Journal of Education, Teaching and Social Studies
ISSN 2642-2336 (Print) ISSN 2642-2328 (Online)
Vol. 6, No. 2, 2024
www.scholink.org/ojs/index.php/jetss

Original Paper

Exploring EFL Learners' Technology Acceptance in Online Learning in Collaborative Education Programs

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Received: May 6, 2024 Accepted: June 1, 2024 Online Published: June 3, 2024

doi:10.22158/jetss.v6n2p195 URL: http://dx.doi.org/10.22158/jetss.v6n2p195

Abstract

Higher education in the world is increasingly supported by the rapid developing technology, and it is worthwhile to investigate the implementation of online teaching. Empirical study on learner's acceptance of online study is thus pragmatic in necessitating further development of such technological circumstances. This study focuses on the investigation of undergraduates in collaborative programs in a South China city to explore their readiness in online learning under the framework of the technology acceptance model. A questionnaire survey was conducted online to access factors influencing learners' technology acceptance and usage. The results found significant positive relationships between technology self-efficacy and perceived ease of use, perceived ease of use and perceived usefulness, perceived usefulness and both attitude towards use and intention to use, as well as between perceived ease of use and attitude towards use. Such findings indicate that ease of use and usefulness significantly shape EFL learners' attitudes and intentions towards technology in collaborative setting, with self-efficacy being crucial in facilitating a positive perception of technology. However, the relationship between attitudes and intention to use did not align with expectations, indicating that learner attitude may not straightforwardly predict learner intention in collaborative programs.

Keywords

EFL learners, technology acceptance, online learning, collaborative education

1. Introduction

Online education has been widely adopted in different education systems globally. It is an access to learning experience via the use of technology by large number of students (Moore, Dickson-Deane, & Galyen, 2011). In China, online learning developed very rapidly since the years of Covid-19 and is

encouraged to become a compulsory way of learning. The information communication not only benefit students in acquiring abundant information but also improve the channels of collaborative education between different levels of teaching institutes. Among all factors influencing the decision making to participate in online learning or not, students are the decisive body (Al Fadda, 2020). As more and more learners engage with English as a Foreign Language (EFL) through virtual access and distant learning, correspondingly, EFL learning changes in learning strategies. Understanding the factors that contribute to effective and satisfying learning experiences becomes necessary. To better predict, explain and improve EFL learner behavior and efficiency, it is crucial to understand student perception of online learning.

Collaborative Education Programs refer to educational programs that involve cooperation between different educational bodies to enhance the student learning experience (He & Ji, 2021). Collaborative education generally includes credit transfer, shared resources, faculty and facilities, as well as curriculum coordination. There are different forms of collaborative education programs, including home-and-abroad collaboration, domestic collaboration among different teaching institutes, and within-organization collaboration. In China, collaborative education is often regarded as a kind of cooperative education mechanism between technical schools and colleges, and between three-year colleges and four-year universities, or cooperative teaching of teachers in different teams (Xu, 2018). For example, students from technical education layer or three-year colleges can pursue a bachelor's degree by utilizing what they have gained, i.e., credits or industry certifications, to earn credits in a higher layer of education, reducing the time to completion of the bachelor's degree. In 2017, the China government issued a policy "On Deepening Industry and Education" to promote the collaborative education national wide to fix the changing need in employment. So far, there is limited research on the operation of collaborative education programs.

The technology acceptance model (TAM) has been attracting substantial attention since the adaptation of computer and the Internet. Represented by Davis, TAM aims to explain and predict users' acceptance of information technology (Davis, 1986). It has two key constructs: perceived usefulness (PU) and perceived ease of use (PEOU), i.e., the degree to which a user believes that using a technology will enhance their job performance and the degree to which a user believes that using the technology will be free of effort (Jin, Im, Yoo, et al., 2023). Technology acceptance is a critical factor in online learning because the it can shape learning efficacy and overall online educational experience.

To effectively use the internet to support students' learning, it is significant to explore user motivation in the application of technology (Manis & Choi, 2018). While existing studies has explored various aspects of online learning, the specific interplay between technology acceptance of EFL learners in cooperative education remained underexplored. Moreover, as online teaching is becoming a common practice in collaborative programs, understanding variables in technologies acceptance can provide valuable insights into optimizing online EFL programs to enhance learner engagement and improve learning outcome.

