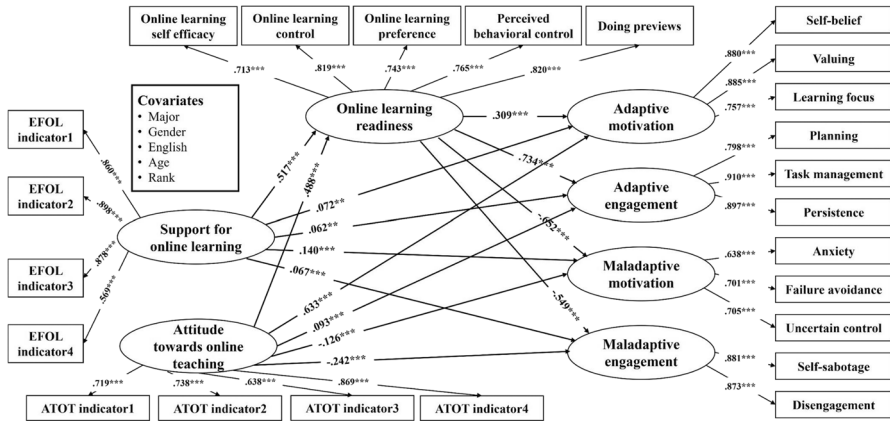


Fig. 4 The mediating role of readiness in associations between support, attitude, and Chinese undergraduate students’ ME in online English learning ($N=6364$)

Table 5 The mediating role of readiness in associations between support, attitude with adaptive and maladaptive motivation and engagement

Indirect effects	Bootstrap estimation based on deviation correction			
	<i>B</i>	<i>SE</i>	95%CI	β
Support → Readiness → Adaptive motivation	.166***	.019	[.132, .205]	.159***
Support → Readiness → Adaptive engagement	.335***	.017	[.303, .369]	.379***
Support → Readiness → Maladaptive motivation	-.290***	.022	[-.334, -.249]	-.337***
Support → Readiness → Maladaptive engagement	-.316***	.025	[-.366, -.265]	-.283***
Attitude → Readiness → Adaptive motivation	.157***	.015	[.128, .189]	.151***
Attitude → Readiness → Adaptive engagement	.316***	.019	[.280, .354]	.358***
Attitude → Readiness → Maladaptive motivation	-.273***	.019	[-.314, -.239]	-.318***
Attitude → Readiness → Maladaptive engagement	-.298***	.023	[-.345, -.255]	-.268***

$N=6364$. * $p < .05$, ** $p < .01$, *** $p < .001$

and maladaptive engagement ($\beta = -.549$, $p < .001$). H3, H4 and H5 were thereby supported. The mediating effects of readiness in the associations between support and OLLVC motivation and engagement, and in the associations between attitude towards OLLVC motivation and engagement are shown in Table 5. The effect sizes were between medium and large in magnitude (i.e., .151 to .379).

Overall, online language learning readiness served as an important linking mechanism that help explain how support for OLLVC and attitude towards OLLVC promote students’ OLLVC ME. Note that support for OLLVC may be a two-edged sword, contributing directly to both adaptive and maladaptive ME.

4 Discussion

4.1 Overall motivation and engagement level

Different from prior studies (e.g., Lin et al., 2017; Islam et al., 2023) that examine motivation and engagement in isolation, this study represents one early attempt to examine motivation and engagement as integrated and multifaceted in the context of OLLVC. Given the multi-dimensionality and interconnected nature of student ME, this study examined university students' ME in OLLVC in the Chinese English education context. The surveyed university students in China were generally motivated and engaged in OLLVC. Such results mirror most of the previous findings that suggest using VC for OLL can be motivating and engaging for students (Berry, 2019; de Oliveira et al., 2021; Manegre & Sabiri, 2022). One important reason for such findings may lie in the affordance of real-time interactions with teachers and peers in OLLVC environments and the interactions can create a sense of being cared among L2 students and teachers who were affected by the unexpected COVID-19 outbreak. This finding lends further support to previous reports (Islam et al., 2023) of the positive evaluation of using VC in online language learning.

