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Students Perceptions, System Characteristics and Online Learning During the COVID-19 Epidemic School Disruption

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ABSTRACT

Due to the emergency educational consequences of the COVID-19 epidemic, it is necessary to find an effective and alternative way of learning. Moreover, during this epidemic, the Chinese Ministry of Education announced the "Disrupted Classes, Undisrupted Learning" initiative, offering flexible online learning. With the aim of facilitating a sound learning environment when using online learning systems, various kinds of tools can be applied. Tencent Meeting is one tool that offers various learning features. This study aimed to investigate how students perceived the effect of the Tencent Meeting system features on the two main determinants of the TAM model, namely perceived ease of use (PEOU) and perceived usefulness (PU). The study further analyzed the effects of these two determinants on learning performance. Data were analyzed using regression analysis. The study found the Tencent Meeting system features could account for 55.1% of PEOU and 40% of PU. Another finding shows that PEOU and PU had a significant effect on the students' learning performance. Finally, a discussions and implications are presented.

KEYWORDS

Learning Performance, Online Learning, Student Perception, System Features

INTRODUCTION

According to government data documented by the South China Morning Post, the first human case of COVID-19, the disease caused by the novel coronavirus, was discovered on November 17, 2019 at the Huana Seafood Wholesale Market in China (Li et al., 2020). Since then, COVID-19 has spread all over the world, becoming a global pandemic. On January 30, 2020, the World Health Organization (WHO) declared the coronavirus outbreak a Global Public Health Emergency. According to Johns Hopkins University's coronavirus resource center, more than 1million people had died due to COVID-19 by the end of September 2020. Most countries around the world started city lockdowns to prevent the spread of the disease and to save lives. Schools and universities were no exception, with many announcing the cessation of physical classes. Since then, there has been a steadily growing number of online learning classes as a result of the emergency in schools around the globe. Before the epidemic, online learning was running in parallel with physical classroom learning. More that 8 months have passed, and many physical schools still remain closed. In addition, Huang et al. (2020) mentioned

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that 276 million Chinese students have been unable to return to their schools and universities during this epidemic. The situation in almost all the countries in the world is the same. UNESCO (2020) highlighted that over 1.5 billion students around the world were not able to attend school or university due to the COVID-19 outbreak as of April 4th, 2020.

In this context, educational institutions all over the world have started considering the use of information and communication technology (ICT) to restructure the entire educational system. They have started to not only provide online education, but to develop different tools to allow classes to continue during this epidemic season. These developed online tools can facilitate effective online education. However, due to the sudden appearance of COVID-19, most countries were not prepared for conducting online courses to such an extent. For example, not only did many teachers have to prepare course materials for online teaching, but there was also a lack of learner-friendly interfaces and essential learning features, as well as price issues for third world countries.

However, there are numerous learning tools available for synchronous live teaching such as teaching interaction (Rain-Classroom, the Tencent Ketang Chaoxing Learning app, ClassIn, CCtalk, UMU), Social communication (QQ Group, WeChat Group), Remote office (Welink, Dingtalk, ZOOM, FEISHU, TED), Conversation Online course platforms (icourse, edX, Coursera, Udacity), and so on. There are also asynchronous teaching tools, for example, the course sharing platforms: icourse, edX, Coursera, and Udacity, regional MOOC platforms, CNMOOC, local university MOOC platforms, and so forth (Huang et al., 2020). These tools are appropriate for live teaching courses. There are different kinds of software which can be chosen to satisfy various demands for interaction, network quality or convenience (Huang et al., 2020). However, some of them are not able to be used in certain countries, some are missing some important learning features, and some have complicated user interfaces.

Therefore, it is very important to implement an effective and efficient tool to improve schooling systems and continue classes during the epidemic so that teachers and students can schedule and join meetings anytime and anywhere, thus eliminating the need to travel, and allowing students to be more efficient and productive. Due to COVID-19, foreign faculty/ students cannot travel from one country to another during the semester. China is also following the same rules. To avoid long-term teacher-student isolation, universities in China have applied their own university applications (apps) or tools to continue their classes. The Tencent Meeting tool is one such tool which provides an efficient and reliable video conferencing service powered by Tencent that is built for collaboration. Tencent has released an international version of its cloud-based video conferencing tool across more than 100 markets, including Singapore, India, Japan, Thailand, and Malaysia. In Tencent Meeting, the online learning application can host up to 300 students simultaneously and is available for free on the Google Play and Apple app stores.

From the viewpoint of the diffusion of innovations, learning with Tencent Meeting has apparent relative advantages over conventional learning, and is compatible with the cognitive aspects of learning practices. The Tencent Meeting tool is user-friendly, simple to use and trialable. It also supports different platforms (i.e., Windows, macOS, tablets and mobile phones, etc.). According to Rogers (2003), one needs to perceive at least some of the benefits of technology and be willing to cope with the uncertainty of the new medium before one can make the decision to accept it. Tencent Meeting-based classes may differ from conventional classrooms in terms of the way in which the content is structured and manifested. Therefore, one of the benefits of Tencent Meeting-based synchronous online classes can be regarded as the inclusion of a new medium into the students' learning practices. However, as yet there has been no empirical research during this time of the epidemic to test how individual students perceive the system features of such new tools (i.e., Tencent Meeting). Some students might face difficulties while using new tools. It might therefore prove advantageous if students' ideas and perceptions are collected and taken into consideration.

