International Journal of Learning Technology

ISSN online: 1741-8119 - ISSN print: 1477-8386
https://www.inderscience.com/ijlt

Demographic differences in China's higher education students' interactions and experiences with online learning during the COVID-19 pandemic

Jiayun Yan, Ting Wang

DOI: 10.1504/IJLT.2024.10063341

Article History:

Received:	03 May 2022
Last revised:	01 November 2022
Accepted:	02 January 2023
Published online:	08 April 2024

Demographic differences in China's higher education students' interactions and experiences with online learning during the COVID-19 pandemic

Jiayun Yan

North China Institute of Aerospace Engineering,
133 East Aimin Rd, Langfang, Hebei, 065009, China
Email: 2367157392@qq.com

Ting Wang*

Emporia State University,
1 Kellogg Cir, Emporia, KS, 66801, USA
Email: twang2@emporia.edu
*Corresponding author

Abstract: This study investigates the relationship between higher education students' demographic backgrounds and their interactions and experiences with online learning during the COVID-19 pandemic. Data were collected using a quantitative cross-sectional online survey of students across China. The survey was distributed from October 10, 2021, to October 12, 2021, with 313 respondents. The results indicate that most participants had lower satisfaction with online learning, which could be due to the face-to-face learning pedagogy was mainly adopted in China before the pandemic. Over 90% of participants used more than one learning management system (LMS) in 2020 and 2021, which might be due to Chinese universities' lack of relevant unified management. Based on the sociocultural learning theory, measures like including extra learning assistance, such as instructional designers, may improve the adaptability of instructors and learners when unexpected changes occur in the social environment and learners are slow or fail to adapt as necessary.

Keywords: online learning; higher education students; sociocultural learning theory; China; COVID-19 pandemic.

Reference to this paper should be made as follows: Yan, J. and Wang, T. (2024) 'Demographic differences in China's higher education students' interactions and experiences with online learning during the COVID-19 pandemic', *Int. J. Learning Technology*, Vol. 19, No. 1, pp.3–24.

Biographical notes: Jiayun Yan is an Associate Professor at the School of Foreign Language, North China Institute of Aerospace Engineering. She has been engaged in college teaching and research for 28 years. She has presided over or mainly participated in projects focusing on the construction and reform of college English courses more than ten times and published more than 20 papers and three books related to higher education, some of which involve the cultivation of international talents and some of which involves the innovation of teaching models. Since the year of 2005, online and blended teaching has become the primary teaching practice and research concern.

Ting Wang is a Lecturer at the School of Library and Information Science at Emporia State University (Kansas, USA). She received her MS in Instructional Design and Technology and PhD in Library and Information Science from Emporia State University. Her main research interests include the healthcare information behaviour of family caregivers of individuals with rare diseases, applying instructional design and technology in online learning, academic librarianship, and public libraries' healthcare information practices in the Global South countries, aiming to promote diversity, equity, and inclusion and international development.

1 Introduction

From primary education to higher education, over half of the students worldwide were forced to return home to self-quarantine due to school closures caused by COVID-19 in early 2020 (UNESCO, 2020). In response to this crisis, most academic institutions promoted online education. Over 30 million students at about 3,000 higher education institutions across China's mainland were asked to stay at home for digital learning (Bao, 2020). Many affected institutions used online platforms for emergency distance teaching and learning to reduce the spread of COVID-19 and fill gaps caused by missed in-person classes during the pandemic (Bao, 2020).

Over the past two decades, Chinese universities have reformed online education, forming open education networks based on emerging information and network technology and offering massive online open courses (Bao, 2020). However, compared with face-to-face courses in universities, the proportion of online courses is still low, and most of the online courses are electives for vocational students. Due to the sudden emergence of COVID-19, most faculties faced the challenges of lacking online teaching experience, preparation, and support from the education technology team. Most students in Chinese higher education institutions lack clear career goals and active academic participation and spend more time studying in class than out of class, exacerbating challenges for learning in the digital environment (Bao, 2019; Bao and Zhang, 2012). Also, students expressed that the biggest challenge during online learning was not technical barriers but the lack of a positive learning attitude, self-discipline, and appropriate learning materials and environments.

Vygotsky and Cole's (1978) sociocultural theory emphasises the significance of social and cultural backgrounds on an individual's psychological development and skill acquisition. As face-to-face learning was dominated higher education institutions in China in the past decades, instructors were more familiar with it and could assist students in acquiring knowledge. However, it is unknown if the unexpected change in the social environment and teaching approaches from face-to-face to online caused by the COVID-19 pandemic would impact students' learning satisfaction.

A digital learning platform is an essential medium for conducting online education. With the outbreak and development of the pandemic, multiple online learning platforms, such as Ding Ding and Tencent Class, were primarily adopted to support online learning in China. Several studies investigated user satisfaction with various online learning platforms in China (Chen et al., 2020a), online learner behaviours (Yang et al., 2020), online learning satisfaction expressed by international students in China (Demuyakor,

2020), and online learning barriers expressed by faculties and students (Huang, 2020) during the pandemic.

Further, Chen et al. (2020b) explored the differences in gender and disciplines in first-year students' learning adaptabilities in China's universities. They revealed that males had more robust adaptability than females, but there were no differences between art and science disciplines. Due to the different skills acquired by associate-degree-seeking, bachelor-degree-seeking, and master-degree-seeking students, their learning adaptability may differ. It is easy to infer that students who prefer online learning are likely to have better adaptability and higher satisfaction with emergency online learning than those who prefer face-to-face and hybrid. However, few studies have investigated and provided relevant scientific evidence.

Therefore, this study aimed to understand the relationships between higher education institution students' demographic factors and their learning satisfaction of emergency online learning during the COVID-19 pandemic by answering the following questions:

1 How did students' gender relate to their interactions and online learning satisfaction?

2 How did students' academic level relate to their interactions and online learning satisfaction?

3 How did students' format preferences relate to their interactions and online learning satisfaction?

4 How did students' disciplines relate to their interactions and online learning satisfaction?

2 Literature review

2.1 Online learning during the pandemic

Before the pandemic, many studies investigated online learning from various angles (Anderson, 2008; Hung et al., 2010; Keengwe and Kidd, 2010; van Joolingen et al., 2005). Since early 2020, more literature has emerged on online learning at various academic levels (e.g., primary, secondary, and higher education) in various countries during the pandemic due to COVID-19 being widespread around the world. Aliyyah et al. (2020) and Fauzi and Khusuma (2020) investigated primary education teachers' perceptions of online learning. Karakose et al. (2021a, 2021b, 2022a, 2022b) conducted a series of studies to investigate school administrators' life satisfaction, perceptions of technology capabilities, and psychological status during the COVID-19 pandemic. Sims and Baker (2021) surveyed a US four-year-university faculty's perceptions of transitional online courses provided in the spring of 2020 and found that faculties believed the course quality remained the same, but student engagement and performance were lower than before the pandemic. Similarly, Almahasees et al. (2021) found that both faculties and students rated online learning as practical during the pandemic but not as effective as face-to-face learning. Due to the advantages of online learning, such as low cost, convenience, and flexibility, hybrid learning can be the primary delivery mode to provide a rigorous learning environment. Many courses provided by universities were urgently moving from face-to-face to online, which may cause anxiety among students who are not comfortable with the delivery mode. Frequent communications with

faculties, virtual tutoring, and timely feedback were approaches to reducing students' anxiety and positively impacting learning outcomes (Murphy et al., 2020). As China was one of the first countries affected by the pandemic, Chinese universities took the lead in implementing online learning in February 2020. Whether online learning can replace face-to-face learning has become the focus of discussions among various Chinese scholars. Jin et al. (2021) described that students' perceptions of increased safety by reducing the virus exposure chances, learning convenience, satisfactory learning quality, the ease of use and usefulness of learning tools, and instructors' positive teaching attitudes make students willing to switch from face-to-face learning to online learning. Although students expressed high satisfaction with the online course contents and increased opportunities to discuss with instructors and other students, many still prefer face-to-face lectures (Zhang et al., 2020). Bao (2020), based on previous online teaching experiences, proposed several suggestions for instructors in higher education in China for online teaching, such as ensuring that online teaching design is highly relevant to students' learning contents, effective transmission of online teaching information, and adequate support from instructors.