4.2 Individual differences

This study also captured individual differences in OLLVC ME in the Chinese educational contexts. Specifically, students of science majors reported higher levels of maladaptive factors (e.g., uncertain control and disengagement) than did students majoring in Arts, who reported higher scores in adaptive factors (e.g., self-belief and persistence). It is conceivable that science students tend to have relatively lower level of English proficiency and thus may discourage their active participation in OLLVC (Hao, 2016; Jiang et al., 2021). In addition, in our experience as university instructors in the Chinese EFL context, it may also be related to science students' comparatively lower level of willingness to turn on video cameras in OLLVC (the underlying reasons for this merit further research). While in physical classrooms, students' motivation and engagement can be facilitated by teachers through physical expressions and body languages, which are often absent when students turn off their video cameras and thus chances for teachers to monitor students' engagement may be limited.

The findings also reveal significant gender differences, with male students having higher levels of maladaptive motivation (i.e., anxiety, failure avoidance, uncertain control) and maladaptive engagement (i.e., self-sabotage, disengagement) than females for OLLVC. Although both parties valued OLLVC and can plan for their OLL in VC environments, male students may be more likely to worry about failure to control their OLLVC than females. This finding differs from Hung et al.'s (2010) study, which suggests that male and female students have similar orientations towards academic learning online. One important reason could be that male students may be less prepared for OLLVC than females, although previous studies reported no differences between male and female university students in terms of computer

competences and readiness in OLLVC (Hung et al., 2010). It also indicates that students' readiness for OLLVC cannot be reduced to mere computer competences as OLLVC readiness in itself is multifaceted.

The importance of English proficiency and academic ranking in predicting OLLVC ME is also supported. As the findings showed, students with higher English proficiency and academic ranking in their classes reported higher adaptive ME and lower maladaptive ME. Such finding lends further support to the observation that students who are more proficient in English may have higher levels of ME in learning, including OLLVC (Cho & Kim, 2013; Yu et al., 2019). This finding also indicates a worrying possibility that the proficiency and achievement gaps among students may be further widened in OLLVC (Jiang et al., 2021; Yilmaz, 2017). Whether and how support for OLLVC can be customized for students of diverse language proficiencies and academic performances merit further research attention.

Last but not least, age differences were also revealed in the findings, with older students reported higher levels of maladaptive ME and lower levels of adaptive ME than students of younger age. One reason may be that students of older age may be less motivated to English learning as they could be more engaged with their own major studies, which often become intensive for senior students in the Chinese education system (Yu et al., 2019). Such findings also echo previous research that reveals a declining tendency in student motivation and engagement in language learning when they progress through university years (Lee et al., 2018; Yu et al., 2019). More effective strategies are needed to tackle the maladaptive factors in student ME in OLLVC, especially for those senior students.

4.3 The roles of online learning support, attitude, and readiness

Compared to previous studies on applying the Motivation and Engagement Wheel (MEW) and Scale in other settings such as student motivation and engagement in L2 writing (e.g., Yu et al., 2019), this study goes beyond the behavioral and cognitive dimensions as specified in the MEW framework and include the examination of social factors through the lenses of environmental support. The study contributes to extant literature on online language learning, motivation, and engagement by revealing a very important mediation mechanism, i.e., the role of learner readiness for OLLVC in mediating the complex inter-relationships between OLLVC support, learner attitude, and OLLVC motivation and engagement. Specifically, the current study examined the role of online learning support and attitude in relation to students' ME in OLLVC through student readiness in online learning environments. School and teacher support for online learning and students' attitudes for online language learning predicted students' adaptive motivation (i.e., self-belief, valuing, learning focus) and adaptive engagement (e.g., planning, task management, and persistence) in OLLVC. This finding reinforces the importance of online learning support and attitude in OLLVC environments (Cho & Kim, 2013; Cho & Cho, 2014; Copur-Gencturk et al., 2022). Students with more positive attitude also reported lower scores in maladaptive ME. This means that a positive attitude towards OLLVC may reduce students' anxiety and increase their feelings of control, with a reduced

possibility to avoid failure and disengage in OLLVC. Further research is warranted to gather more empirical data in support of this observation.

