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Exploring the impact of teacher-student interaction on college students' active learning willingness in online English course

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Abstract: *Under the network technology environment, teacher-student interaction extends to technology-based online platforms, presenting a new paradigm. Based on a social constructivist perspective, this study explores the impact of teacher-student interaction on college students' active learning willingness in online English course. A total of 405 valid samples were obtained through a questionnaire survey of undergraduate students enrolled in a college English course at a university in eastern China. SPSS 21.0 and Amos 21.0 were used to analyze the research data. The results showed that there were more behavioral interactions and relatively less emotional interactions in the teacher-student interactions based on the online platform. Cognitive interactions had the most significant effect on college students' active learning willingness in online courses, while emotional interactions, although also significant, had relatively fewer effects. This study reveals the key role of cognitive interaction in online learning. The unique role of emotional interaction beyond cognitive and behavioral interactions complements the psychological mechanisms by which teacher-student interactions influence active learning willingness in online learning environments and enriches the theoretical framework of technology-mediated instructional interactions.*

Keywords—teacher-student interaction; active learning willingness; college English; online course; impact mechanism

1. INTRODUCTION

In traditional pedagogical research, teacher-student interaction refers to the interpersonal interaction between teachers and students, which usually entails teachers and students to be in the same spatial and temporal context. With the help of network information technology, college students' access to knowledge has long exceeded the physical space of the classroom, and the source of knowledge acquisition is no longer confined to teachers, books and classrooms, but extended to a broader network virtual space (Chapelle, 2010). Especially with the deep development of digital transformation of education, online teaching has evolved into a core component of the new education ecology (Liu et al., 2017). In the online environment, teacher-student interaction is no longer a single "subject-object" relationship, but a unique relationship mediated by digital symbols. Teachers and students not only have real identities, but also have network virtual identities, and the latter hides real interpersonal relationships, realizing the reconstruction of real subject identities in the network environment.

Established research has shown that the quality of teacher-student interaction is a key predictor of learner engagement

(Gasser et al., 2018). In traditional classrooms, face-to-face interactions have been shown to significantly enhance learners' depth of knowledge construction through pedagogical co-presence, which is constructed through cognitive encounters and emotional empathy (Nye et al., 2004). However, the characteristic spatial and temporal separation of online education has reshaped the essential attributes of interaction: first, the increased frequency of teacher-student interactions; and, second, the absence of nonverbal cues that make it difficult for teachers to perceive the true cognitive state of their students (Caskurlu, 2018). This state of affairs has forced researchers to revisit the efficacy-generating mechanisms of online teacher-student interactions.

When explaining the influence of interaction on learning willingness, current research mainly follows three paths: (1) based on Social Presence Theory, emphasizing that emotional interaction stimulates learning motivation by satisfying the need for belonging (Molinillo et al., 2018); (2) following the Cognitive Load Theory, which advocates that structured interactions enhance learning effectiveness by optimizing resource allocation (Khalil et al., 2024); and (3) based on Activity Theory, which focuses on the meaning negotiation network formed by teacher-student-technology multi-subject interactions (Burner & Svendsen, 2020). Although these studies have made important progress, there are still obvious limitations: first, most of the existing measurements focus on synchronous interactions but ignore the unique role of asynchronous interactions; second, the moderating role of technology mediation is not sufficiently explored; and third, the heterogeneity of the interaction effects in cross-cultural contexts has not yet been adequately explained.

In view of this, this study, grounded on the social constructivist perspective, is to explore the effect of teacher-student interaction on college students' active learning willingness in online course, in order to provide a reference for solving the dilemma of online learning engagement.

2. LITERATURE REVIEW

2.1 Conceptual Dimensions and Theoretical Perspectives of Teacher-student Interaction

Teacher-student interaction, as a core proposition in the field of education, is often defined as the act of information exchange and emotional connection between teachers and students in a teaching and learning situation (Hofkens et al., 2023). In online learning environments, teacher-student interactions are asynchronous and technologically mediated (Ong & Quek, 2023), and their dimensions can be summarized as: cognitive interactions (e.g., academic feedback), emotional interactions (e.g., encouragement and support), and behavioral interactions (e.g., monitoring of learning progress).