Online learning tools and platforms were also widely used during the pandemic as an auxiliary to learning activities. Alturki and Aldraiweesh (2021) pointed out that online learning tools, such as learning management systems (LMSs), in higher education institutions can be beneficial in that instructors provide students with up-to-date learning materials and build students' knowledge base. Users' high computer self-efficacy, high degree of satisfaction with LMS, high intimacy among users, and fast internet connection positively impacted their perceptions of the tool's ease of use and continued use in online learning (Alturki and Aldraiweesh, 2021; Bin et al., 2020; Jiang et al., 2021). The perceived ease of use and usefulness of the tools also depends on users' abilities and beliefs about the usage of their tools. The easier it is for users in higher education to use the LMS, the more benefits the system provides, and the higher user satisfaction with the system (Jiang et al., 2021). From the instructors' perspective, their attitudes towards technology directly affect the amount of technology integrated into teaching and the results of using technology in teaching (Alturki and Aldraiweesh, 2021). Adding such functions as real-time communication, collaboration tools, and social interaction to the LMS can alleviate instructors' issues during online teachings, such as the lack of effective real-time communication with students, technical unproficiency, and low interactions between instructors and students (Bahar et al., 2020).

2.2 Demographics and online learning satisfaction

A large body of literature has explored the impact of learners' demographic factors on their online learning experiences and the use of online LMSs. Factors such as a learner's age, gender (Aldowah et al., 2017; Yoo andHuang, 2013), online learning experiences (Aldowah et al., 2017), location, and community poverty level (Rizvi et al., 2019) have a significant impact on learning outcomes (Rizvi et al., 2019), unenrol, reenrol, and complete online learning programs (Layne et al., 2013). Strachota (2003) proposed a *Student Satisfaction Survey* in his dissertation to evaluate student online learning satisfaction, examining the interaction experiences between learner and content, learner and instructor, learner and learner, learner and technology, and general satisfaction (GS). Scholars from various fields soon used the survey to study interaction experiences in an online and hybrid learning environment. Chang (2011) explored the relationships

between student online learning GS and the four interactive variables with the modified survey, student demographics, and participants' previous experience with the Internet and discussion board. Similarly, Andersen (2013) applied the modified survey in his dissertation to investigate the relationships among online learning GS, learner and instructor interaction (LII) scores, and learner and social media interaction scores by collecting data of participants' demographic factors, the two types of interactions, and the GS.

Ekwunife-Orakwue and Teng (2014) measured the impact of student interactions in an online and hybrid learning environment on student learning outcomes via learning satisfaction and academic achievement. Recently, Valieiev et al. (2021) took the *Student Satisfaction Survey* as part of their research instrument to investigate the academic satisfaction level of cadets in Ukraine with offline, hybrid, and online learning before and during the COVID-19 pandemic. Ngo and Ngadiman (2021) took the survey to learn the satisfaction of Indonesian university students with the online learning environment during the pandemic. The results indicated that the integration of synchronous and asynchronous online learning effectively promotes students' learning efficiency and improves students' learning satisfaction.

3 Theoretical framework

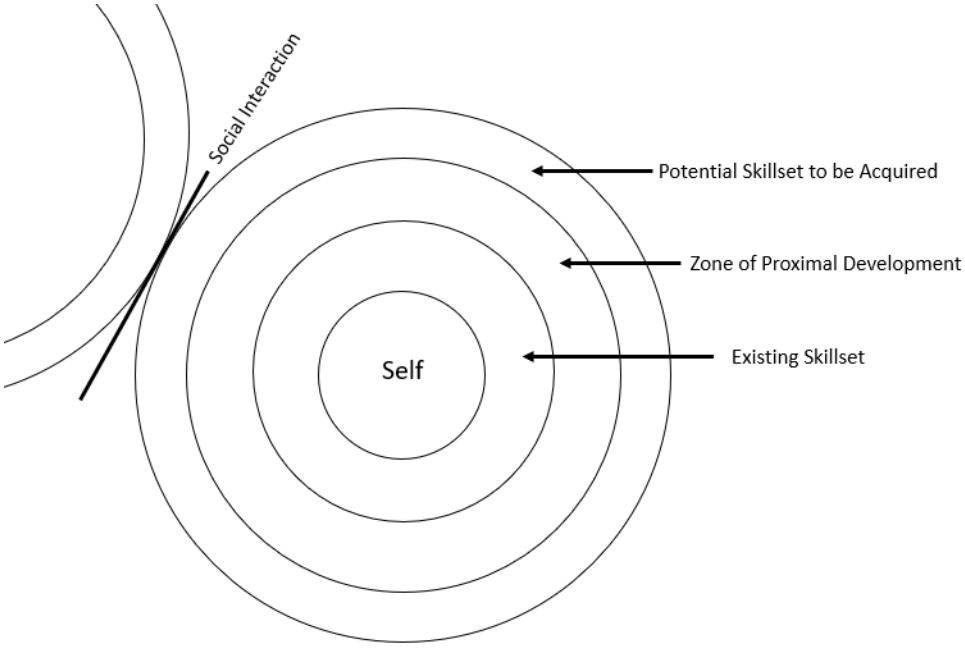
This study is guided by Vygotsky and Cole's (1978) sociocultural theory, describing learning as a social process that originates from human intelligence in culture or society. A visual depiction of Vygotsky's main theoretical contributions is provided in Figure 1. Wertsch (1991) identified three main themes for the theory. First, individual development, including higher psychological functioning, originates in society. That is, a child gains cultural development function psychologically based on interpersonal communication (Vygotsky and Cole, 1978). Learners gain new strategies and knowledge about the world and culture by participating in external joint activities and internalising cooperating work (Scott and Palincsar, 2013). The second theme that Wertsch (1991) identified is that human behaviour at the social and individual levels is modulated by semiotic means, such as language, diagrams, works of art, and computers, which promote knowledge
co-construction and internalise independent problem-solving abilities. Learners can use the objects meaningfully in new life situations they encounter by incorporating them into learners learning activities (Newman et al., 1989). The third theme examines the first two themes through genetic and developmental analysis, discovering the nature of learning through changes and developmental processes over an individual's lifetime (Wertsch, 1991).

The sociocultural theory has been incorporated into online education technologies in recent years, and much research evidence indicates that teacher-centred pedagogy is not suitable for online learning (Scott and Palincsar, 2013). For instance, Charbonneau-Gowdy (2018), Clark and Sampson (2008) and Raeside et al. (2008) pointed out that learners' active participation in knowledge building through interactive online communities has a positive impact on achieving learning outcomes and forming epistemic reasoning. Ma (2017) explored the experiences of college students using mobile technologies to learn a second language with sociocultural theory. The study revealed that cognitive processing (e.g., learning goal setting, creating vocabulary

learning records, and watching instructional videos on YouTube), physical tools (e.g., mobile technologies and apps), and interpersonal communication (e.g., instructors and peers) were the three basic approaches for second language learning. The studies emphasised the sociality of learning activities and learning tools in sociocultural learning theory.