Similar findings, however, did not apply to online language learning support. As manifested by the findings, students who reported higher level of support also reported high scores in their maladaptive motivation (i.e., anxiety, failure avoidance, uncertain control) and maladaptive engagement (i.e., self-sabotage, disengagement). This finding is unexpected as it indicates that more support for OLLVC in the experience of the researched participants may have led to higher levels of anxiety and uncertainty in control, leading to negative behaviors such as disengagement. While the negative relation between support and ME remains a hypothesis to be further tested, we speculate two possible reasons in the researched context. One reason may be related to the quality of support offered to students. During the pandemic, several VC platforms and online learning tools (e.g., *Tecent meeting*, *Ketangpai*, *Rain Classroom*, *Icourse*, *WeChat*, *Dingding talk*) from various internet companies had been recommended by the governments and universities to the students. It was not exaggerating to say that some students may have been bombarded with various tools and platforms as they need to manage several tools and platforms at the same time. With many choices at their disposal, it is natural that, though with more resource support, students may find it overwhelming to manage OLLVC, and this can lead to disengagement and decrease in motivation. Future research can adopt qualitative probing methods such as in-depth interviews to further verify such speculation.

Another reason may be due to the failure of the support to prepare students adequately for OLLVC during the time of pandemic. The findings provided empirical evidences to the conclusion that online learning support and attitude were associated with online learning readiness, which in turn promoted adaptive motivation (i.e., self-belief, valuing, learning focus) and adaptive engagement (i.e., planning, task management, persistence), and reduced maladaptive motivation (i.e., anxiety, failure avoidance, uncertain control) and maladaptive engagement (i.e., self-sabotage, disengagement). This finding echoed previous report of the importance of online learning readiness as an important predictor of student motivation and engagement (Cho & Cho, 2014; Yilmaz, 2017). What the current study adds to the extant literature is that online learning readiness turned out to be an important mechanism to explain how supports and attitude would contribute to student ME in OLLVC. This highlights the importance of taking students' online learning readiness as an important goal to achieve when enhancing students' online learning attitude with various sources of support for OLLVC.

One important caveat is the need to avoid taking online learning readiness as a monolithic construct. As displayed in Fig. 4, online learning readiness comprises at least five dimensions (i.e., online learning self-efficacy, online learning control, online learning preference, perceived behavioral control, doing preview). The nurturing of readiness thus requires multiple forms of support, which cannot be reduced to offering access to VC, data package, or digital devices. The mindset that assumes a direct causal relationship between rendering support of access to VC learner readiness for OLLVC should thus be refuted. Further research on how students' online learning readiness may be promoted is warranted.

5 Conclusion

Along with technology advancements, OLLVC continues to be a focus in both private and public education sectors. While previous studies have mainly examined the benefits of using OLLVC (Manegre & Sabiri, 2022), this study evaluated students' motivation and engagement for OLLVC based on a large-scale investigation in the Chinese EFL context during the pandemic. The current study also revealed that student evaluation of their readiness for online learning mediated the relationships between support and attitude for online learning and student motivation and engagement in OLLVC. In line with previous studies conducted in online environments, students' readiness for OLLVC is critical for promoting students' motivation and engagement because it explains whether and why online learning support and attitude make a significant contribution to the student motivation and engagement in OLLVC. This study thus provides a practical guideline for effective strategies for online educators and policy makers who strive to promote student ME in OLL that takes VC as an essential component.