The current study aims to explore the technology acceptance of EFL learners in collaborative education context. It addresses EFL learners' readiness in online learning under the framework of TAM with research questions broken down into four:

Q1: How do EFL learners perceive the usefulness of online learning technologies in collaborative education programs?

Q2: What are the attitudes of EFL learners towards using technology in their online collaborative learning environments?

Q3. How does perceived ease of use affect EFL learners' acceptance of online learning technologies in collaborative education settings?

Q4: What role does students' self-efficacy with technology play in their acceptance of online learning tools in collaborative educational programs?

2. Literature Review

2.1 Collaborative Education Programs

Collaborative teaching, or co-teaching is initially used to address the issue of teaching disabled students in an exclusive classroom (Wong, 2023; Cook & Friend, 1995). In practice, collaborative teaching models is often implemented in a broader sense than team teaching, requiring different levels of participation and responsibility from team teachers in teaching process (Wong, 2023). In the 1990s, many countries began to adopt various networks to improve educational outcomes, and school-to-school collaboration has become a popular approach of education improvement (Muijs, Ainscow, Chapman, & West, 2011).

In China context, collaborative education generally refers to school-to-school support through sharing various forms of educational resources, such as school facilities, human resources, experience and so on, in which dual enrollment, articulation agreements, and credit recognition is common practice. School collaboration has become a popular approach for education improvement, in particular, trying to fill the gap of supply and demand in talent bases when China is in the phase of industrial transformation. Collaborative education in practice has broad and various systems, indicating cooperation between different levels of education institutions with corresponding difference in credit requirement, terms of learning years, certificates, ways of transition, class patterns, geographic requirements, internship, and so on.

Previous studies have mainly focused on the mechanism of collaborative education, the theme of professional teaching, the comparative study of home and abroad collaboration education and the like. In mechanism and network study, a triple model of university/college, industry and government, or dual relationship between university/college and lower performing education, or collaboration within same-level of teaching is built to support the collaboration, with emphasis on mutual benefit of the parties involved, or appropriate supervision provided by government, high performing institution and low performing institution, or strategies to guarantee closed relationship between two layers of

education bodies (Newman, 2001; Moody, 2004; Yoshikane, Nozawa, & Tsuji, 2006). Researchers also observe teaching outcome, teamwork, work efficiency, teachers' acceptance, communication between teachers and students and other qualities in collaborative education programs (Wong, 2023; Miani & Picucci-Huang, 2023; Yuan & Liu, 2024). Moreover, international collaboration of universities and colleges is a big concern as more and more Chinese students try to develop potential ability to fit themselves for the market, leading to comparative analysis of student and teacher performance, language and professional proficiency of students, dilemma of collaboration program and so on (Cui & Zhang, 2024; Xie, Sui, Liu, & Liu, 2023; Etzkowitz & Leydesdorff, 1995; Fernandes, O'Sullivan, Miguel, & Ferreira, 2022).

National policies on education in China encouraging collaborative education programs are issued continuously in recent decade, indicating that more and more literal and empirical study on collaborative affairs is needed.

2.2 Technology Acceptance in Education

TAM is a theory to explore reasons for using a technology in work context. It is an intention-based model developed by Davis in the late 1980s when email and word processing system quickly replaced paper jobs in office (Davis, 1989). Instead of focusing on technology, TAM explains people's belief and perception of technology (Gupta, Abbas, & Srivastava, 2022; Alfadda & Mahdi, 2021). It assumes that people plan their behavior and they are rational in actions. In this sense, technology acceptance is an individual's psychological state, i.e., user motivation, in relation to his or her voluntary or intended use of technology, ages, genders, learning experience and other personal traits. Figure 1 shows the causal relationships among TAM components: perceived usefulness (PU), perceived ease of use (PEOU), attitude toward using (ATU) and actual system use. In TAM, user motivation is decoded into three variables: PU, PEOU and ATU. PU is the degree of the user faith in believing that using a particular system would enhance job performance. PEU is the degree to which one believes using a particular system would free his or her physical and mental effort. PU and PEOU are two significant variables representing cognitive response, with the latter exerting direct influence on the former: the higher PEOU, the more positive PU, and vice versa. Besides, ATU is a function of PU and PEOU, indicating affective response, and consequently effects the actual system use. While TAM external variables are firstly termed by Fishbein paradigm, they are, therefore, inexplicitly in the model. External variables directly influence PU and PEOU, encompassing demographic and personality characteristics of the actor, characteristics of referents and so on (Davis, 1989).