Since the start of the COVID-19 pandemic, many studies have explored the learning communities building and learning tools application in online learning settings from various perspectives. For instance, approaches of colleges support online professional learning communities by training instructors in the use of teaching tools (Tucker and Quintero-Ares, 2021), the negative impact of learning communities on learners' emotional engagement as a result of reduced interpersonal interaction (Salta et al., 2022), and learners' sense of belonging to and satisfaction with online learning communities (Zhou and Zhang, 2021).

Figure 1 Visual depiction of Vygotsky's sociocultural learning model



4 Methods

The population for the current study is students who enrolled in the core courses and elective courses offered by their tertiary higher education institutions during the COVID-19 pandemic for emergency teaching, including associate-degree-seeking students, bachelor-degree-seeking students, and master-degree-seeking students. This study used an online survey approach to answer research questions. A copy of the survey is included in Appendix. The survey was distributed from October 10, 2021, to October 12, 2021, with data collected by instructors sending survey links to their students.

Convenience sampling and snowball sampling methods were adopted. The researchers sent the survey to colleagues teaching at various Chinese universities, who distributed the survey to students who enrolled in their courses. Participants were also encouraged to distribute the survey link to their classmates and friends. Students needed to agree with the informed consent to access the survey questions. All students volunteered to participate in the survey. Following the data collection, the data were transferred to SPSS, and conducted Chi-square tests to identify the relationships between participants' demographic factors and learning satisfaction and between online learning interactions and learning satisfaction.

The sample size of the current study is 313 students enrolled in Chinese higher education institutions who received emergency learning during the COVID-19 pandemic, including students in their master's (graduate) level (n = 40), four-year (bachelor/undergrad) university students (n = 177), and vocational (associates) college students (n = 96). As the number of students admitted at the undergraduate level (associate- and bachelor-degree seeking students) is about ten times as many as the graduate level (master-degree-seeking students) (China Education Online, 2019a, 2019b), the number of undergraduate participants in the current study was several times higher than the number of graduates. Students primarily came from science and technology-related universities and programs.

Due to the lack of online learning experiences in higher education institutions during the survey distribution, current first-year students in four-year universities and vocational colleges were not investigated. The first-year students involved in this study were master's students. A pilot test with 42 participants who were sophomore students majoring in a science discipline was conducted before the primary survey for this study was distributed. The final survey questions were modified based on the pilot test participants' comments. The sample for the pilot study also used a convenient sample – participants were students enrolled in one of the researcher's undergraduate courses. A p-value of 0.05 was considered statistically significant for the purpose of this study, though there were a few instances (noted in the narrative) where a relationship was not significant at 0.05 but was significant at 0.1.

The survey was adapted from Strachota's (2003) *Student Satisfaction Survey*, examining interactions experiences between learner and instructor, learner and learner, and learner and technology to determine the variables significant to a higher online learning satisfaction (Appendix). The unexpected sociocultural change caused by the pandemic triggered a change in the communication approach (from face-to-face to online communication), which may impact students' acquisition of potential skillsets (Vygotsky and Cole, 1978) and, in turn, affect their learning satisfaction and academic achievement (Ali and Ahmad, 2011; Dhaqane and Afrah, 2016). Therefore, it is necessary to investigate whether and how students' learning satisfaction is affected by emergency online learning and provide a reference for future relevant practice. Before the pilot test, questions on demographic factors were included based on the *Student Satisfaction Survey* and fine-tuned to fit the current study. The survey was for evaluating one online course. Questions such as 'lessons or lecture notes used in this class facilitated my learning' were revised to 'lessons or lecture notes used in online courses facilitated my learning' to discover students' overall satisfaction with the online learning experience. The survey questions adapted in the present study included two sections: participants' demographic factors, including gender, affiliated universities and colleges, majors, academic level and grade, previously used LMS(s), and preferred learning format, and learners' perception

about LII, learner and learner interaction (LLI), learner and technology interaction (LTI), and GS. All survey questions' responses included three categories of response ranging from 3 = agree, 2 = neutral, and 1 = disagree.

5 Results

5.1 Description of participants

The survey received 313 completed responses. Cronbach's alpha was calculated for the response items in the survey, with the value being 0.646. According to the University of Virginia Library (2015), this falls at the lower end of the acceptable range. Participants included 216 males (69%), 87 females (27.8%), and ten who preferred not to indicate their gender (3.19%). This distribution is fairly representative of that of science and technology-related programs in China, where males outnumber females on the whole and especially within STEM higher education programs (Guo et al., 2010). The participants came from 19 different higher education institutions, of which North China Institute of Aerospace Engineering (40.58%) was the main one, followed by Inner Mongolia University (24.6%), and Inner Mongolia University Vocational and Technical Institute of Communications (12.46%). The total number of participants from 11 universities accounted for less than 5% of the total participants.

In terms of participants' majors, most of the participants majored in mechanology, electronics, materialogy, and civil engineering (61.02%), followed by other majors (11.18%) and management and economics (9.27%).

Table 1 Demographics of survey respondents

Categories	*Frequencies*
Gender	
Female	87
Male	216
Prefer not to say	10
Affiliated universities or colleges	
Communication University of Zhejiang	1
Hebei Normal University	1
Hebei University	6
Hebei University of Economics and Business	1
Hebei University of Engineering	1
Inner Mongolia Agricultural University	15
Inner Mongolia University	77
Inner Mongolia University Vocational and Technical Institute of Communications	39
Minzu University of China	2
North China Institute of Aerospace Engineering	127
North University of China	1
Northwestern Polytechnical University	2

Table 1 Demographics of survey respondents (continued)

Categories	*Frequencies*
Affiliated universities or colleges	
Peking University	1
Tangshan College	3
Tsinghua University	2
Xi'an Jiaotong University	2
Yanjing Vocational Technical Institute	28
Yanshan University	1
Yunnan University of Finance and Economics	3
Major	
Arts	18
Computer Science	25
Language and literature, Journalism and Communication	15
Management, Economics	29
Mechanology, Electronics, Materialogy, Civil Engineering	191
Others	35
School grade	
First year in Master	13
Second year in Master	17
Second year in four-year-university	47
Second year in vocational college	58
Third year in Master	11
Third year in four-year-university	60
Third year in vocational college	36
Fourth year in Master	0
Fourth year in four-year-university	70
Fourth year in vocational college	1
Previously used LMS	
Ding Ding	258
MOODLE	20
Rain Classroom	205
Tencent Class	208
Chaoxing Learning	228
Others	71
Preferred learning format	
Face-to-face learning	132
Hybrid learning	154
Online learning	37

Among all participants, seniors at four-year universities accounted for the most significant portion (22.36%), followed by juniors at four-year universities (19.17%) and sophomores at vocational colleges (18.53%). Ding Ding was the LMS used by most participants, followed by Chaoxing Learning and Rain Classroom. Nearly 90% of the participants (272) had used more than one LMS, which may be due to China's higher education institutions' lack of unified management of LMS.

5.2 Demographic factors and online learning interaction and satisfaction

Statistical relationships between participants' demographic factors and online learning interactions and satisfaction were examined with the Chi-square tests (Table 2). Full question text is provided in the sample survey that is included as an Appendix to this study (question numbers can be used for reference). Before conducting Chi-square, participants' majors were divided into art discipline and science discipline. Overall, the academic level has the greatest influence on online learning interaction and satisfaction (9), followed by learning format preferences (5), gender (2), and disciplines (1).