Therefore, this study aimed to explore the impacts of the Tencent Meeting system characteristics on students' perceptions of Tencent class participation in terms of its ease of use and usefulness. Considering the psychological aspects of learning, and the perception that make the acceptance of

technology easy or difficult (Rogers, 2003) we claim that there are still some factors that drive people to adopt and sustain continual learning while enhancing their learning performance from the use of such technologies. One's perceived ease of use and perceived usefulness are the very factors which might affect one's learning performance. However, very little research has been conducted to identify the direct influences of these two core constructs on learning performance. During this epidemic, students' perceptions of their learning performance with these new tools remain inconclusive. Thus, another aim of this study was to identify the effects of perceived ease of use and usefulness on students' learning performance. A course was conducted for undergraduate students in the winter semester of 2020 during this epidemic using Tencent Meeting. The aim of the study was to determine whether the students considered the tool to be useful and easy for learning, and was guided by the following research questions. Research purposes/questions:

1. How do the "Tencent Meeting" learning features influence students' perceived usefulness (PU) and perceived ease of use (PEOU)?
2. How do students' perceived ease of use (PEOU) and perceived usefulness (PU) influence students' learning performance in the Tencent Meeting-based class during the COVID-19 lockdown period?

The study is composed with six different procedures. Firstly, the research motivations and purposes are analyzed to identify the importance and necessity of Tencent Meeting based class (i.e., system features) on PEOU, PU, and learning performance. Secondly, a review of related theories and literature helped to present the relationships with Tencent Meeting system features on PEOU and PU, and then, PEOU and PU on learning performance participation towards a Tencent Meeting based online learning during COVID-19 pandemic. Thirdly, research methods are applied to answer the research questions. Fourthly, a measurement instrument with reliability and validity are developed with empirical data collection. Fifthly, "Tencent Meeting" used was used as an experiment field. Finally, the collected data are analyzed by the statistical tools for examining research questions.

LITERATURE REVIEW

Learning Tools and the Technology Acceptance Models (TAM)

For more than a decade now, online tools/apps (i.e., Facebook, blogs, Twitter, WeChat, etc.) have been used as facilitators of teaching and as learning platforms (Baird & Fisher, 2005; Williams & Sekret, 2018; Prestridge, 2019; Saini & Abraham, 2019; Yan, 2019). For example, Prestridge (2019) suggested that a new paradigm of professional development for teachers can be possible by using social media. Other studies have found that social media such as Facebook are effective in terms of encouraging students to learn (Awidi et al., 2019), that blog-based interaction can enhance learning performance (Quadir et al., 2019), that Twitter can be used for professional development (Emke, 2019), and that it can increase the enrollment and revenue of higher education institutions (Aman & Hussin, 2018), and that WeChat-based writing improves students' writing efficiency and critical thinking (Yan, 2019).

Recently, there have been many studies which have used tools for synchronous and asynchronous teaching and learning (Xiangming & Song, 2018; Yong & Lim, 2016; Huang, 2020). For example, Xiangming and Song (2018) used Rain Classroom as a WeChat-based app and found that the group exposed to Rain Classroom had a positive attitude towards the mobile technology tool. In another study, Yong and Lim (2016) investigated the testing effect of Coursera video-based learning. They identified that repeated studying produced better recall performance than did repeated testing when the final test was administered immediately, and that testing produced better performance when the final test was delayed by a week. In addition, Huang (2020) used the DingTalk platform in his study to interact with students, so that the online teaching method met the students' individual needs. They

found positive results of students with different English foundations and levels, and the students' interest in learning was stimulated. The aforementioned learning tools were tested by using renowned theory such as diffusion of innovation (DOI) and Technology Acceptance Model (TAM) etc. For example, the Technology Acceptance Model (TAM) was developed by Davis (1989) to predict the adoption of new technologies in different conditions and different fields (Teo, 2009). For more than 2 decades, TAM has been widely used to explain and predict students' acceptance of learning technologies, including the acceptance of MOOCs (Wu & Chen, 2017), blogs (Ifinedo, 2016), Web 2.0 (Chang et al., 2015), flipped learning (Anduja et al., 2020), technology pedagogy and content knowledge (Zoo, 2018) due to its simplicity and parsimony (Lee & Ryu, 2013).

The two main determinants of TAM models, namely perceived ease of use (PEOU) and perceived usefulness (PU) have been used in most of the studies to explore the relationships with other perceived factors of new technology, and their significance has been confirmed (Abdullah et al., 2016; Elkaseh et al., 2016). As Rogers (2003) pointed out, one needs to perceive at least some of the relative advantages of technology and be willing to cope with the uncertainty of a new medium prior to making the decision to adopt it (Quadir & Chen, 2015). Therefore, PEOU was used in this study to explain the student's notion of how easy it is to use the Tencent Meeting-based classroom. PEOU can be defined as the extent to which students believe that participating in Tencent Meetings will be free of effort, and the PU of Tencent Meeting can be described as the extent to which a student believes that it can be a driving force towards achieving learning goals. These two determinants might be the notion of the beneficial usage of Tencent Meeting and the ease of learning, which might enhance learning performance. Some studies have found that the system features of a new technology or innovative user interface are very important issues and have a positive impact on PEOU and PU (Alsabawy et al., 2016; Elkaseh et al., 2016; Stavros et al., 2017; Nikou & Economides, 2017; Wu & Chen, 2017). For example, Nikou and Economides (2017) found in their mobile-based assessment study that the user interface has a positive relationship with PEOU. Some other studies have found similar results, while research on e-learning acceptance (Liu et al., 2010) and mobile learning acceptance (Joo et al., 2014) revealed user interface effects on PEO and PU. In another study, Wu and Chen (2017) found that MOOC system features including openness and reputation have a positive effect on the PEOU and PU of MOOCs.