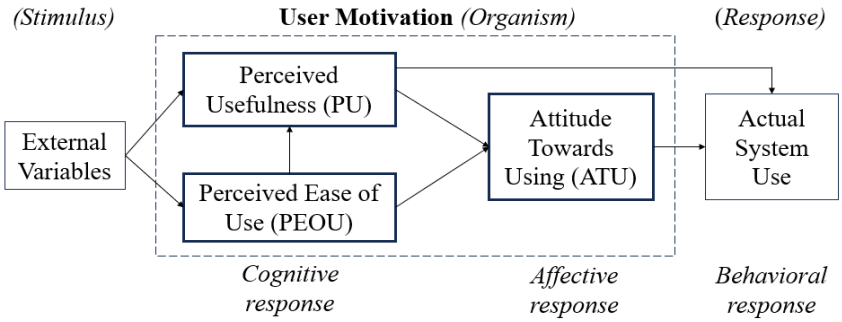

Figure 1. Original Model of TAM by David Mediating between System Characteristics and User Behavior (1986)

TAM has been continuously enriched and expanded. Further development of TAM includes TAM2, the Unified theory of acceptance and use of technology (UTAUT), TAM3, task technology fit (TTF), general extended technology acceptance model for e-learning (GETAMEL), expectancy confirmation model (ECM) and other models (Gupta, Abbas, & Srivastava, 2022). These upgrades either try to enrich external factors, like TAM2 and GETAMEL, or apply TAM to business fields, like TAM3 and ECM, or probe into the role of technology, etc. While for e-learning study, TAM is still the most adopted model, using questionnaire survey as the instrument to explain and predict mortal manners of respondents, college students being the majority.

Extensive empirical studies on TAM have been made accompanying with technological development within decade. Firstly, TAM is found to be effective in explaining learners' behavior and teacher attitudes on technology in online training course (Alfadda & Mahdi, 2021; Wasserman & Migdal, 2019). Students' PEOU contributes significantly to students' rate of using Moodle system (Essel & Wilson, 2017). Students using STEM are more behavioral responsive to use e-learning and have higher intention in PEOU (Thongsri, Shen, Liang, & Bao, 2019). Researchers in recent decades solidified TAM's application in different demographic groups using diverse technologies (Al-Adwan, Li, Al-Adwan, Abbasi, Albelbisi, & Habibi, 2023; Huang, Teo, & Guo, 2021; Rafique, Almagrabi, Shamim, Anwar, & Bashir, 2020). Besides, perceptions on technology in different learning stages are compared. Learning methods do have impact on learners' willingness to use technology, and moreover, learning motives and learning strategies significantly influence learners' PU in tablet computers (Liu, Wu, & Sun, 2014). Eastern students and western students are different in learning style (Ibrahim, Leng, Yusoff, et al., 2017). However, some learners also found that PU and PEOU can determine students' technology acceptance regardless of student degree (Azawei, Parslow, & Lundqvist, 2017). Moreover, influential factors of PU, PEOU and other mental responses have aroused researchers' attention. For MOOC learning, major influencing factors on technology acceptance are online learning modes, matching degree with the platform, user satisfaction and learning effect (Rekha, Shetty, & Basri, 2023). In terms of influential capacity, PEOU can best predict learning experience, followed by enjoyment, self-efficacy and subjective norm (Abdullah, Ward, & Ahmed, 2016).

In TAM research, EFL learners' acceptance of online platforms can critically shape their learning efficacy and overall educational experience (Latip, Noh, Tamrin, & Latip, 2020). Self-efficacy with technology is not explicitly included as a separate construct in TAM proposed by David, but it is often considered a related concept that influences users' perception of both usefulness and ease of use (Mew & Honey, 2010). Technology self-efficacy (TSE) refers to students' perception of their capabilities to utilize technological tools and websites to conduct learning behaviors so as to achieve intended learning outcome (Pan, 2020). Previous research found a significant positive effect of TSE on technology acceptance, and TSE is considered a proxy of learners' control beliefs in using technology (Celik & Yesilyurt, 2013; Venkatesh & Davis, 1996). Researchers also found that TSE significantly affects learners' perceptions of usefulness of technology and behavioral preferences to use technological tools (Keengwe, 2007).