Table 2 Chi-square tests report for demographics and online learning satisfaction and satisfaction

Variable	*Gender*		*Academic level*		*Format preference*		*Discipline (art/sciences)*	
Question	*Statistic*	*Significance*	*Statistic*	*Significance*	*Statistic*	*Significance*	*Statistic*	*Significance*
LII-1	0.46	0.79	4.41	0.35	1.45	0.84	2.54	0.28
LII-2	0.06	0.97	9.24	0.05**	2.37	0.67	0.92	0.63
LII-3	5.73	0.05**	8.56	0.07*	5.42	0.25	0.73	0.7
LII-4	0.4	0.82	7.11	0.13	1.96	0.74	0.41	0.82
LII-5	2.38	0.3	6.09	0.19	2.29	0.68	0.22	0.9
LII-6	0.04	0.98	5.21	0.27	5.85	0.21	0.08	0.96
LLI-1	0.34	0.85	7.91	0.1*	3.07	0.55	0.75	0.69
LLI-2	0.39	0.82	5.74	0.22	2.48	0.65	0.95	0.62
LLI-3	11.07	0.004	17.95	0.001**	5.99	0.2	7.67	0.02**
LLI-4	0.59	0.76	9.31	0.05**	1.45	0.83	1.17	0.56
LLI-5	1.48	0.48	7.61	0.11	0.97	0.91	0.002	0.99
LLI-6	0.5	0.78	8.21	0.08*	0.78	0.94	3.23	0.20
LLI-7	2.99	0.22	8.77	0.07*	2.84	0.58	1.11	0.57
LTI-1	1.48	0.48	3.28	0.51	2.16	0.71	1.8	0.41
LTI-2	1.86	0.39	8.58	0.07*	1.49	0.83	0.74	0.69
LTI-3	1.06	0.59	5.67	0.23	4.81	0.31	0.96	0.62
LTI-4	3.16	0.21	8.03	0.09*	3.35	0.5	0.36	0.84
LTI-5	0.47	0.79	5.06	0.28	2.54	0.64	0.63	0.73

Notes: *Significant at $p < 0.10$. **Significant at $p < 0.05$.

Table 2 Chi-square tests report for demographics and online learning satisfaction and satisfaction

Variable	*Gender*		*Academic level*		*Format preference*		*Discipline (art/sciences)*	
Question	*Statistic*	*Significance*	*Statistic*	*Significance*	*Statistic*	*Significance*	*Statistic*	*Significance*
LTI-6	2.16	0.34	2.18	0.7	2.58	0.63	1.81	0.41
LTI-7	0.04	0.98	13.9	0.008**	4.74	0.32	0.03	0.98
GS-1	1.47	0.48	8.26	0.08	19.03	0.0007**	3.34	0.19
GS-2	3.62	0.16	7.64	0.11	18.36	0.001**	0.91	0.64
GS-3	2.76	0.25	14.29	0.006**	7.15	0.13	2.56	0.28
GS-4	0.14	0.82	9.24	0.05	10.57	0.03**	1.21	0.55
GS-5	2.55	0.28	14.82	0.005**	11.65	0.02**	0.76	0.68
GS-6	2.99	0.23	8	0.09*	13.65	0.008**	4	4

Notes: *Significant at $p < 0.10$. **Significant at $p < 0.05$.

5.2.1 Gender and online learning interaction and satisfaction

In the interaction between learners and instructors, males were more frustrated by the lack of feedback from instructors (69.4% versus 57.5% for females) and were more likely to think that the discussion boards were a waste of time (50.4% versus 33.8% for females).

5.2.2 Academic level and online learning interaction and satisfaction

Compared with associate-degree-seeking students and master-degree-seeking students, bachelor-degree seeking students were more likely to disagree that they received timely feedback from instructors. Associate's students were more appeared to agree that the course created a sense of community (96.9% compared to 88.7% for bachelor and 87.5% for master), to state that the LMS was attractive (94.8% compared to 81.4% for bachelor and 72.5% for master); to believe that online learning courses did not meet their needs (71.9% compared to 58.2% for bachelor and 40.0% for master), to feel that they learned as much in this course as a face-to-face one (88.5% compared to 70.6% for bachelor and 70.0% for master). Fewer bachelor-degree-seeking students would recommend online courses to others (78.0% compared to 90.6% for associate and 87.5% for master's).

It is also worth noting that when the significant level is at .1, the academic level has a statistical relationship with more online learning interaction and satisfaction factors. Associate-degree-seeking students were more likely to feel frustrated with a lack of feedback from the instructor (71.9% compared to 64.9% for bachelor students and 60.0% for master students), to say that the online course encouraged students to discuss ideas and concepts covered with other students (97.9% compared to 89.8% for the bachelor and 92.5% for the master), to express that the LMS for courses was useful to fulfil their learning needs (92.7% compared to 83.1% for the bachelor and 85.0% for the master),

and to believe that it was easy for them to understand the features of the LMS for online courses (95.8% compared to 89.3% for the bachelor and 87.5% for the master). Master-degree-seeking students were less likely to feel that they received timely feedback (80.0% compared to 92.7% for associate students and 90.9% for bachelor students).

5.2.3 Format preferences and online learning interaction and satisfaction

Those who prefer face-to-face instruction were less satisfied with online courses (78.8% compared to 93.5% of those who prefer hybrid and 96.3% for those who prefer online) and were less likely to be interested in taking another online course (72.0% compared to 86.4% of those who prefer hybrid and 96.3% for those who prefer online). Those who favour online or hybrid courses were more likely to recommend online courses to others (92.6% for online and 87.66% for hybrid to 75.76% for those who prefer face-to-face). Those who prefer to learn in a face-to-face format were less likely to suggest that they learned as much in online courses as a face-to-face one (67.4% compared to 80.5% of those who prefer the hybrid format and 92.6% of those who prefer the online format). Therefore, fewer students who prefer the face-to-face format believe that online courses are as effective as face-to-face courses (65.9% compared to 79.9% of those who prefer hybrid courses and 92.6% of those who prefer online courses).

5.2.4 Disciplines and online learning interaction and satisfaction

Science students were more likely to believe that the discussion boards were a waste of time (49.9% compared to 30.9% of art students).

6 Discussion

This study's results indicated that most participants preferred face-to-face or blended learning, who expressed lower satisfaction with online courses and believed that they could not achieve their learning outcomes. The situation might be due to the influence of Confucianism that face-to-face learning pedagogy was mainly adopted from higher education to primary education in China before the COVID-19 pandemic (Zhao, 2020). The sudden onset of the pandemic has forced many students and instructors to move from familiar pedagogy to online learning, resulting in a lack of adaptation and dissatisfaction with online learning. The situation echoes the influence of the social environment on learning described in sociocultural learning theories (Vygotsky and Cole, 1978). That is, it would have a (negative) impact on learners' learning abilities when a new social culture appears unexpected, and learners are not prepared psychologically and have to integrate into the environment.

In the current study, students' learning format preferences have no statistical relationship with learner-technology interaction and satisfaction. However, Basith et al. (2020) pointed out that online course technology is a critical part of online learning as a medium connecting instructors and students, affects achieving learning objectives and reduces learning satisfaction when it does not function optimally. In the current study, the lower satisfaction may relate to other factors, such as network instability, insufficient learner orientation (Keengwe and Kidd, 2010), and fatigue caused by switching among multiple online learning management tools, which were not involved in the survey.