In addition, there are numerous studies which have been conducted with the PEOU and PU, to investigate the effects on learning (Ifinedo, 2017; Islam, 2013; Nagy, 2018; Joo et al. 2018; Al-Rahmi & Zeki, 2017). For example, Ifinedo (2017) found that the course instructor noticed that the class average in the preceding four MIS classes was lower than the mean score for the four classes in which blogs were used. The usefulness of blogging can enhance students' attitudes towards using blogs for learning (Ifinedo, 2017), which might enhance learning performance. Therefore, students' willingness to engage in activities relies significantly on how easy or difficult it is to use the technology. PEOU plays an important role in attitudes towards using E-Learning 2.0 (Wu & Zhang, 2014), which could enhance learning performance. The ease of use of information systems is predicted to be able to increase users' performance (Nugroho et al., 2018). Islam (2013) analyzed the role played by PEOU in the e-learning context and found that it can affect students' performance. Therefore, it is one of the perceptions of a student that technology has benefits. For example, it is the perception that the technology can enhance his/her learning performance. In this study, learning performance was measured in terms of learners' subjective and objective learning performance. Objective learning outcomes are evaluated by students' Tencent Meeting-based course activities such as discussion topics, Group presentations, assignments, as well as their midterm report, oral exam and final exam (Yang, et al. 2016). In a word, the study measured objective learning performance is the student's result at the end of the surveyed course (Nagy, 2018). Subjective learning performances are assessed as learners' learning perception based questionnaires during participating in the Tencent Meeting-based course (Yang, et al. 2016).

Figure 1. Registration login

TENCENT MEETING SYSTEM FEATURES AND LEARNING ACTIVITIES

Tencent Meeting was used for an undergraduate level course, "E-Commerce," in a renowned university in Shandong province, China. The duration of this course was one semester during the COVID-19 epidemic. Tencent Meeting consists of its system features and learning features with learning activities.

Tencent Meeting System Features

There are three steps involved in using the Tencent Meeting system (i.e., entering class, during class and after class) and each step has its own characteristics as described below.

Entering Class

Tencent Meeting is real-time online software that users can download and log into via computers, mobile phones and other electronic devices. Users register and log into Tencent Meeting through their mobile phone number and WeChat, as shown in Figure 1. Teachers can create a quick classroom and then generate a link. Students can join by using this link. The person who creates the classroom plays the role of moderator. By default, in this system the teacher is the moderator. The moderators perform some important roles such as booking a meeting with a theme, specifying the start time and end time, setting the meeting password, muting the meeting, and uploading the meeting documents. The scheduled meeting can be connected to the calendar to remind the teacher to attend, and the meeting ID is automatically generated, as shown in Figure 2. Scheduled meetings are displayed on the main page. The teacher sends the meeting ID link to the WeChat class group, and the students join the meeting by phone number, WeChat, and their created classroom ID number input into the app, as shown in Figure 3 and Figure 4. Students should complete the display name, audio and camera settings before joining the class. Before class, teachers upload the teaching resources for the students, and the students download the courseware for preview after joining the class.

During the Class

In class teacher shares the screen to show the PPT courseware and uses a microphone to teach, as shown in Figure 5. In the student's interface list, the teacher can see the attendance records of each

Figure 2. Scheduled meeting

Figure 3. Classroom link

student, as shown in Figure 6. The teacher can also ask questions using the students' names displayed in the list of the students' interface, and students can answer the questions immediately by turning on the microphone and webcam, so as to ensure effective interaction between the teacher and student. Moreover, Tencent Meeting has a chat box where teachers and students can interact when issues arise, as shown in Figure 7. The teacher will also send important information to the chat box to make the teaching information clearer. Students use the screen to share the group work, and the teacher gives comments.

After Class

Students can re-enter the class anytime and upload their homework in the meeting documents section as shown in Figure 8. The teacher can check that all students can see each other's assignment

Figure 4. Join the class

Figure 5. Teacher lecturing

assessment. Therefore, students can learn through the process. Tencent Meeting users can also use the meeting display member function to see the number of attendance, expression functions such as raising hands, encouraging, and other features.

Tencent Meeting Learning Features and Grading Policy

Each student is required to attend the class. The class attendance comprises 5% of the total score. The teacher can check attendance via the log data. The students develop an understanding of the course through reading the course content each week as uploaded prior to class. In the class, the teacher can teach the learning materials, ask the students questions, and give them assignments. Then, with the students' enquiring questions and uploaded assignments, the students can understand the critical issues of learning and discuss them with each other via the Tencent Meeting chat box. Such kinds of discussion sessions along with Q&A comprises 10% of the total score.

Students also need to present their assigned topic (i.e., case study) given by the teacher for group presentation using the screen sharing options shown in Figure 9. Based on their presentation, the teacher and other students ask them questions in the discussion section, as shown in Figure 10. The group presentation comprises 10% of the total score. Therefore, learner-content, learner-learner,