The study is not without limitations. First, given the dramatic individual differences in Chinese undergraduate students across regions, this study may not present a full picture of Chinese students' ME in OLLVC, although over 6000 from different universities had participated in the study. Then, given the potential response bias derived from self-report data, multiple sources of data, including observation and interview, are warranted in future research so as to better situate students' ME in specific contexts. Future studies may also involve the perspectives of teachers to better understand how students' ME for OLLVC can be supported and sustained.

Despite the limitations, the study delineates the multifaceted nature and individual differences in student ME for OLLVC and it offers several critical implications for practice and future research. First, it is important to note the complex nature of student ME across a range of individual factors, including gender, age, English proficiency, and majors (Martin, 2008; Yu et al., 2019). Instead of taking students as either motivated or demotivated, engaged or disengaged, it is important to attend to the subcomponents of the four factors of ME to better understand Chinese students' affect, perceptions, and behaviors (Martin, 2007, 2008). Aligning with Martin's (2007, 2010) theorizing of motivation and engagement as interconnected, future research should employ an integrative perspective to examine how OLLVC motivation and engagement are integrated as a multifaceted entity and process. Second, to improve students' overall ME for OLLVC, school and instructor support are necessary, together with students' positive attitude towards OLLVC. Yet what is even more important is to take students' readiness levels into consideration when planning and organizing support for students (Jiang et al., 2021; Jung et al., 2019). In addition to technical support (e.g., offering data package for VC access), support that caters for learners' affective, cognitive, and social needs during OLLVC should also be carefully planned and made available to students (Islam et al., 2023). For instance, personalized support from teachers such as virtual office hours, individual video conferences, or online discussion forums can be set up for students to ask open questions, seek clarifications, and share learning experiences. Community-building

activities such as online peer reviews in virtual classrooms can be scheduled to help students feel connected and supported when engaging with OLLVC. Given the individual differences, the support made available to students should be customized for students of diversity in, for instance, age, gender, and major studies. There is a need to resist the one-size-fits-for-all model when offering support. Otherwise, as manifested by the findings, the support can lead to student anxiety and feeling of helplessness and disengagement in OLLVC. Future research can explore what and how various forms of support can be provided at an optimal level of learner readiness for better preparation of students for OLLVC. The findings of the study can also be scaled up by expanding the attention to online learning of other subjects such as math, based on which, cross-subject and cross-curriculum comparisons can be conducted to reveal a more complete picture of student motivation and engagement in VC-mediated online learning.

Acknowledgements We thank the staff of this project for their unending contributions to this work and the teachers who made this research possible.

Authors' contributions Lianjiang Jiang: Conceptualization, data curation, writing-original draft, review & editing. Nan Zhou: Conceptualization, data curation and analysis, writing, review & editing. Yuqin-Yang: Data analysis, validation, writing.

Funding Preparation of this article was supported by the Fujian Province Undergraduate Education and Teaching Reform Project (FBJG20190086) to Lianjiang Jiang.

Data availability The data that support the findings of this study are available from the authors upon reasonable request.

Declarations

Conflict of interest The authors declare that they have no conflicts of interest.