Synchronous online courses provided by most Chinese universities (e.g., students need to spend four to five hours per day in synchronous video courses) lead to 'zoom fatigue' [Ramachandran, (2021), para 3] which could be another explanation for lower online learning satisfaction. More specifically, the results indicated that male and science students viewed the online discussion forums as a waste of time. The situation may be attributed to the instructors' and students' lower digital skills for fewer previous online learning experiences or instructors' and students' lack of motivation to interact during online learning due to inadequacy of online academic communication skills (Bao, 2019; Bao and Zhang, 2012; Ferri et al., 2020). On the other hand, it may be because both instructors and learners believe that collaboration among students is detrimental to academic success (Guzdial et al., 2001). However, social interactions with peers via scholarly communication are fundamental to acquiring new knowledge and skills (Vygotsky and Cole, 1978). During the pandemic, when face-to-face communication is not allowed, learners can use new learning tools such as LMS to achieve online communication with instructors and peers to cope with the suddenly changing social environment. Palloff and Pratt (2007) and Guzdial et al. (2001) suggested that instructors change perceptions and coordinate online discussions to make science students benefit more from discussions by allowing students to create critical dialogue and facilitate it instead of dominating.

Another interesting finding is that more than 90% of participants expressed that they had used more than one online LMS in the past two years, and some even used more than four. Such a situation may indicate that many Chinese universities lack unified management of online LMS, which instructors choose according to their preferences during teaching. In the USA, 99% of higher education institutions adopt one LMS, such as Blackboard, Canvas, and MOODLE, according to their needs to support the entire institution's online learning activities (Rhode et al., 2017). In the absence of unified management of LMS across the university, students may have to spend a significant amount of time learning to use multiple LMS, resulting in a relatively reduced time spent on course content. The lack of unified management may also result in a lack of relevant skills training to improve the digital skills of less computer-proficient teachers and students and affect the necessary instructor-learner interactions during online learning. Therefore, relevant departments in Chinese universities can promote the development of online education by implementing unified LMS in universities regarding literature (Gonçalves and Pedro, 2012; Saraswat, 2014; Wright et al., 2014).

Based on sociocultural learning theory, it is necessary to include extra assistance, such as instructional designers, to improve the adaptability of instructors and students when unexpected changes occur in the social environment and learners slowly or failed to adapt. Instructional designers play an essential role in online learning by providing course content designs that meet various needs. In the US, instructional design has been relatively mature after decades of development (Reiser, 2001). In the first decade of the 21st century, with the development of online learning, instructional designers play a crucial role in creating online courses, which opens up new job opportunities and challenges for those in the instructional design field. As COVID-19 spread worldwide, instructional designers became superheroes in supporting working from home and online learning by designing appropriate training and development activities to assist in this unique transition (Greer, 2021). However, when searching 'instructional design and technology' as the keyword on the subject of online courses in China National Knowledge Infrastructure, one of the most extensive knowledge databases, there are only

65 results since 2002, which may be a signal that the field is still in its infancy in China. To further promote the development of online learning in China, the Ministry of Education at all levels can increase citizens' understanding and willingness to study instructional design and technology through publicity. It is also possible for higher education institutions to add instructional designers-related positions to support faculties in online teaching activities.

The current study supports the proposed impact of the social environment on learners' learning as described by Vygotsky and Cole's (1978) sociocultural theory and extends the impact of the social environment on instructors. The new social culture influences both learners and instructors during learning activities and transforms instructors into learners to seek adaptable pedagogies when the social environment turns sharply. Instructors need to communicate and cooperate with professionals in other fields (Scott and Palincsar, 2013), such as instructional designers, to acquire new semiotics means (Wertsch, 1991) (e.g., online course design skills) and apply it in the new environment meaningfully (Newman et al., 1989). Higher education institutions in countries with less mature instructional design profession can promote communication among countries to better understand the field, acquire guidance, and face occurring challenges.

From a practical standpoint, an instructional designer can provide guidance and support for instructors on implementing online teaching effectively when the environment changes from face-to-face to online without expectation. Xie et al. (2021) described instructional designers' role in providing instructors in higher education institutions with a mindset shift about teaching and working with instructors to explore teaching challenges in emergency online teaching. In Chinese higher education institutions, instructional designers can help instructors change the online learning environment, such as switching from a synchronous online course to an asynchronous one reducing students' zoom fatigue and allowing self-paced learning. Instructors can also provide an online learning guide for students when familiar with the online teaching model, rather than copying the traditional face-to-face teaching to online teaching. Further, teacher-centred pedagogy is unsuitable for online learning (Scott and Palincsar, 2013). Instructors can adopt a combination of teacher-centred and student-centred pedagogy to adapt to the Chinese sociocultural environment and emergency online learning situations. For instance, Awacorach et al. (2021) proposed combining the two pedagogies through community-based group practice activities and instructors' continuous indoctrination of textbook knowledge to enhance students' understanding of new knowledge, interest in learning activities, and teamwork abilities.

It is also worth noting that the internal consistency of the survey questions is within a lower but acceptable range, indicating that the survey instrument is feasible but needs further modification in different online learning contexts. Without proven instruments to assess individuals' knowledge, attitudes, and practices regarding COVID-19 vaccines, Kumari et al. (2021) established a survey with high internal consistency. They constructed a survey instrument by literature review, expert focus group discussion, and expert validation. In the context of emergency online learning, given the findings of the current study and other relevant studies, questions relevant to, for instance, college students' computer self-efficacy (Zheng et al., 2021), course structures (Baber, 2021), and instructors' computer efficacy, can be added to the survey instrument in future studies.

7 Limitations and future research

The primary limitations of this study were the uneven distribution of participants' affiliations, genders, and majors. Most participants were male, majored in science, and enrolled at North China Aerospace Institute. Using the snowball sampling method caused some universities to have a smaller number of participants, such as the Communication University of Zhejiang and Hebei Normal University only one participant, which might lead to a bias in the research results. Also, the convenience and snowball sampling methods resulted in the uneven distribution of university classifications (e.g., 985 or 211). For instance, there were only seven participants from both 985 and 211 categories of universities (e.g., Northwestern Polytechnical University and Minzu University of China), accounting for 2% of the total. Most participants were from universities that were neither 985 nor 211 categories, accounting for 72.5% of the total, which could also lead to a bias in the research results.

Future research can explore the perceptions of instructions in higher education institutions on instructional design professions, such as professional understanding and expectations, to provide evidence for relevant training following China's situation and promote the development of online education. Similar research can also be carried out in other countries where the instructional design profession is in its infancy.

8 Conclusions

The COVID-19 pandemic in the spring of 2020 forced higher education institutions in China to switch from traditional face-to-face lectures to online courses. This study used a cross-sectional survey research approach to develop a picture to understand the phenomenon under study at a particular time (Creswell, 2021) – university students' satisfaction with emergency online learning. Based on Vygotsky and Cole's (1978) sociocultural learning theory and Strachota's (2003) *Student Satisfaction Survey*, this study took an online survey and Chi-Square analysis to investigate higher education students' perceptions of their interaction experiences in emergency online learning during the unique time of the pandemic. The results indicated that most students had difficulties adapting to online learning and believed that it could not provide the necessary interpersonal communication opportunities or achieve learning outcomes. It might be due to a lower teaching and learning efficiency caused by the inability of instructors and students to adapt to the teaching model generated by the unexpected new social environment. In future practice, Chinese universities can introduce instructional designers to support online education by providing instructors with online teaching guidance and promoting communication among universities around the world about online teaching.