Figure 6. Managing members

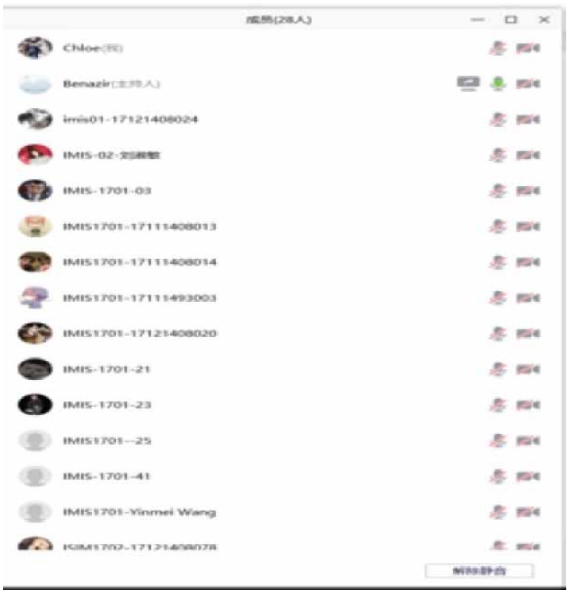


Figure 7. Chat box

Figure 8. Student's name, assignment title and submission time and date

Figure 9. Students presentation

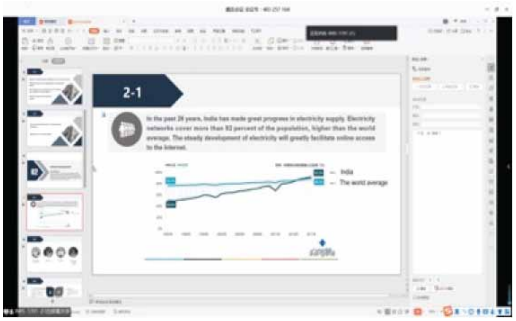
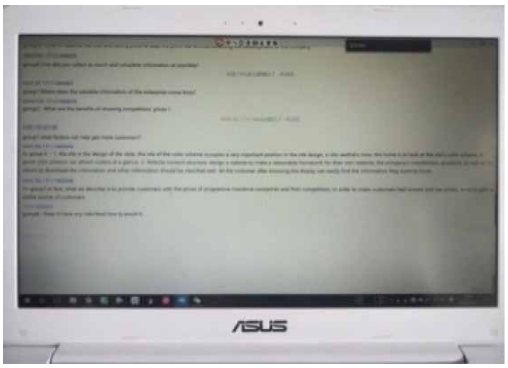


Figure 10. Students discussion session



and learner-teacher interaction can be enhanced, and collaborative learning can be promoted by participating in the Q&A sessions, as shown in Figure 11. The teacher and students can re-enter the meeting after the class to upload or download the learning materials as shown in Figure 12, to allow students to preview prior to class and review after class, so as to facilitate the transfer of teaching resources to the students. For the oral test, students enter the meeting using the webcam to check whether they have completed the oral test without having cheated, as shown in Figure 12. The oral test and final examination, all students are required to turn on the webcam and the microphone, as shown in Figure 13 and 14. The oral test and final exam comprises respectively 20% and 40% of the total score, as shown in Table 1. The final examination consisted of 40 questions with four different sets and was worth 40 points.

Figure 11. Q&A sessions

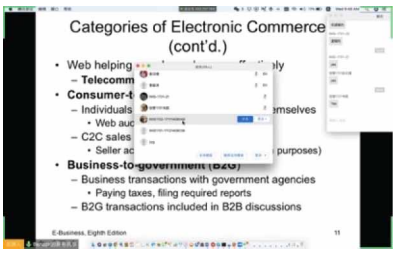


Figure 12. Upload homework

Figure 13. Oral test

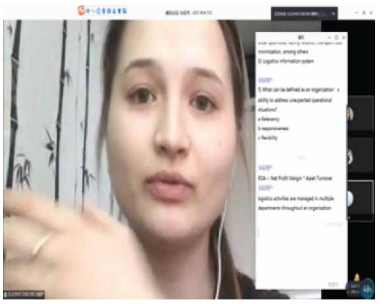
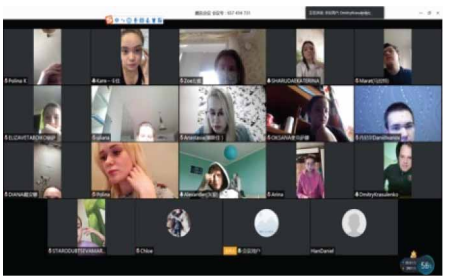


Figure 14. Final exam



METHOD

Participants

A total of 27 4th year undergraduate students (13 males, 14 females; 20-22 years old) majoring in Information Management Systems in a Chinese university in Shandong province participated in this study. Those students are chosen while attending e-commerce course. The research was conducting due to school disruption during the COVID-19 epidemic in 2020.

Table 1. Course activities and grading policy

Course Activities	Weight	Grading Policy
Class attendance and attentiveness	5%	Randomly asked students to check their attendance and attention.
Discussion topics	10%	Asking and answering questions-5% Explanation of assigned topics- 5%
Group Presentations	10%	Presentation style- 2% Presentation content quality- 4% Group Q&A sessions -4%
Mid-term reports	15%	Content-5% Significance-5% Results and discussions-5%
Oral examination	20%	Students are randomly asked 5 questions, each worth 4 points
Final exam_MCQ test	40%	40 questions each worth 1 point

Instruments

A questionnaire was developed to investigate the Tencent Meeting system features, the participants' perceptions of their usefulness and ease of use, and their learning performance. The questionnaire was divided into several sections. For example, the first section was to capture the respondent's basic information, such as age and gender. Items were developed to identify perceived system features, perceived usefulness and ease of use, and learning performance. The question items of system characteristics were taken from studies by recognized scholars (Alsabawy et al., 2016; Elkaseh et al., 2016; Nikou & Economides, 2017; Wu & Chen, 2017; Ifinedo, 2017; Islam, 2013; Nagy, 2018; Joo et al. 2018; Al-Rahmi & Zeki, 2017; Wu & Zhang, 2014; Quadir & Chen, 2014; Quadir & Chen, 2015; Yang et. al., 2016; Quadir, Yang & Chen, 2019). These items have already been used in different formal studies, but they were slightly modified to fit the context of the current study. Each item regarding the Tencent Meeting system features, perceived ease of use and usefulness, and subjective learning performance was rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Evaluation of Reliability and Validity

Cronbach's alpha reliability was used in this study to determine the consistency of the Tencent Meeting system features, perceived usefulness, perceived ease of use, and learning performance. Cronbach's alpha (i.e., internal consistency) showed system features, perceived ease of use, perceived usefulness, and learning performance of .813, .894, .914, and .787, respectively. With principal component analysis as the extraction method and varimax as the rotation method, data were tested to achieve structural validity. At a cut-off load of .50 and an eigenvalue greater than 1.0, no entries were deleted. The Cronbach's alpha value of each factor, the factor load, and the descriptive statistical results are shown in Table 2.