References

- Acock, A. C. (2005). Working with missing values. *Journal of Marriage and Family*, 67(4), 1012–1028. <https://doi.org/10.1111/j.1741-3737.2005.00191.x>
- Alhamami, M. (2022). Language learners' attitudes toward online and face-to-face language environments. *Frontiers in Psychology*, 13, 926310. <https://doi.org/10.3389/fpsyg.2022.926310>
- Al-Nuaim, H. (2012). The use of virtual classrooms in e-learning: A case study in King Abdulaziz University, Saudi Arabia. *E-Learning and Digital Media*, 9(2), 211–222. <https://doi.org/10.2304/elea.2012.9.2.211>
- Bollen, K. (1989). *Structural equations with latent variables*. Wiley.
- Burnett, C., & Merchant, G. (2018). *New media in the classroom: Rethinking primary literacy*. Sage Publications Ltd..
- Byrne, B. M. (2013). *Structural equation modeling with Mplus: Basic concepts, applications, and programming*. Routledge.
- Carbajal-Carrera, B. (2021). Mapping connections among activism interactional practices and presence in videoconferencing language learning. *System*, 99, 102527. <https://doi.org/10.1016/j.system.2021.102527>
- Cho, M.-H., & Cho, Y. (2014). Instructor scaffolding for interaction and students' academic engagement in online learning: Mediating role of perceived online class goal structures. *The Internet and Higher Education*, 21, 25–30. <https://doi.org/10.1016/j.iheduc.2013.10.008>

- Cho, M.-H., & Kim, B. J. (2013). Students' self-regulation for interaction with others in online learning environments. *The Internet and Higher Education*, 17, 69–75. <https://doi.org/10.1016/j.iheduc.2012.11.001>
- Copur-Gencturk, Y., Thacker, I., & Cimpian, J. R. (2022). Teacher bias in the virtual classroom. *Computers & Education*, 191, 104627. <https://doi.org/10.1016/j.compedu.2022.104627>
- Doman, E., & Webb, M. (2017). The flipped experience for Chinese University students studying English as a foreign language. *TESOL Journal*, 8(1), 102–141. <https://doi.org/10.1002/tesj.264>
- Dornyei, Z. (1997). Motivational factors in second language attainment: A review of research in Hungary. *Acta Linguistica Hungarica*, 44(1–2), 261–275.
- Durak, H. Y. (2018). Flipped learning readiness in teaching programming in middle schools: Modelling its relation to various variables. *Journal of Computer Assisted Learning*, 34(6), 939–959. <https://doi.org/10.1111/jcal.12302>
- Erbil, D. G., & Kocabaş, A. (2020). Flipping the 4th grade social studies course in a cooperative way: Effects on academic achievement and motivation. *Studies in Educational Evaluation*, 66, 100878.
- Hampel, R., & Stickler, U. (2012). The use of videoconferencing to support multimodal interaction in an online language classroom. *ReCALL*, 24(2), 116–137.
- Hao, Y. (2016). Middle school students' flipped learning readiness in foreign language classrooms: Exploring its relationship with personal characteristics and individual circumstances. *Computers in Human Behavior*, 59, 295–303.
- Hartwick, P. (2018). Investigating research approaches: Classroom-based interaction studies in physical and virtual contexts. *ReCALL*, 30(2), 161–176.
- Islam, M., Mazlan, N., Murshidi, G., Hoque, M., Karthiga, S., & Reza, M. (2023). UAE university students' experiences of virtual classroom learning during Covid 19. *Smart Learning Environments*, 10(1), 1–16. <https://doi.org/10.1186/s40561-023-00225-1>
- Jung, Y., Kim, Y., Lee, H., Cathey, R., Carver, J., & Skalicky, S. (2019). Learner perception of multimodal synchronous computer-mediated communication in foreign language classrooms. *Language Teaching Research*, 23(3), 287–309. <https://doi.org/10.1177/1362168817731910>
- Kahu, E. R. (2013). Framing student engagement in higher education. *Studies in Higher Education*, 38(5), 758–773. <https://doi.org/10.1080/03075079.2011.598505>
- Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). Guilford.
- Ku, H. Y., & Lohr, L. L. (2003). A case study of Chinese student's attitudes toward their first online learning experience. *Educational Technology Research and Development*, 51, 95–102. <https://doi.org/10.1007/BF02504557>
- Lai, H. M., Hsiao, Y. L., & Hsieh, P. J. (2018). The role of motivation, ability, and opportunity in university teachers' continuance use intention for flipped teaching. *Computers & Education*, 124, 37–50. <https://doi.org/10.1016/j.compedu.2018.05.013>
- Lee, I., Yu, S., & Liu, Y. (2018). Hong Kong secondary students' motivation in EFL writing: A survey study. *TESOL Quarterly*, 51(1), 176–187. <https://doi.org/10.1002/tesq.364>
- Lin, S. H., & Huang, Y. C. (2017). Assessing college student engagement: Development and validation of the student course engagement scale. *Journal of Psychoeducational Assessment*, 36(7), 694–708. <https://doi.org/10.1177/0734282917697618>
- Lin, C., Zhang, Y., & Zheng, B. (2017). The roles of learning strategies and motivation in online language learning: A structural equation modeling analysis. *Computers & Education*, 113, 75–85. <https://doi.org/10.1016/j.compedu.2017.05.014>
- MacIntyre, P. D., Gregersen, T., & Mercer, S. (2020). Language teachers' coping strategies during the Covid-19 conversion to online teaching: Correlations with stress, wellbeing and negative emotions. *System*, 94, 102352.
- Magen-Nagar, N., & Shonfeld, M. (2018). Attitudes, openness to multiculturalism, and integration of online collaborative learning. *Educational Technology & Society*, 21(3), 1–11.
- Martin, A. J. (2007). Examining a multidimensional model of student motivation and engagement using a construct validation approach. *British Journal of Educational Psychology*, 77(2), 413–440. <https://doi.org/10.1348/000709906x118036>
- Martin, A. J. (2008). Enhancing student motivation and engagement: The effects of a multidimensional intervention. *Contemporary Educational Psychology*, 33(2), 239–269. <https://doi.org/10.1016/j.cedpsych.2006.11.003>
- Moser, K. M., Wei, T., & Brenner, D. (2021). Remote teaching during COVID-19: Implications from a national survey of language educators. *System*, 97, 102431.