Acknowledgements

The authors Jiayun Yan and Ting Wang acknowledge support from Brady D. Lund, PhD (Brady.lund@unt.edu). Dr. Lund is an Assistant Professor of Information Science at the University of North Texas. Brady is a graduate of Emporia State University (Kansas, USA) (MLS, PhD) and Wichita State University (BA). His research aims to understand and address critical issues at the intersection of information and data and to promote

ethical and responsible practices in these fields. Special emphases of mine are in UX/technology adoption, scholarly communications, and DEIB.

References

Aldowah, H., Ghazal, S., Umar, I.N. and Muniandy, B. (2017) 'The impacts of demographic variables on technological and contextual challenges of e-learning implementation', *Journal of Physics: Conference Series*, Vol. 892, No. 1, p.012013, DOI: 10.1088/1742-6596/892/1/012013.

Ali, A. and Ahmad, I. (2011) 'Key factors for determining student satisfaction in distance learning courses: a study of Allama Iqbal Open University', *Contemporary Educational Technology*, Vol. 2, No. 2, pp.118–134.

Aliyyah, R.R., Rachmadtullah, R., Samsudin, A., Syaodih, E., Nurtanto, M. and Tambunan, A.R.S. (2020) 'The perceptions of primary school teachers of online learning during the COVID-19 pandemic period: a case study in Indonesia', *Journal of Ethnic and Cultural Studies*, Vol. 7, No. 2, pp.90–109, http://dx.doi.org/10.29333/ejecs/388.

Almahasees, Z., Mohsen, K. and Omer, M. (2021) 'Faculty's and students' perceptions of online learning during COVID-19', *Frontiers in Education*, Vol. 6, p.638470, https://doi.org/10.3389/feduc.2021.638470.

Alturki, U. and Aldraiweesh, A. (2021) 'Application of learning management system (LMS) during the covid-19 pandemic: a sustainable acceptance model of the expansion technology approach', *Sustainability*, Vol. 13, No. 19, p.10991.

Andersen, J.C. (2013) *Learner Satisfaction in Online Learning: An Analysis of the Perceived Impact of Learner-Social Media and Learner-Instructor Interaction*, Doctoral dissertation, East Tennessee State University, Digital Commons [online] https://dc.etsu.edu/cgi/viewcontent.cgi?article=2296&context=etd (accessed 12 April 2022).

Anderson, T. (Ed.) (2008) *The Theory and Practice of Online Learning*, Athabasca University Press, Athabasca, Canada.

Awacorach, J., Jensen, I., Lassen, I., Olanya, D.R., Zakaria, H.L. and Tabo, G.O. (2021) 'Exploring transition in higher education: engagement and challenges in moving from teacher-centered to student-centered learning', *Journal of Problem Based Learning in Higher Education*, Vol. 9, No. 2, pp.113–130.

Baber, H. (2021) 'Social interaction and effectiveness of the online learning – a moderating role of maintaining social distance during the pandemic COVID-19', *Asian Education and Development Studies*, Vol. 11, No. 1, pp.159–171.

Bahar, N., Wahab, S.N. and Ahmad, N.D. (2020) 'Understanding challenges faced in online teaching and learning among Malaysian Universities' instructors during COVID-19 pandemic', *2020 Sixth International Conference on e-Learning (econf)*, December, pp.154–157, DOI: 10.1109/ECONF51404.2020.9385474.

Bao, W. (2019) 'Bridging the gap between research and practice: identifying high-impact educational practices for Chinese undergraduate education', *Peking University Education Review*, Vol. 1, pp.105–129, DOI: 10.1002/hbe2.191.

Bao, W. (2020) 'COVID-19 and online teaching in higher education: a case study of Peking University', *Human Behavior and Emerging Technologies*, Vol. 2, No. 2, pp.113–115, https://doi.org/10.1002/hbe2.191.

Bao, W. and Zhang, X.Y. (2012) 'The multi-dimensional structure and influence mechanism of student academic involvement in China', *Fudan Education Forum*, Vol. 6, pp.20–28, https://en.cnki.com.cn/Article_en/CJFDTotal-GWZX201206008.htm.

Basith, A., Rosmaiyadi, R., Triani, S.N. and Fitri, F. (2020) 'Investigation of online learning satisfaction during COVID 19: in relation to academic achievement', *Journal of Educational Science and Technology*, Vol. 6, No. 3, pp.265–275.

Bin, E., Islam, A.A., Gu, X., Spector, J.M. and Wang, F. (2020) 'A study of Chinese technical and vocational college teachers' adoption and gratification in new technologies', *British Journal of Educational Technology*, Vol. 51, No. 6, pp.2359–2375, https://doi.org/10.1111/bjet.12915.

Chang, K.Y. (2011) *Factors Affecting Student Satisfaction in Different Learning Deliveries*, Doctoral Dissertation, Illinois State University, ISU ReD: Research and eData [online] https://core.ac.uk/download/pdf/48840749.pdf (accessed 12 April 2022).

Charbonneau-Gowdy, P. (2018) 'Beyond stalemate: seeking solutions to challenges in online and blended learning programs', *Electronic Journal of E-Learning*, Vol. 16, No. 1, pp.56–66 [online] https://www.academic-publishing.org/index.php/ejel/article/view/1856/1819 (accessed 12 April 2022).

Chen, H., Ling, L., Ma, Y., Wen, Y., Gao, X. and Gu, X. (2020a) 'Suggestions for Chinese university freshmen based on adaptability analysis and sustainable development education', *Sustainability*, Vol. 12, No. 4, p.1371.

Chen, T., Peng, L., Yin, X., Rong, J., Yang, J. and Cong, G. (2020b) 'Analysis of user satisfaction with online education platforms in China during the COVID-19 pandemic', *Healthcare*, Vol. 8, No. 3, p.200, https://doi.org/10.3390/healthcare8030200.

China Education Online (2019a) 'In 2018, a total of 7.9 million students were enrolled for the national college entrance examination, with an enrollment rate of 81.13 percent' [online] https://gaokao.eol.cn/news/201902/t20190226_1646237.shtml (accessed 12 April 2022).

China Education Online (2019b) 'National graduate enrollment survey report' [online] https://www.eol.cn/e_ky/zt/2019/report/section3.html (accessed 12 April 2022).

Clark, D.B. and Sampson, V. (2008) 'Assessing dialogic argumentation in online environments to relate structure, grounds, and conceptual quality', *Journal of Research in Science Teaching*, Vol. 45, No. 3, pp.293–321, https://doi.org/10.1002/tea.20216.

Creswell, J.W. (2021) *A Concise Introduction to Mixed Methods Research*, SAGE Publications.

Demuyakor, J. (2020) 'Coronavirus (COVID-19) and online learning in higher institutions of education: a survey of the perceptions of Ghanaian international students in China', *Online Journal of Communication and Media Technologies*, Vol. 10, No. 3, p.e202018, https://doi.org/10.29333/ojcmt/8286.

Dhaqane, M.K. and Afrah, N.A. (2016) 'Satisfaction of students and academic performance in Benadir University', *Journal of Education and Practice*, Vol. 7, No. 24, pp.59–63.

Ekwunife-Orakwue, K.C. and Teng, T.L. (2014) 'The impact of transactional distance dialogic interactions on student learning outcomes in online and blended environments', *Computers & Education*, Vol. 78, pp.414–427, https://doi.org/10.1016/j.compedu.2014.06.011.

Fauzi, I. and Khusuma, I.H.S. (2020) 'Teachers' elementary school in online learning of COVID-19 pandemic conditions', *Jurnal Iqra': Kajian Ilmu Pendidikan*, Vol. 5, No. 1, pp.58–70, https://doi.org/10.25217/ji.v5i1.914.