While qualitative and quantitative research on TAM's effectiveness in assessing online learning acceptance is well-established, its targeted application to language acquisition within Chinese higher education, especially in collaborative education programs, remains ample room for investigation. As this study tries to answer the four research questions while at the same time it does not probe into detailed learning activities during the online learning process of EFL students in collaborative education programs, the study proposes the following six hypotheses (see Figure 2).

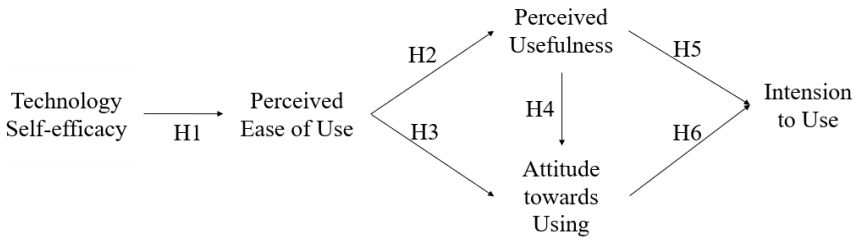

Figure 2. Path Model of Hypotheses

Hypothesis 1: Technology self-efficacy has a significant effect on the perceived ease of use among EFL learners in collaborative programs.

Hypothesis 2: Perceived ease of use has a significant effect on the perceived usefulness.

Hypothesis 3: Perceived ease of use has a significant effect on attitude towards using technology.

Hypothesis 4: Perceived usefulness has s significant effect on attitude towards using technology

Hypothesis 5: Perceived usefulness has a significant effect on intention to use.

Hypothesis 6: Attitude towards using technology has a significant effect on intention to use.

3. Methodology

Questionnaire survey was adopted to explore EFL students' acceptance of technology in collaborative programs. 176 respondents from collaborative programs were recruited through teacher network in higher education in Guangzhou City, China. They are undergraduates majoring in English, i.e.,

traditional English education for general language teaching, Business English, and English Translation and they are in the 3 plus 2, 3 plus 1, or 2 plus 2 collaborative education system. All of them had online learning experience in the past years or are having online English course. Channels of online English teaching includes an intranet platform Chaoxing, MOOC, and Tencent Meeting, either in formal settings or beyond-class settings. All respondents filled in the questionnaire through a link of Wenjuanxing, an opened tool specialized in questionnaire survey. The data collection process lasted for one month.

According to the demographic information in Table 1, among 176 EFL learners, 157 (89%) were females and 19 (19%) were males. In terms of age difference, 20-21 years old (44%) and 22-23 years old (36%) students are the majority, followed by students aged 18-19 and 24 years old and above.

Table 1. Demographic Information of Respondents (n=176)

Demographic variables	Number of participants
Gender	
females	157
males	19
Age	
18-19	27
20-21	78
22-23	64
24 and above	7

Questionnaire survey contains 18 items covering five dimensions: PU, PEOU, ATU, TSE and intention to use (ITU). Multiple-choice questions investigate demographics and technology usage pattern. The 5-point Likert scale items ranging from 1 “strongly disagree” to 5 “strongly agree” covers PEOU, PU and ATU and self-efficacy with technology. Moreover, two open-ended questions are used to further explore user experience and challenges in using technology in language learning.

4. Result

Firstly, A reliability analysis based on Cronbach’s Alpha was conducted to ensure the reliability and internal consistency. Table 2 demonstrates an overall high alpha ($\alpha>0.7$). Among five components of the questionnaire, the internal consistency of PEOU ($\alpha=0.791$) is acceptable, while the rest variables are good ($0.8 \leq \alpha < 0.9$) (Crocker & Algina, 2006). Therefore, this Cronbach’s alpha coefficient identified that the survey result is reliable.

Table 2. Cronbach's Alpha Coefficient

Scale	Number of items	Cronbach's Alpha
Perceived ease of use	4	.791
Perceived usefulness	4	.833
Attitude towards using	4	.804
Self-efficacy with technology	3	.826
Intention to use	3	.887

A factor analysis was then performed to check the variability among measure items. The essay adopted principal factor analysis (PFA) to create five dimensions in the set, including PEOU, PU, ATU, TSE and ITU (see Table 3). These dimensions constitute five factors. Table 3 shows the variables with high loading coefficient (>0.6), exhibiting a strong association with the factors and a good convergent validity (Hair, Anderson, Babin, & Black, 2010). As also can be seen, after varimax rotation, the five factors (PEOU, PU, ATU, TSE and ITU) respectively accounts for 44.41%, 24.86%, 12.67%, 11.34% and 10.62% of the variance. Which provides a robust criterion for determining the number of factors in the latter analysis.