Data Analysis

The data collected from participants of Tencent Meeting classroom for quantitative analysis. In order to account for the effects of Tencent Meeting system features on PEOU and PU, regression analysis was conducted. In order to examine the effects of PEOU and PU on learning performance (i.e., subjective and objective) in the Tencent Meeting based online course, regression was computed.

Table 2. Descriptive statistics of the questionnaire items

The Name of the Constructs and Items	Mean	SD	FL
System features (Cronbach's alpha=.813) (Liu, Chen, et al. 2010; Lee et al. 2015; Nikou, et al., 2017)			
SF1: Before I attend the class, I can go through the learning material by myself for better academic learning	4.3333	.87706	.876
SF2: The chat box helps me to communicate with the teacher and classmates	4.5926	.69389	.652
SF3: I can enter every class by the Meeting ID on time	4.8889	.32026	.615
SF4: I can follow the teacher's screen sharing to finish my learning	4.5926	.88835	.654
SF5: I think Tencent classroom creates an environment suitable for learning by muting the member's voice	4.5926	.69389	.732
SF6: After class, I can upload homework documents on Tencent Meeting quickly	4.7407	.44658	.684
SF7: The voice and video quality in Tencent Meeting is very high	4.6667	.55470	.833
Perceived ease of use(PEOU) (Cronbach's alpha=.894) (Davis, 1989; Wu & Chen, 2016 ; Nikou, et al., 2017; Joo, et al., 2018)			
PE1: I found Tencent Meeting easy to use	4.5185	.64273	.900
PE2: Learning to use Tencent Meeting was easy for me	4.4074	.74726	.913
PE3: My interaction with Tencent Meeting was clear and understandable	4.4074	.69389	.925
PE4: It was easy for me to find information on Tencent Meeting	4.5185	.70002	.750
Perceived usefulness (PU) (Cronbach's alpha=.914) (Davis, 1989; Wu & Chen, 2016 ; Nikou, et al., 2017; Joo, et al., 2018)			
PU1: Using Tencent Meeting enhanced my learning effectiveness	4.4074	.79707	.910
PU2: Using Tencent Meeting improved my course performance.	4.3333	.78446	.872
PU3: Using Tencent Meeting increased my productivity in my course work.	4.4444	.69798	.934
PU4: I found Tencent Meeting useful.	4.4074	.84395	.863
Learning performance (Cronbach's alpha=.787) (Quadir & Chen, 2015; Yang et. al., 2016; Quadir, Yang & Chen, 2019)			
LP1: Having PPT prior to class gave me a better learning experience	4.7037	.46532	.756
LP2: In the class, being asked to answer questions by microphone helped me focus on what the teacher was teaching	4.5926	.63605	.795
LP3: Using screen sharing to show group homework can improve my expressive ability	4.8148	.39585	.934
LP4: I can take the classroom test much better/I feel more relaxed about taking the test on Tencent Meeting than traditional tests	4.6296	.56488	.746
LP5: Discussing in the chat box improved my comprehension of this class	4.7037	.46532	.778
LP6: The distant online classes make the knowledge more enjoyable and create more activity in class	4.5556	.75107	.677
LP7: Uploading and downloading learning materials in the Meeting document section can promote my autonomous learning	4.6667	.55470	.771
LP8: Compared to traditional classes, online meeting promotes my conversation with the teacher and classmates	4.6296	.56488	.795
LP9: I found a less distracting environment when I came to class	4.3704	.79169	.722
LP10: In the online class, I always set high standards for myself	4.5926	.69389	.947
LP11: I didn't work hard because I took this online class	3.0741	1.8171	.813

RESULTS AND DISCUSSIONS

The Influence of Tencent Meeting System Characteristics on Perceived Ease of Use (PEOU) and Perceived Usefulness (PU)

A linear regression analysis was performed, with the Tencent Meeting system characteristics as the independent variable and the students' PEOU and PU as the dependent variables. The results of the regression analysis are presented in Tables 3 and 4. Tencent Meeting system characteristics were a significant predictor of PEOU ($F[1, 25] = 30.65$, $p < .001$) as shown in Table 3. It was found that the Tencent Meeting system characteristics significantly predicted PEOU ($\beta = .74$, $p < .01$). The squared multiple correlation coefficient, R^2, was 55.1%, which means the Tencent Meeting system characteristics could account for 55.1% of PEOU.

The Tencent Meeting system characteristics were a significant predictor of PU ($F[1, 25] = 16.29$, $p < .001$) as shown in Table 4. It was found that the Tencent Meeting system characteristics significantly predicted PU ($\beta = .62$, $p < .01$). The squared multiple correlation coefficient, R^2, was 40%, which means the Tencent Meeting system characteristics could account for 40% of PU.

The results of the current study are consistent with what has been reported in several previous studies, namely that students' PEOU and PU could be promoted if they feel that they actually benefit from the learning support mechanisms (Elkaseh et al. 2016; Stavros et al. 2017; Nikou & Economides, 2017; Wu & Chen, 2017). For example, Wu and Chen's (2017) study identified that MOOC system features including openness and reputation had a positive effect on PEOU and PU of MOOCs. In another study, Elkaseh et al. (2016) found that social media had a significant effect on PEOU and PU. Adamson (2012) mentioned that social networking media are a vital tool for teaching and learning, and should be used extensively for learning. In another study, Nikou and Economides (2017) found that the user interface of a technology has a positive relationship with PEOU. The results of this study are similar to the results of Stavros et al.'s (2017) and Anderson's (2003) studies. It was found in the current study that perceived system characteristics significantly predicted students' PEOU, which aligned with previous studies. As Stavros et al. (2017) found, User Interface (UI) had a positive effect on PEOU. In another study, Alsabawy et al. (2016) found that IT infrastructure had a significant effect on PU.