Ferri, F., Grifoni, P. and Guzzo, T. (2020) 'Online learning and emergency remote teaching: opportunities and challenges in emergency situations', *Societies*, Vol. 10, No. 4, p.86, https://doi.org/10.3390/soc10040086.

Gonçalves, A. and Pedro, N. (2012) 'Innovation, e-learning and higher education: an example of a University LMS adoption process', *WASET, Proceedings of the International Conference in Higher Education*, pp.1075–1082 [online] http://hdl.handle.net/10451/25026 (accessed 12 April 2022).

Greer, T. (2021) 'New pandemic heroes: instructional designers' [online] https://umobile.edu/learning/new-pandemic-heroes-instructional-designers/ (accessed 12 April 2022).

Guo, C., Tsang, M.C. and Ding, X. (2010) 'Gender disparities in science and engineering in Chinese universities', *Economics of Education Review*, Vol. 29, No. 2, pp.225–235.

Guzdial, M., Ludovice, P., Realff, M., Morley, T., Carroll, K. and Ladak, A. (2001) 'The challenge of collaborative learning in engineering and math', *Impact on Engineering and Science Education*, Vol. 1, p.T3B-24, https://doi.org/10.1109/FIE.2001.963910.

Huang, J. (2020) 'Successes and challenges: online teaching and learning of chemistry in higher education in China in the time of COVID-19', *Journal of Chemical Education*, Vol. 97, No. 9, pp.2810–2814, https://dx.doi.org/10.1021/acs.jchemed.0c00671?ref=pdf.

Hung, M.L., Chou, C., Chen, C.H. and Own, Z.Y. (2010) 'Learner readiness for online learning: Scale development and student perceptions', *Computers & Education*, Vol. 55, No. 3, pp.1080–1090, https://doi.org/10.1016/j.compedu.2010.05.004.

Jiang, H., Islam, A.A., Gu, X. and Spector, J.M. (2021) 'Online learning satisfaction in higher education during the COVID-19 pandemic: a regional comparison between Eastern and Western Chinese universities', *Education and Information Technologies*, pp.1–23, https://doi.org/10.1007/s10639-021-10519-x.

Jin, Y.Q., Lin, C.L., Zhao, Q., Yu, S.W. and Su, Y.S. (2021) 'A study on traditional teaching method transferring to e-learning under the COVID-19 pandemic: from Chinese students' perspectives', *Frontiers in Psychology*, Vol. 12, p.632787.

Karakose, T., Ozdemir, T.Y., Papadakis, S., Yirci, R., Ozkayran, S.E. and Polat, H. (2022a) 'Investigating the relationships between COVID-19 quality of life, loneliness, happiness, and internet addiction among K-12 teachers and school administrators – a structural equation modeling approach', *International Journal of Environmental Research and Public Health*, Vol. 19, No. 3, p.1052.

Karakose, T., Polat, H. and Papadakis, S. (2021a) 'Examining teachers' perspectives on school principals' digital leadership roles and technology capabilities during the COVID-19 pandemic', *Sustainability*, Vol. 13, No. 23, p.13448.

Karakose, T., Yirci, R. and Papadakis, S. (2021b) 'Exploring the interrelationship between COVID-19 phobia, work-family conflict, family-work conflict, and life satisfaction among school administrators for advancing sustainable management', *Sustainability*, Vol. 13, No. 15, p.8654.

Karakose, T., Yirci, R. and Papadakis, S. (2022b) 'Examining the associations between COVID-19-related psychological distress, social media addiction, COVID-19-related burnout, and depression among school principals and teachers through structural equation modeling', *International Journal of Environmental Research and Public Health*, Vol. 19, No. 4, p.1951.

Keengwe, J. and Kidd, T.T. (2010) 'Towards best practices in online learning and teaching in higher education', *MERLOT Journal of Online Learning and Teaching*, Vol. 6, No. 2, pp.533–541, https://jolt.merlot.org/vol6no2/keengwe_0610.pdf.

Kumari, A., Ranjan, P., Chopra, S., Kaur, D., Upadhyay, A.D., Kaur, T. and Vikram, N.K. (2021) 'Development and validation of a questionnaire to assess knowledge, attitude, practices, and concerns regarding COVID-19 vaccination among the general population', *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, Vol. 15, No. 3, pp.919–925.

Layne, M., Boston, W.E. and Ice, P. (2013) 'A longitudinal study of online learners: shoppers, swirlers, stoppers, and succeeders as a function of demographic characteristics', *Online Journal of Distance Learning Administration*, Vol. 16, No. 2, pp.1–12 [online] http://www.westga.edu/~distance/ojdla/summer162/layne_boston_ice162.html (accessed 12 April 2022).

Ma, Q. (2017) 'A multi-case study of university students' language-learning experience mediated by mobile technologies: a socio-cultural perspective', *Computer Assisted Language Learning*, Vol. 30, Nos. 3–4, pp.183–203, https://doi.org/10.1080/09588221.2017.1301957.

Murphy, L., Eduljee, N.B. and Croteau, K. (2020) 'College student transition to synchronous virtual classes during the COVID-19 pandemic in northeastern United States', *Pedagogical Research*, Vol. 5, No. 4, p.em0078, https://doi.org/10.29333/pr/8485.

Newman, D., Griffin, P. and Cole, M. (1989) *The Construction Zone: Working for Cognitive Change in School*, Cambridge University Press.

Ngo, J. and Ngadiman, A. (2021) 'Investigating student satisfaction in remote online learning settings during Covid-19 in Indonesia', *Journal of International and Comparative Education (JICE)*, pp.73–95, https://doi.org/10.14425/jice.2021.10.2.0704.

Palloff, R.M. and Pratt, K. (2007) *Building Online Learning Communities: Effective Strategies for the Virtual Classroom*, John Wiley & Sons.

Raeside, L., Busschots, B., Waddington, S. and Keating, J.G. (2008) 'An online image analysis tool for science education', *Computers & Education*, Vol. 50, No. 2, pp.547–558, https://doi.org/10.1016/j.compedu.2007.09.021.

Ramachandran, V. (2021) 'Stanford researchers identify four causes for 'Zoom fatigue' and their simple fixes' [online] https://news.stanford.edu/2021/02/23/four-causes-zoom-fatigue-solutions/ (accessed 12 April 2022).

Reiser, R.A. (2001) 'A history of instructional design and technology: part II: a history of instructional design', *Educational Technology Research and Development*, Vol. 49, No. 2, pp.57–67, https://doi.org/10.1007/BF02504928.

Rhode, J., Richter, S., Gowen, P., Miller, T. and Wills, C. (2017) 'Understanding faculty use of the learning management system', *Online Learning*, Vol. 21, No. 3, pp.68–86 [online] https://files.eric.ed.gov/fulltext/EJ1154161.pdf (accessed 12 April 2022).

Rizvi, S., Rienties, B. and Khoja, S.A. (2019) 'The role of demographics in online learning: a decision tree based approach', *Computers & Education*, Vol. 137, pp.32–47, https://doi.org/10.1016/j.compedu.2019.04.001.

Salta, K., Paschalidou, K., Tsetseri, M. and Koulougliotis, D. (2022) 'Shift from a traditional to a distance learning environment during the COVID-19 pandemic', *Science & Education*, Vol. 31, No. 1, pp.93–122, https://link.springer.com/article/10.1007/s11191-021-00234-x.