Table 3. Varimax Rotated Factor-loading Matrix from Factor Analysis

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
PEOU 1	0.862				
PEOU 2	0.735				
PEOU 4	0.723				
PEOU 3	0.643				
PU 2		0.953			
PU 1		0.802			
PU 3		0.657			
PU 4		0610			
ATU 3			0.731		
ATU 4			0.722		
ATU 1			0.695		
ATU 2			0.638		
TSE 2				0.819	
TSE 3				0.760	
TSE 1				0.722	
TUP 1					0.870
TUP 2					0.848

TUP 3					0.703
Total variance explained, %	44.41	24.86	23.67	11.34	10.62

Besides, Statistical Analysis System (SAS) was used for advanced analytics. Linear and logistic regression was conducted. For each hypothesis, dependent variable and independent variable were set. The symbol (β) represents the regression coefficients associated with each independent variable, standard error of the estimated coefficient, t-value, p-value and R-squared value (R^2) are shown Table 4.

Table 4. Coefficient Table

Hypothesis	Variable	Coefficient	Std. Error	t value	p value	R-squared value
1	PEOU	.658	.015	3.562	<0.001	.472
2	PU	.794	.041	5.001	<0.001	.587
3	ATU	.345	.133	2.291	<0.001	.446
4	ATU	.262	.076	8.749	<0.001	
5	ITU	.553	.056	3.573	<0.001	.603
6	ITU	.220	.124	0.511	>0.050	

From the above table, five predictors are significant in collaborative programs. For Hypothesis 1, EFL learners' technology self-efficacy has a significant effect on perceived ease of use, with coefficient (0.658) indicating a positive and potentially strong relationship between the TSE and PEOU: as TSE increases, PEOU also increases. Standard Error (0.015) suggests the estimate of the coefficient is precise; p-value (<0.001) is low and it confirms that probability of observing the strong association between TSE and PEOU by chance is very limited, less than 0.1%; and R-squared value (0.472) explains that TSE is an important factor in influencing how easily EFL learners perceive technology can be used in collaborative education programs, i.e., 47.2% of the variability in PEOU is explained by TSE. In a word, the SAS results support Hypothesis 1. Similar significant data support is also found in the Hypothesis2, 3, 4 and 5. While the last Hypothesis 6 that "Attitude toward using technology has a significant effect on intention to use" suggests a different outcome. Although Coefficient ($\beta = 0.220$) indicates a positive relationship between ATU and ITU technology, the effect size is relatively modest. Standard Error (0.124) is relatively high when compared to the coefficient value, which suggests a lower level of precision in estimating coefficient. Moreover, a low t-value (0.511) symbols the coefficient is not statistically different away from zero. Likewise, the p-value (>0.050) shows a not significant statistical result. Thus, it is not confident to say that there is an effect of attitude towards using technology on the intention to use.

Hypothesis 1: Technology self-efficacy has a significant effect on the perceived ease of use: Supported, indicating a significant positive relationship.

Hypothesis 2: Perceived Ease of Use and Perceived Usefulness: Supported, indicating a significant positive relationship.

Hypothesis 3: Perceived Ease of Use and Attitude Towards Using Technology: Supported, indicating a significant positive relationship.

Hypothesis 4: Perceived Usefulness and Attitude Towards Using Technology: Supported, indicating a significant positive relationship.

Hypothesis 5: Perceived Usefulness and Intention to Use: Supported, indicating a significant positive relationship.

Hypothesis 6: Attitude towards using technology has a significant effect on intention to use: Not supported.

As a result, the impact of variables in the questionnaire survey of EFL learners in collaborative context is demonstrated in Figure 3, among which a dashed line indicating a negative relationship between ATU and ITU.