Table 3. The regression results of Tencent Meeting system characteristics on PEOU

Model	SS	Df	MS	F	Sig.
Regression	5.281	1	5.281	30.655	.000
Residual	4.307	25	.172		
Total	9.588	26			

IV= Tencent Meeting system features, DV=PEOU

Table 4. The regression results of Tencent Meeting system characteristics on PU

Model	SS	Df	MS	F	Sig.
Regression	4.994	1	4.994	16.293	.000
Residual	7.663	25	.307		
Total	12.657	26			

IV= Tencent Meeting system features, DV=PU

The Influence of PEOU and PU of Tencent Meeting on Learning Performance (Subjective)

A linear regression analysis was performed, with PEOU and PU as the independent variables and students' learning performance (subjective) as the dependent variable. The results of the regression analysis are presented in Table 5. PEOU is a significant predictor of learning performance ($F[1, 25] = 12.83$, $p < .01$). It was found that PEOU significantly predicted the subjective learning performance ($\beta=.582$, $p < .01$). The squared multiple correlation coefficient, R^2, was 33.9%, which means the PEOU could account for 33.9% of learning performance.

The results of the regression analysis are presented in Table 6. PU is a significant predictor of learning performance ($F[1, 25] = 15.80$, $p < .01$). It was found that PU significantly predicted the subjective learning performance ($\beta=.622$, $p < .01$). The squared multiple correlation coefficient, R^2, was 38.7%, which means PU could account for 38.7% of learning performance.

The Influence of PEOU and PU of Tencent Meeting on Learning Performance (Objective)

A multiple regression analysis was performed, with PEOU and PU as the independent variables and students' learning performance (objective) as the dependent variable. The results of the regression analysis are presented in Table 7. PEOU and PU are significant predictors of learning performance, ($F[2, 24] = 4.85$, $p < .05$) and . It was found that PEOU and PU significantly predicted the objective learning performance respectively, ($\beta=.014$, $p < .01$) and ($\beta=-.011$, $p < .05$). The squared multiple

Table 5. The regression results of PEOU on learning performance

Model	SS	Df	MS	F	Sig.
Regression	1.771	1	1.771	12.830	.001
Residual	3.452	25	.138		
Total	5.223	26			

IV= PEOU, DV=Learning performance

Table 6. The regression results of PU on learning performance

Model	SS	Df	MS	F	Sig.
Regression	2.023	1	4.994	15.808	.001
Residual	3.200	25	.307		
Total	5.223	26			

IV= PU, DV=Learning performance

Table 7. The regression results of PEOU and PU on learning performance

Model	SS	Df	MS	F	Sig.
Regression	228.404	2	114.202	4.857	.017
Residual	564.263	24	23.511		
Total	792.667	26			

IV= PEOU, DV=Learning performance

correlation coefficient, R^2, was 29%, which means the PEOU and PU could account for 29% of objective learning performance.

The results of the current study are similar to the other previous study results of (Al-Rahmi and Zeki, 2017; Islam, 2013; Tabak and Nguyen, 2013) but in a different context. For example, in the e-learning context, perceived ease of use can affect students' learning performance (Islam, 2013) due to the easiness of using the information system. The easier the learning system is to use, the better the performance (Islam, 2013). In another study, Nagy (2018) analyzed the role of PU in a video-based learning context and indicated that video usage had a significant effect on learning performance. The same concept was found in Joo et al.'s (2018) study that perceived ease of use and perceived usefulness had a positive influence on students' satisfaction with the K-MOOC course. They mentioned that PEOU and PU, mediated by satisfaction, had indirect effects on the continuance intention to use K-MOOCs, which is the purpose of self-development and life-long learning, going beyond a means to earn credit hours. In addition, Kuo (2017) found that the PU of an online English listening system which was integrated with an attention-promoting mechanism had a relation with the students' attitude towards enhancing their learning. There are some other studies which have discussed perceived learning performance and learning ease of use which found that the technology had an indirect effect on learning performance. For example, Tabak and Nguyen (2013) mentioned that PEOU and PU, mediated by self-regulated learning process, had indirect effects on the overall course performance. Islam (2013) found that PEOU and PU, mediated by learning assistance and community building, had indirect effects on learning performance. In another study, Al-Rahmi and Zeki (2017) identified that perceived ease of use, mediated by the collaborative learning process, had indirect effects on learning performance; and PU, mediated by social media use and students' satisfaction, had indirect effects on learning performance. However, Nugroho et al. (2018) found that PEOU and PU had no significant effect on learning performance. The same results were found by Thomas et al. (2018), namely that perceived ease of use had no significant relation with perceived learning.

CONCLUSION

This study investigated how do the "Tencent Meeting" learning features influence students' PEOU and PU, and reported the results of the analysis to answer the research question. It was found that the Tencent Meeting system features significantly predicted PEOU and PU. Tencent Meeting system features could account for 55.1% variance of PEOU and 40% variance of PU. This study also investigated how do the students' PEOU and PU influence their learning performance in the Tencent Meeting-based class during the COVID-19 lockdown period. It was found that PEOU and PU significantly predicted the subjective learning performance could respectively account for 33.9% and 38.7% variance of learning performance. The findings of this study suggest that learners' PEOU and PU of "Tencent Meeting" related to the instructional design consists of not only technology-related usefulness but also the usefulness of the learning process.