Saraswat, S. (2014) 'Customization and implementation of LMS Moodle', *International Journal of Scientific and Research Publications*, Vol. 4, No. 5, pp.1–4 [online] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.642.750&rep=rep1&type=pdf (accessed 12 April 2022).

Scott, S. and Palincsar, A. (2013) 'Sociocultural theory', *Education.com*, pp.1–10.

Sims, S.K. and Baker, D.M. (2021) 'Faculty perceptions of teaching online during the COVID-19 university transition of courses to an online format', *Journal of Teaching and Learning with Technology*, Vol. 10, pp.337–353.

Strachota, E.M. (2003) *Student Satisfaction in Online Courses: An Analysis of the Impact of Learner-Content, Learner-Instructor, Learner-Learner and Learner-Technology Interaction*, Doctor dissertation, University of Wisconsin-Milwaukee, ProQuest Dissertations Publishing [online] http://proquest.com/docview/305284514?pq-origsite=gscholar&fromopenview=true (accessed 12 April 2022).

Tucker, L. and Quintero-Ares, A. (2021) 'Professional learning communities as a faculty support during the COVID-19 transition to online learning', *Online Journal of Distance Learning Administration*, Vol. 24, No. 1, pp.1–18.

UNESCO (2020) 'COVID-19 educational disruption and response' [online] https://en.unesco.org/news/covid-19-educational-disruption-and-response (accessed 12 April 2022).

University of Virginia Library (2015) 'Using and interpreting Cronbach's alpha' [online] https://data.library.virginia.edu/using-and-interpreting-cronbachs-alpha/ (accessed 12 April 2022).

Valieiev, R., Pokaichuk, Y., Zhbanchyk, A., Polyvaniuk, V., Nykyforova, O. and Nedria, K. (2021) 'In the search for the golden mean: students satisfaction with face-to-face, blended and distance learning', *Revista Romaneasca pentru Educatie Multidimensionala*, Vol. 13, No. 1, pp.20–40, https://doi.org/10.18662/rrem/13.1/357.

van Joolingen, W.R., de Jong, T., Lazonder, A.W., Savelsbergh, E.R. and Manlove, S. (2005) 'Co-Lab: research and development of an online learning environment for collaborative scientific discovery learning', *Computers in Human Behavior*, Vol. 21, No. 4, pp.671–688, https://doi.org/10.1016/j.chb.2004.10.039.

Vygotsky, L.S. and Cole, M. (1978) *Mind in Society: Development of Higher Psychological Processes*, Harvard University Press.

Wertsch, J. (1991) *Voices of the Mind: A Sociocultural Approach to Mediated Action*, Harvard University Press, Cambridge, MA.

Wright, C.R., Lopes, V., Montgomerie, T.C., Reju, S.A. and Schmoller, S. (2014) 'Selecting a learning management system: advice from an academic perspective', *Educause Review*, Vol. 2, No. 3, pp.1–18 [online] https://er.educause.edu/articles/2014/4/selecting-a-learning-management-system-advice-from-an-academic-perspective (accessed 12 April 2022).

Xie, J., Rice, M.F. and Griswold, D.E. (2021) 'Instructional designers' shifting thinking about supporting teaching during and post-COVID-19', *Distance Education*, Vol. 42, No. 3, pp.331–351.

Yang, X., Li, D., Liu, X. and Tan, J. (2020) 'Learner behaviors in synchronous online prosthodontic education during the 2020 COVID-19 pandemic', *The Journal of Prosthetic Dentistry*, https://doi.org/10.1016/j.prosdent.2020.08.004.

Yoo, S.J. and Huang, W.D. (2013) 'Engaging online adult learners in higher education: Motivational factors impacted by gender, age, and prior experiences', *The Journal of Continuing Higher Education*, Vol. 61, No. 3, pp.151–164, https://doi.org/10.1080/07377363.2013.836823.

Zhang, Q., He, Y.J., Zhu, Y.H., Dai, M.C., Pan, M.M., Wu, J.Q. and Qu, F. (2020) 'The evaluation of online course of traditional Chinese medicine for MBBS international students during the COVID-19 epidemic period', *Integrative Medicine Research*, Vol. 9, No. 3, p.100449, https://dx.doi.org/10.1016%2Fj.imr.2020.100449.

Zhao, W. (2020) 'Epistemological flashpoint in China's classroom reform: (how) can a 'Confucian do-after-me pedagogy' cultivate critical thinking?', *Journal of Curriculum Studies*, Vol. 52, No. 1, pp.101–117, https://doi.org/10.1080/00220272.2019.1641844.

Zheng, W., Ma, Y.Y. and Lin, H.L. (2021) 'Research on blended learning in physical education during the COVID-19 pandemic: a case study of Chinese students', *SAGE Open*, Vol. 11, No. 4, p.21582440211058196.

Zhou, J. and Zhang, Q. (2021) 'A survey study on US college students' learning experience in COVID-19', *Education Sciences*, Vol. 11, No. 5, p.248, https://doi.org/10.3390/educsci11050248.

Appendix

Demographic information

1 What is your gender identification?
   - female
   - male
   - prefer not to say
   - other

2 What stage of study are you currently in?
   - master degree
   - undergraduate degree
   - associate degree

3 What year are you currently in your university/college of study?
   - first year
   - second year
   - third year
   - fourth year

4 Which higher education institution do you attend? Please specify.

5 What is your major? Please specify.
- arts
- computer science
- language and literature, journalism and communication
- management, economics
- mechanology, electronics, materialogy, civil engineering
- others

6 What learning management system have you used before? Select all apply.
- Ding Ding
- MOODLE
- Rain classroom
- Tencent's class
- Chaoxing
- others

7 Which learning format do you prefer?
- face-to-face learning
- online learning
- hybrid.

Learner-instructor interaction

LII-1 In online courses, the professor was an active member of the discussion group offering direction to posted comments.

LII-2 I received timely feedback (within 24–48 hours) from my professor.

LII-3 I felt frustrated by the lack of feedback from my teacher.

LII-4 I was able to get individualised attention from my professor when needed.

LII-5 In online course, the professor functioned as the facilitator of the course by continuously encouraging communication.

LII-6 Although I could not see the professor in person, I felt his presence.

Learner-learner interaction

LLI-1 The online discussion board provided opportunity for problem solving with other students.

LLI-2 The online discussion board provided opportunity for critical thinking with other students.

LLI-3 The discussion board in online classes was a waste of time.

LLI-4 Online courses created a sense of community among students.

LLI-5 In this course I was able to ask for clarification for a fellow student when needed.

LLI-6 I received timely (within 24–48 hours) feedback from students in the class.

LLI-7 Online courses encouraged students to discuss ideas and concepts covered with other students.

Learner-technology interaction

LTI-1 Do you find it is easy to use the learning management system used in online courses for your learning with ease?

LTI-2 Was the LMS for online courses useful to fulfil your learning needs?

LTI-3 Was the LMS for online courses organised to satisfy your learning objectives?

LTI-4 Was it easy for you to understand the features of the LMS for online courses?

LTI-5 Was the LMS used for online courses providing you with the precise course content that you are looking for?

LTI-6 Was the LMS used by online courses providing you with flexibility to navigate among learning resources to control your individual learning speed?

LTI-7 Was the design and user interface of the LMS used in online courses attractive?

General satisfaction

GS-1 I am very satisfied with online courses.

GS-2 I would like to take another online course.

GS-3 Online courses did not meet my learning needs.

GS-4 I would recommend online course to others.

GS-5 I learned as much in online courses as compared to a face-to-face course.

GS-6 I feel online courses are effective as face-to-face courses.