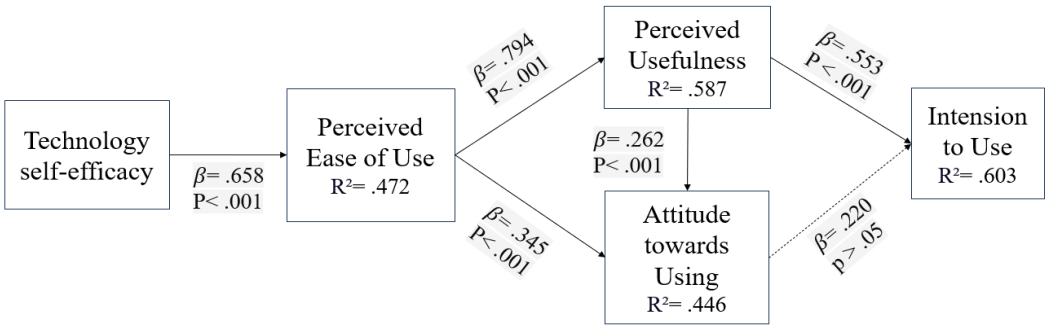

Figure 3. Results of Regression Analysis

5. Discussion

Demographically, there were more female respondents (89%) in this study. However, the analysis of variance showed no significant correlation between age and gender among the EFL learners. This finding indicates age and gender difference operate independently and they have no effects on the research outcomes: Both age and gender groups show no statistical difference on technological self-efficacy, perceived ease of use, perceived usefulness, attitude towards using and intention to use technology (Ibrahim, Leng, Yusoff, et al., 2017; Teo, Fan, & Du, 2015). These descriptions of demography also suggest that EFL learners in collaborative programs have experience in adopting e-platforms as, since the end of 2018, e-learning has been nationally promoted in every corner of education with rich access to learning online.

For self-efficacy with technology, the study explored its contribution with technology acceptance to expand previous studies in a collaborative setting. Results found that the links between technological self-efficacy and perceived ease of use are corroborated, providing robust evidence to the interaction between technological self-efficacy and perceived ease of use (Azawei, Parslow, & Lundqvist, 2017;

Keengwe, 2007). A higher self-efficacy could stimulate learners to perceive using technology with less psychological pressure. It can also further propose that interventions aimed at increasing EFL learners' confidence on their capacity to exert control over their learning behaviors could effectively enhance EFL learners' belief on conquering barrier in using a e-learning system, thus providing insights for teaching activities in collaborative education (Chun-Hsiung, 2020).

Besides, the variables of user motivation of technology acceptance were evaluated. Perceived ease of use can positively affect perceived usefulness and attitude towards using, and perceived usefulness also exert positive influence on attitude towards using. These findings are in agreement with postulates and are in accordance to pervious researches on technology acceptance model (He & Ji, 2021; Huang, Teo, & Guo, 2021; Rafique, Almagrabi, Shamim, Anwar, & Bashir, 2020; Rekha, Shetty, & Basri, 2023). This alignment confirms the applicability of the technology acceptance model in EFL learning and in collaborative education programs, and thus, reaffirms the model's generalizability across different settings. For detailed explanation, the finding suggests that improving the usability and utility of technology in collaborative learning could positively influence EFL learners' attitude towards using such technology, adding to cumulative evidence of validity of the TAM model. In other words, in teaching, enhancing the ease of use and presenting the usefulness of online learning devices can be crucial strategies to constitute a more positive attitude and a stronger intention to use technologies among EFL learners. However, special attention should be paid to variables related to intention to use technology: statistical analyses proved a significant effect on intension to use by perceived usefulness but failed to support a positive relation between attitude towards using and the intention. The significant correlation between perceived usefulness and intention to use align with the TAM model. Despite that the original TAM proposes attitude towards using should impact intention to use, this study might suggest a diminishing role of attitude when comparing to other variables like perceived usefulness, and similar finding can be found in previous research though (Masrom, 2007). This unalignment indicates further study in the specific context might be necessary, including prior exposure to technology, cultural influences, operation of online teaching and learning, and the like.

6. Conclusion

Rapid development of technology and extensive application have brought about new learning styles and learning setting. This study explored the EFL learners' acceptance of online learning technology in collaborative programs. Positive relationships are found between five pairs of hypothesized variables, indicating that EFL learners hold a generally positive perception on technology use. A positive attitude on technology self-efficacy could help to shape an optimistic view in the ease of using technology and feedback on technological usefulness, and thus possibly, leading to a confident attitude towards using online tools and a good intention to use in collaborative educational programs. This study could enrich the empirical study concerning technology acceptance and studies on collaborative context, providing insights on teaching activities. However, it also calls for further studies in corresponding perspectives,

especially on the relationship between attitudes and intensions in the online learning, as an insignificant relationship has been found, signifying a weak interaction between learner attitudes and their intention to use technology.

Funding

This study was supported by the Grant from Guangzhou College of Commerce (2022ZLGC18), and supported in part by Guangdong Association of Higher Education (GAHE23CRS006).

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