- Parkes, M., Stein, S., & Reading, C. (2015). Student preparedness for university e-learning environments. *The Internet and Higher Education*, 25, 1–10. <https://doi.org/10.1016/j.iheduc.2014.10.002>
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879–891. <https://doi.org/10.3758/BRM.40.3.879>
- Prensky, M. (2001). Digital natives, digital immigrants. *Horizon*, 9(5), 1–6. <https://doi.org/10.1108/10748120110424816>
- Tao, J., & Gao, X. (2022). Teaching and learning languages online: Challenges and responses. *System*, 107, 102819.
- Vo, H. M., Zhu, C., & Diep, N. A. (2017). The effect of blended learning on student performance at course-level in higher education: A meta-analysis. *Studies in Educational Evaluation*, 53, 17–28.
- Wardrip, P. S. (2021). Educators enacting online learning support roles in remote educational experiences. *Education Technology Research and Development*, 69, 213–216. <https://doi.org/10.1007/s11423-020-09883-1>
- Yilmaz, R. (2017). Exploring the role of e-learning readiness on student satisfaction and motivation in flipped classroom. *Computers in Human Behavior*, 70, 251–260. <https://doi.org/10.1016/j.chb.2016.12.085>
- Yin, H. (2018). What motivates Chinese undergraduates to engage in learning? Insights from a psychological approach to student engagement research. *Higher Education*, 76(5), 827–847. <https://doi.org/10.1007/s10734-018-0239-0>
- Yu, S., Zhou, N., Zheng, Y., Zhang, L., Cao, H., & Li, X. (2019). Evaluating student motivation and engagement in the Chinese EFL writing context. *Studies in Educational Evaluation*, 62, 129–141.
- Zhan, Z., Xu, F., & Ye, H. (2011). Effects of an online learning community on active and reflective learners' learning performance and attitudes in a face-to-face undergraduate course. *Computers & Education*, 56(4), 961–968. <https://doi.org/10.1016/j.compedu.2010.11.012>
- Jiang, L., Meng, H., & Zhou, N. (2021). English learners' readiness for online flipped learning: Interrelationships with motivation and engagement, attitude, and support. *Language Teaching Research*, 0(0). <https://doi.org/10.1177/13621688211027459>
- Jiang, L., Zang, N., Zhou, N. & Cao, H. (2022). English teachers' intention to use flipped teaching: interrelationships with needs satisfaction, motivation, self-efficacy, belief, and support. *Computer Assisted Language Learning*, 35(8), 1890–1919. <https://doi.org/10.1080/09588221.2020.1846566>
- Berry, S. (2019). The role of video and text chat in a virtual classroom: How technology impacts community. *Educational Technology and Resources for Synchronous Learning in Higher Education*. <https://doi.org/10.4018/978-1-5225-7567-2.ch009>
- Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling*, 14, 464–504. <https://doi.org/10.1080/10705510701301834>
- Cho, M. H., & Summers, S. (2012). Factor validity of the motivated strategies for learning questionnaire in asynchronous online learning environments (AOLE). *Journal of Interactive Learning Research*, 23, 5–28. Retrieved October 3, 2020 from <https://www.learntechlib.org/primary/p/34129/>
- de Oliveira, M., Sporn, Z., Kliemann, L., Borschke, A., & Meyering, M. (2021). Online language learning and workplace communication: A study on Babbel's virtual-classroom solution. *Computer Assisted Language Learning*. Online Advanced Publication. <https://doi.org/10.1080/09588221.2021.2002364>
- Hung, M.-L., Chou, C., Chen, C.-H., & Own, Z.-Y. (2010). Learner readiness for online learning: Scale development and student perceptions. *Computers & Education*, 55(3), 1080–1090. <https://doi.org/10.1016/j.compedu.2010.05.004>
- International Association of Universities (2020). Covid-19: Higher education challenges and responses. Retrieved October 3, 2020 from <https://www.iau-aiu.net/Covid-19-Higher-Education-challenges-and-responses>
- Jiang, L., Zhou, N., Gu, M. & Li, X. (2024). Exploring student motivation and engagement in EMI: A latent profile analysis. *Language & Education, online advance*. <https://doi.org/10.1080/09500782.2024.2311146>
- Manegre, M., & Sabiri, K. A. (2022). Online language learning using virtual classrooms: An analysis of teacher perceptions. *Computer Assisted Language Learning*. Advance online publication. <https://doi.org/10.1080/09588221.2020.1770290>
- Martin, A. J. (2012). Motivation and engagement: Conceptual, operational, and empirical clarity. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 303–311). New York: Springer.