Teacher-student interaction is an important factor that affects the learning effect of learners. Teacher-student interaction cannot be separated from the interaction between the elements in the teaching system, and after the transformation of the teaching system to virtualization, the teacher-student interaction has shown a new pattern. In the field of second language acquisition (SLA), the role of interaction is particularly important. Socio-cultural theories (Vygotsky, 1978) emphasize the teacher's role as the "scaffolding of higher-order knowledge", and the interaction hypothesis (Shabani, 2016) states that negotiation of linguistic input is the key to language acquisition. Teacher-student interactions in online environments can be achieved through tools such as videoconferencing, forum discussions, instant messaging, etc., but their effectiveness may vary depending on the form of interaction (e.g., synchronous/asynchronous) and the mode of participation of language learners (Ziegler, 2016). It has been found that timely feedback and encouraging responses from teachers (Wang et al., 2020) enhance students' sense of engagement and indirectly increase their drive for self-directed learning. Interaction involves multidimensionality, e.g., instructor support (academic guidance vs. emotional care), frequency and depth of interaction (e.g., personalized feedback) have been shown to be key variables (Granziera et al., 2022), with emotional interactions being particularly important in alleviating online learning isolation (Kuo et al., 2014).

2.2 Connotation and Influencing Factors of Online Active Learning Willingness

Active learning willingness (ALW) refers to a learner's motivational tendency to spontaneously invest cognitive resources in exploring learning goals. According to self-determination theory (Ryan & Deci, 2017), ALW is driven by the dimensions of autonomy (sense of control over learning), competence (confidence in competence), and belonging (community connectedness). In online environments, ALW may be influenced by the usefulness and ease of use of technology (Sheppard & Vibert, 2019); task-challenging course design and multimodal resource integration (Li, 2020); and the instructor's role of leadership and feedback (Garrison et al., 2000). In SLA, active willingness is also closely related to language anxiety (MacIntyre & Gardner, 1994) and cross-cultural communication motivation (Dörnyei, 2009), and instructors need to alleviate anxiety and stimulate cross-cultural interest through interactions. Davis's Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB) have been widely used in the study of online learning behaviors and intentions. TRA emphasizes the influence of attitudes, subjective norms, and perceived behavioral control on behavioral intention, while TPB adds behavioral intention as a predictor of behavior, and these two theoretical frameworks provide a theoretical cornerstone for understanding the active learning willingness in online course. Meanwhile, individual difference factors have also been emphasized in many studies. For example, technology self-efficacy is positively related to online active learning willingness. In terms of external environmental factors, technical support and service quality, course content and teaching methods, and socio-cultural environments have all been shown to play a role in learners' online active learning behavior.

Currently, there are a number of trends in online active learning willingness research. On the one hand, as the application of emerging technologies such as Artificial Intelligence (AI) and Virtual Reality (VR) in the field of education continues to deepen, research has begun to focus on how these new technologies affect learners' willingness to learn actively and how they can be used to create more attractive and interactive online learning environments to stimulate learners' active learning behaviors. On the other hand, research on personalized learning paths is gradually emerging, through the analysis of learners' interests, abilities and learning styles, and other characteristics, to customize exclusive online learning programs for them, so as to improve learners' active participation and learning effects.

2.3 Impact of Teacher-student Interaction on Online Active Learning Willingness

Research has shown that high-quality teacher-student interactions significantly enhance online learners' active engagement (Miao et al., 2022) through the following mechanisms: 1) timely feedback from the teacher enhances students' task clarity and reduces cognitive load, which in turn boosts their confidence in learning (Swan, 2003); 2) encouraging language from the teacher alleviates students' sense of isolation and strengthens their sense of belonging (Joksimović et al., 2015), which is particularly important for language learners who need to overcome anxiety to engage in target language practices; and 3) teacher-set rules of interaction can shape learning habits (Dukuzumuremyi & Siklander, 2018).

Some scholars have explored the association between teacher-student interaction and online active learning willingness from the perspective of emotional factors. For example, studies have shown that positive teacher-student emotional interactions, such as timely and sincere encouragement and patient listening to students' ideas, can enhance students' self-confidence and sense of belonging (Claessens et al., 2016). When students feel recognized and cared for by their teachers, they are more willing to actively engage in learning and see learning as a way to realize their self-worth, thus increasing their willingness to engage in online active learning.

The cognitive dimension is also a focus of research. According to relevant studies, high-quality teacher-student cognitive interactions, such as teachers asking inspiring questions, guiding students to think deeply and expanding their knowledge, can effectively stimulate students' interest and curiosity in learning. In online learning environments, such interactions help students better understand complex knowledge, build a sound knowledge system, and make them feel a sense of achievement, which in turn motivates them to seek more learning opportunities and increase their willingness to learn actively.