Moreover, the study developed a Tencent Meeting system features, PEOU, PU and learning performance scale for "Tencent Meeting based learning" and examined the validity and reliability of the scale. The findings of this study can be a reference to educators regarding how to promote learners' PEOU and PU in online learning with such new tools. Future studies should investigate the relationship of learners, "Tencent Meeting" system features, relative advantages, complexity, compatibility, reliability and acceptance of "Tencent Meeting" according to the diffusion of innovation theory (DOI). Moreover, there are some other perceived factors such as perceived interest, playfulness, and self efficacy which need to be considered while conducting such kinds of new technology adoption research.

There are some implications for educational institutions, educators and learners. For example, educational institutions could implement any tools, even if they are not well developed, to avoid wasting time. To optimize the use of such developed tools, educators can partially use social media for learning

such as opening classroom groups. For example, a new tool might cause technical difficulties or other difficulties such as the lack of synchronous live discussion with many users. Therefore, it might be more effective if educators can use WeChat or other social networking sites together with the new tool. Therefore, based on the empirical evidence provided by the current study, educators can adopt new tools and use them to continue teaching their classes online during this epidemic to ensure that the "stay home, stay safe" slogan might be more effective. Students can participate joyfully when they find that their learning performance is improving. Although a comprehensive study was carried out, a few limitations of the present study should be noted. One of the limitations of the free version of the Tencent Meeting is that can only be used for 30 days; after that a new classroom needs to be opened. Thus, students and teachers might lose their uploaded files and assignments. Another limitation is that there is no archive of classes for the Tencent system features. Subsequently, there was a small sample size due to the practical constraint of the university elective courses, so the results may not be generalized to other samples. Using different demographics with a wider range of samples from elsewhere is encouraged for future generalization of the items.

REFERENCES

Abdullah, F., Ward, R., & Ahmed, E. (2016). Investigating the influence of the most commonly used external variables of TAM on students' Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) of e-portfolios. *Computers in Human Behavior*, *63*, 75–90. doi:10.1016/j.chb.2016.05.014

Adamson, C. (2012). *The Role of Social Media in Education*. Available: http://www.icwe.net/oeb_special/OEB_Newsportal/the-role-of-socialand-mobile-media-in-education/

Alsabawy, A. Y., Cater-Steel, A., & Soar, J. (2016). Determinants of perceived usefulness of e-learning systems. *Computers in Human Behavior*, *64*, 843–858. doi:10.1016/j.chb.2016.07.065

Al-Rahmi, W. M., & Zeki, A. M. (2017). A model of using social media for collaborative learning to enhance learners' performance on learning. *Journal of King Saud University - Computer and Information Sciences, 29*(4), 526–535. doi:10.1016/j.jksuci.2016.09.002

Aman, K., & Hussin, N. (2018). The Effectiveness of Social Media Marketing in Higher Education Institution. *International Journal of Academic Research in Business and Social Science*, *8*(9), 827–934. doi:10.6007/IJARBSS/v8-i9/4657

Andujar, A., Salaberri-Ramiro, M. S., & Cruz Martínez, M. S. (2020). Integrating flipped foreign language learning through mobile devices: Technology acceptance and flipped learning experience. *Sustainability*, *12*(3), 1110. doi:10.3390/su12031110

Awidi, I. T., Paynter, M., & Vujosevic, T. (2019). Facebook group in the learning design of a higher education course: An analysis of factors influencing positive learning experience for students. *Computers & Education*, *129*, 106–121. doi:10.1016/j.compedu.2018.10.018

Baird, D. E., & Fisher, M. (2005). Neomillennial user experience design strategies: Utilizing social networking media to support "always on" learning styles. *Journal of Educational Technology Systems*, *34*(1), 5–32. doi:10.2190/6WMW-47L0-M81Q-12G1

Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *Management Information Systems Quarterly*, *13*(3), 319–340. doi:10.2307/249008

Elkaseh, A. M., Wong, K. W., & Fung, C. C. (2016). Perceived ease of use and perceived usefulness of social media for e-learning in Libyan higher education: A structural equation modeling analysis. *International Journal of Information and Education Technology (IJIET)*, *6*(3), 192–199. doi:10.7763/IJIET.2016.V6.683

Emke, M. (2019). Always In-between: Of Rhizomes and Assemblages in Language Teacher Education Research. In Deterritorializing Language, Teaching, Learning, and Research (pp. 199-223). Brill Sense. doi:10.1163/9789004420939_010

Huang, R., Tlili, A., Chang, T. W., Zhang, X., Nascimbeni, F., & Burgos, D. (2020). Disrupted classes, undisrupted learning during COVID-19 outbreak in China: Application of open educational practices and resources. *Smart Learning Environments*, *7*(1), 1–15. doi:10.1186/s40561-020-00125-8

Huang, Q. (2020). Analysis of the Pros and Cons of Students' Online Courses during the Epidemic and the Prospects for the Development of English Online Platform in Secondary Vocational School. *Education Reform and Development*, *2*(1), 17–21.