- Moorhouse, B. (2023). Teachers' digital technology use after a period of online teaching. *ELT Journal*. <https://doi.org/10.1093/elt/ccac050>
- Muthén, L. K., & Muthén, B. O. (1998–2017). *Mplus user's guide*. Los Angeles, CA: Author.
- Parker, M.A. & Martin, F. (2010) Using virtual classrooms: Student perceptions of features and characteristics in an online and a blended learning course. *MERLOT Journal of Online Learning and Teaching*, 6(1), 138. http://jolt.merlot.org/vol6no1/parker_0310.pdf. Accessed 10 Oct 2023.
- Pham, H.-H., & Ho, T.-H. (2020). Toward a 'new normal' with e-learning in Vietnamese higher education during the post COVID-19 pandemic. *Higher Education Research & Development*. Advance online publication. <https://doi.org/10.1080/07294360.2020.1823945>
- Yang, R. (2020). China's higher education during the COVID-19 pandemic: Some preliminary observations. *Higher Education Research & Development*, Advance online publication. <https://doi.org/10.1080/07294360.2020.1824212>
- Zhao, N. & McDougall, D. (2008). Cultural influences on Chinese students' asynchronous online learning in a Canadian University. *Journal of Distance Education*, 22(2), 59–80. Retrieved October 3, 2020 from <https://www.learntechlib.org/p/102726/>

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