From a behavioral perspective, effective behavioral interactions between teachers and students can significantly enhance students' learning self-efficacy, so that they have more confidence and motivation to actively promote the learning process with clear learning goals and their own learning progress.

In summary, it can be found that teacher-student interactions have a positive and multidimensional impact on students' willingness to learn online. Positive and good teacher-student interactions can create a high-quality online learning atmosphere, satisfy students' emotional, cognitive and behavioral learning needs, and thus enhance students' online active learning willingness.

3. METHOD

3.1 Participants and Research Procedure

This study was conducted with undergraduate students at a university in eastern China who had taken at least one online college English course (including synchronous live classes and asynchronous discussion classes) with real-time interactive sessions. College English, as a second language course, is a mandatory course for Chinese college students. In this study, a face-to-face offline questionnaire was administered at college English class intervals. The length of time was within 10 minutes. Informed consent was obtained from the participants. An anonymous survey format was used and participation in this questionnaire would not have any effect on the participants. 426 questionnaires were recovered and 405 valid questionnaires were obtained for subsequent data analysis by excluding invalid questionnaires with incomplete information.

3.2 Instruments

The Teacher-Student Interaction Questionnaire was adapted from Can & Güven (2025)'s Teacher-Student Interaction Scale (TIS), which consists of 3 dimensions: cognitive interaction (CI, 4 items), emotional interaction (EI, 5 items), and behavioral interaction (BI, 3 items). A 5-point Likert scale was used, with 1 indicating strongly disagree and 5 indicating strongly agree. Higher scores indicate that the participants perceived the dimensions of teacher-student interaction to be stronger. The overall Cronbach α of the questionnaire was 0.945; the Cronbach α coefficients of the three sub-dimensions were 0.877; 0.931 and 0.850, indicating the reliability of the scale.

The Active Learning Willingness Questionnaire referred to and was adapted from Carr et al.'s (2015) active learning scale, which mainly measures goal setting, self-monitoring of strategy use, and other components involving active learning willingness. A 5-point Likert scale was used, with 1 indicating strongly disagree and 5 indicating strongly agree. Higher scores indicate greater willingness to learn actively. The Cronbach α of the scale was 0.952, demonstrating good reliability.

3.3 Data Analysis

SPSS 21.0 was used to carry out descriptive and correlation analysis of the questionnaire results. AMOS 21.0 was used to analyze the impact of teacher-student interaction on active learning willingness to engage in online college English learning.

4. RESULTS

4.1 Descriptive Statistics and Reliability Analysis

Table 1 presents the descriptive statistics and reliability indices for the measured variables. All constructs demonstrated high internal consistency, with Cronbach's α values exceeding the recommended threshold of 0.70, ranging from 0.850 (BI) to 0.952 (ALW), indicating strong reliability. The means of the variables (measured on a Likert-type scale) were generally favorable, with behavioral interaction (BI) showing the highest average score (M=4.644, SD=0.912), followed by active learning willingness (ALW) (M=4.404, SD=0.926), cognitive interaction (CI) (M=4.377, SD=0.959), and emotional interaction (EI) (M=4.256, SD=0.997). The standard deviations all fell below 1.0, suggesting relatively low variability in participants' responses.

Table 1. Descriptive statistics and reliability analysis.

Variables/indicators	Mean	SD	Cronbach α
CI	4.377	0.959	0.877
EI	4.256	0.997	0.931
BI	4.644	0.912	0.850
ALW	4.404	0.926	0.952

Note: CI= cognitive interaction; EI= emotional interaction; BI= behavioral interaction; ALW= active learning willingness.

4.2 Correlation Analysis

Table 2 demonstrates the Pearson correlation coefficients between the variables. The results showed that (1) cognitive interaction (CI) showed a highly positive correlation (r=0.742) with active learning willingness (ALW), as well as a strong positive correlation with both emotional interaction (EI, r=0.628) and behavioral interaction (BI, r=0.583); (2) in addition to cognitive interaction, emotional interaction (EI) was also significantly positively correlated with active learning willingness (ALW, r=0.624) and behavioral interaction (BI, r=0.540) were also significantly positively correlated; (3) behavioral interaction (BI) had the highest strength of positive correlation with active learning willingness (ALW) (r=0.665), which was significantly higher than its relationship with emotional interaction. Overall, active learning willingness (ALW) showed the strongest correlation with cognitive interaction, while the interaction dimensions (CI/EI/BI) showed a moderate to strong degree of correlation with each other.

Table 2. Correlation analysis.