Ifinedo, P. (2017). Examining students' intention to continue using blogs for learning: Perspectives from technology acceptance, motivational, and social-cognitive frameworks. *Computers in Human Behavior*, *72*, 189–199. doi:10.1016/j.chb.2016.12.049

Islam, A. K. M. N. (2013). Investigating e-learning system usage outcomes in the university context. *Computers & Education*, *69*, 387–399. doi:10.1016/j.compedu.2013.07.037

Joo, Y. J., So, H.-J., & Kim, N. H. (2018). Examination of relationships among students' self-determination, technology acceptance, satisfaction, and continuance intention to use K-MOOCs. *Computers & Education*, *122*, 260–272. doi:10.1016/j.compedu.2018.01.003

Joo, Y., Lee, H., & Ham, Y. (2014). Integrating user interface and personal innovativeness into the TAM for mobile learning in Cyber University. *Journal of Computing in Higher Education*, *26*(2), 143–158. doi:10.1007/s12528-014-9081-2

Kuo, Y.-C., Chu, H.-C., & Tsai, M.-C. (2017). Effects of an integrated physiological signal-based attention-promoting and English listening system on students' learning performance and behavioral patterns. *Computers in Human Behavior*, *75*, 218–227. doi:10.1016/j.chb.2017.05.017

Lee, D., Moon, J., Kim, Y. J., & Yi, M. Y. (2015). Antecedents and consequences of mobile phone usability: Linking simplicity and interactivity to satisfaction, trust, and brand loyalty. *Information & Management*, *52*(3), 295–304. doi:10.1016/j.im.2014.12.001

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., Ren, R., Leung, K. S. M., Lau, E. H. Y., Wong, J. Y., Xing, X., Xiang, N., Wu, Y., Li, C., Chen, Q., Li, D., Liu, T., Zhao, J., Liu, M., & Feng, Z. et al. (2020). Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. *The New England Journal of Medicine*, *382*(13), 1199–1207. Advance online publication. doi:10.1056/NEJMoa2001316 PMID:31995857

Liu, I. F., Chen, M. C., Sun, Y. S., Wible, D., & Kuo, C. H. (2010). Extending the TAM model to explore the factors that affect intention to use an online learning community. *Computers & Education*, *54*(2), 600–610. doi:10.1016/j.compedu.2009.09.009

Nagy, J. T. (2018). Evaluation of online video usage and learning satisfaction: An extension of the technology acceptance model. *International Review of Research in Open and Distributed Learning*, *19*(1). Advance online publication. doi:10.19173/irrodl.v19i1.2886

Nikou, S. A., & Economides, A. A. (2017). Mobile-based assessment: Investigating the factors that influence behavioral intention to use. *Computers & Education*, *109*, 56–73. doi:10.1016/j.compedu.2017.02.005

Nugroho, M. A., Dewanti, P. W., & Novitasari, B. T. (2018, September). The Impact of Perceived Usefulness and Perceived Ease of Use on Student's Performance in Mandatory E-Learning Use. In *2018 International Conference on Applied Information Technology and Innovation (ICAITI)* (pp. 26-30). IEEE. doi:10.1109/ICAITI.2018.8686742

Prestridge, S. (2019). Categorising teachers' use of social media for their professional learning: A self-generating professional learning paradigm. *Computers & Education*, *129*, 143–158. doi:10.1016/j.compedu.2018.11.003

Quadir, B., & Chen, N. S. (2015). The effects of reading and writing habits on blog adoption. *Behaviour & Information Technology*, *34*(9), 893–901. doi:10.1080/0144929X.2015.1022224

Quadir, B., & Chen, N.-S. (2014). The Effects of Reading and Writing Habits on Learning Performance in a Blog Learning Environment. *The Asia-Pacific Education Researcher*, *24*(4), 635–644. doi:10.1007/s40299-014-0210-5

Quadir, B., Yang, J. C., & Chen, N. S. (2019). The effects of interaction types on learning outcomes in a blog-based interactive learning environment. *Interactive Learning Environments*, *12*(1), 1–14. doi:10.1080/10494820.2019.1652835

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). Free Press.

Saini, C., & Abraham, J. (2019). Implementing Facebook-based instructional approach in pre-service teacher education: An empirical investigation. *Computers & Education*, *128*, 243–255. doi:10.1016/j.compedu.2018.09.025

Tabak, F., & Nguyen, N. T. (2013). Technology Acceptance and Performance in Online Learning Environments: Impact of Self Regulation. *Journal of Online Learning and Teaching*, *9*(1), 116–130.

Teo, T. (2009). Is there an attitude problem? Reconsidering the role of attitude in the TAM. *British Journal of Educational Technology*, *40*(6), 1139–1141. doi:10.1111/j.1467-8535.2008.00913.x

Thomas, L. J., Parsons, M., & Whitcombe, D. (2018). Assessment in Smart Learning Environments: Psychological Factors Affecting Perceived Learning. *Computers in Human Behavior*, *95*, 197–207. doi:10.1016/j.chb.2018.11.037

Williams, P., & Sekret, I. (2018). Implementation of social media for enhancing learning interactivity in formal education. *Pedagogical Advances in Technology-Mediated Education*, *1*(1), 68–83.

Wu, B., & Chen, X. (2017). Continuance intention to use MOOCs: Integrating the technology acceptance model (TAM) and task technology fit (TTF) model. *Computers in Human Behavior*, *67*, 221–232. doi:10.1016/j.chb.2016.10.028

Wu, B., & Zhang, C. (2014). Empirical study on continuance intentions towards E-Learning 2.0 systems. *Behaviour & Information Technology*, *33*(10), 1027–1038. doi:10.1080/0144929X.2014.934291

Xiangming, L., & Song, S. (2018). Mobile technology affordance and its social implications: A case of "Rain Classroom". *British Journal of Educational Technology*, *49*(2), 276–291. doi:10.1111/bjet.12586

Yan, L. (2019). A Study on WeChat-Based Collaborative Learning in College English Writing. *English Language Teaching*, *12*(6), 1–9. doi:10.5539/elt.v12n6p1

Yang, J. C., Quadir, B., Chen, N.-S., & Miao, Q. (2016). Effects of online presence on learning performance in a blog-based online course. *The Internet and Higher Education*, *30*, 11–20. doi:10.1016/j.iheduc.2016.04.002

Yong, P. Z., & Lim, S. W. H. (2016). Observing the testing effect using Coursera video-recorded lectures: A preliminary study. *Frontiers in Psychology*, *6*, 2064. doi:10.3389/fpsyg.2015.02064 PMID:26858667

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