Variables	CI	EI	BI	ALW
CI	1			
EI	0.628	1		
BI	0.583	0.540	1	
ALW	0.742	0.624	0.665	1

4.3 Path Coefficient Analysis

As shown in Table 3, the path coefficient analysis of the structural equation modeling indicated that all three latent variables showed statistically significant positive effects on ALW. Specifically, the standardized path coefficient of cognitive interaction (CI) on active learning willingness (ALW) was 0.454 (S.E.=0.038, C.R.=11.161, p<0.001), showing its strongest explanatory power; the path coefficient of behavioral interaction (BI) was 0.306 (S.E.=0.038, C.R.=8.127, p< 0.001), which ranked second, while the path coefficient for emotional interaction (EI) was smaller (β =0.173, S.E.=0.035) but still passed the significance test (C.R.=4.402, p<0.001).

Table 3. Path coefficient analysis.

Paths	Estimate	S.E.	C.R.	*p*
CI→ALW	0.454	0.038	11.161	***
EI→ALW	0.173	0.035	4.402	***
BI→ALW	0.306	0.038	8.127	***

Besides, the critical ratio (C.R.) for all paths exceeded the recommended value of 1.96 and the standard errors were at a low level, indicating good stability and statistical validity of the parameter estimates.

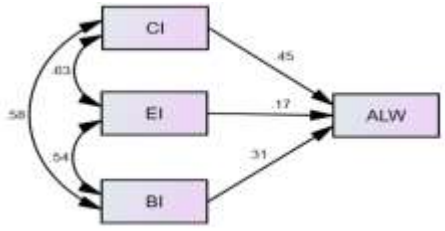

Figure 1. The final research model.

5. DISCUSSION

Focusing on the impact of teacher-student interaction on college students' online active learning willingness, this study reveals the differential impact of the multidimensional structure of teacher-student interaction on active learning willingness through quantitative analysis. It is found that teacher-student interaction significantly affects college students' active learning willingness in online college English courses through three core dimensions: cognitive interaction, emotional interaction, and behavioral interaction, in which cognitive interaction is the primary driver to stimulate active learning willingness, while behavioral interaction is the second most important one, and emotional interaction also has a significant effect on online active learning willingness, but to a lesser extent. Specifically, first, the deep driving effect of cognitive guidance is crucial. Teachers' cognitive support behaviors such as guiding critical thinking through questioning and providing learning strategy suggestions were significantly and strongly positively correlated with active learning willingness (e.g., active design of learning plans, cross-resource integration) (β =0.454, p<0.001). Second, the effect of immediacy of behavioral interactions is also apparent. Timely and specific academic feedback has a direct facilitating effect on active learning willingness, reflecting the special value of immediate interaction in online environments (Molinillo et al., 2018). Third, the fundamental role of emotional interaction entails. Emotional connection between teachers and students (e.g., personalized care, positive encouragement) can effectively reduce the sense of alienation in online learning, and significantly increase students' willingness to actively participate in discussions and independently explore learning resources (Gasser et al., 2018).

It is found that the general problem of "insufficient emotional support" exists in the current teacher-student interaction in online teaching, which leads to the restriction of students' willingness to learn actively. In conclusion, this study confirms that teacher-student interaction is the key link to activate active learning willingness in e-learning, but its effect needs to be optimized through the interaction strategies of emotional, feedback, and cognitive support (Huang & Lajoie, 2023).

Compared with previous studies, this study has both commonalities and differences in its findings. Some of the previous studies found that teacher-student interaction plays a key role in enhancing students' motivation to learn, which is consistent with the findings of this study. However, while previous studies have mostly focused on teacher-student interactions in traditional classrooms, this study focuses on interaction patterns in online learning scenarios and finds that the immediacy and convenience features of online interactions can efficiently stimulate students' willingness to learn actively. However, this study only adopted a cross-sectional research methodology and the research sample was limited to undergraduate students in a college English course at one university, so there is a possibility of biased conclusions. Future research suggests expanding the research sample to involve multiple disciplines and incorporating longitudinal research methods.

6. CONCLUSION

This study provides some insights into the theory and practice of teacher-student interaction in online education. It reveals the key role of cognitive interaction in online learning. The unique role of emotional interaction in addition to cognitive and behavioral interaction complements the psychological mechanisms by which teacher-student interaction influences active learning in online learning environments, and enriches the theoretical framework of technology-mediated instructional interaction. This study suggests that teachers should strengthen emotional interactions (e.g., personalized communication), construct positive cognitive interactions, enhance teachers' guidance and supervision of online learning, and pay attention to the dynamic development of students' self-efficacy in online teaching.

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