Effects of Interactive Feedback and Learning Proficiency on Chinese EFL Learners' Affective Engagement

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Abstract

Using Python semantic orientation analysis and SPSS 26.0 to analyze group discussion text of 72 non-English major graduate students, this study investigates the effects of interactive feedback and English learning proficiency on EFL learners' affective engagement in English collaborative learning. The study found that: (1) Interactive feedback positively influenced affective engagement, while the experimental group elicited significantly higher affective engagement than the control group, with richer emotional experiences and enhanced interactivity. (2) Significant differences existed in the effects of English learning proficiency on learners' affective engagement, with high-proficiency learners exhibiting greater engagement than low-proficiency peers. (3) Interactive feedback and English learning proficiency levels had a significant interaction effect on learners' affective engagement. High-proficiency learners in AWE-teacher-peer feedback demonstrated the highest engagement, followed by high-proficiency learners in teacher-peer feedback, low-proficiency learners in AWE-teacher-peer feedback and low-proficiency learners in teacher-peer feedback. These findings offer valuable insights that can guide educators in providing appropriate affordance and emotional support to effectively stimulate learners' affective engagement in English learning.

Keywords: interactive feedback, affective engagement in English collaborative learning, the Control-Value Theory, ecological affordance

1. Introduction

As an essential teaching strategy that provides learners with real-time assessment and diagnostic feedback (Tian & Zhou, 2020), interactive feedback has drawn wide attention in academic circles of linguistic academics. Initial research in second language (L2) writing pedagogy predominantly centered on teacher feedback. Subsequent shifts toward a process-oriented writing approach spurred scholarly interest in peer assessment mechanisms. Under the multiple interactive perspective, the application of the AWE system provides a new environment of human-machine mixed feedback for second language writing teaching practice (Zhang & Jiang, 2022). During second language learning, the importance of learners' English learning proficiency levels has

also been highlighted, and more researchers have begun exploring this topic (Huang *et al.*, 2017). However, extant research predominantly examines individual learners' affective engagement with feedback and correlations between isolated proficiency levels and affective engagement (Zheng & Yu, 2018; Zheng *et al.*, 2023). Accordingly, it needs to expand its attention from individual learners or single proficiency levels to a collaborative group perspective to further perfect the second language affective research theory.

Affective engagement in collaborative learning refers to learners' positive emotional state when solving a problem or completing a collaborative task (Skinner *et al.*, 2009; Zhang *et al.*, 2021). Existing research mainly focuses on the interaction and learning emotions in collaborative learning and explores the influence of peer interaction patterns and emotions on affective engagement in collaborative learning (Barrett *et al.*, 2021; Zhang *et al.*, 2023). However, the impact of interactive feedback and English learning proficiency level—critical factors shaping collaborative learning—on affective engagement, particularly their interactive effects, remains underexplored. Therefore, guided by Control-Value Theory and Ecological Affordance Theory, this study intends to explore the effect of interactive feedback and English learning proficiency on EFL learners' affective engagement in English collaborative learning with social network analysis.

2. Literature Review

2.1 Studies on Interactive Feedback

In English writing teaching, interactive feedback is a process of communication and discussion between teachers and students regarding the problems with grammar, content, and structure in learners' writing provided by teachers, peers, and AWE (Automated Writing Evaluation) systems, using iterative discourse cycles that can promote multiple rounds of discourse communication for interaction (Zagita & Sun, 2021).

Teacher feedback was the main focus in the early stages of second language writing teaching. In traditional writing teaching, feedback is considered the responsibility of teachers, who are reliable sources of information and are more likely to identify errors and misconceptions (Nicol & Macfarlane-Dick, 2006). Early research mainly focused on the focal points of teacher feedback, the types of feedback preferred by students, and the characteristics of students' reactions, cognitive engagement, and attitude towards written teacher feedback (Omer Hasssan Ali Mahfoodh, 2017). With the deepening of research, the focus of research has gradually shifted toward students' emotional responses to teacher-written feedback (Ranalli, 2021). Research on peer feedback primarily examined the development of a process-oriented writing approach. Currently, the research on peer feedback mainly focuses on the characteristics, cognition, positive and negative effects of peer feedback, and how to improve the quality of peer feedback, prioritizing issues related to content and meaning (Tsui & Ng, 2010; Ruegg, 2015).

The advancement of technology has led to increasing attention to Automated Writing Evaluation (AWE) systems for providing learners with real-time feedback. The application of AWE in teaching mainly focuses on learners' perception and evaluation of online automatic feedback (Chen & Cheng, 2008; Li *et al.*, 2015). However, as increasing evidence highlights the positive effects of feedback on students' L2 writing development, some new perspectives appeared. Bitchener (2012) critically investigated the pedagogical efficacy of written corrective feedback (WCF), systematizing feedback into categories such as direct/indirect and focused/unfocused and evaluating their effects on grammatical acquisition in ESL settings. Moreover, Han (2019) introduced an ecological framework to WCF research, framing feedback as part of a dynamic interplay between learners, educators, and institutional contexts. Han's study advocated for adaptive, context-sensitive strategies and participatory research to capture WCF's multidimensional impacts. Besides the studies on the factors influencing interactive feedback, some researchers pay much attention to the effectiveness of interactive feedback on learners' language production and engagement (Elola & Oskoz, 2016). Interactive feedback highlights the communication and interaction between teachers and students, as well as between students and students.

Since Ellis (2010) proposed the three-dimensional framework of learning engagement (affective engagement, behavioral engagement, and cognitive engagement), researchers have paid much attention to

interactive feedback research under the framework of sociocultural theory (Shi, 2021). Lu (2016) found that AWE feedback has a certain impact on students' writing process. Zhang and Hyland (2018) identified the strengths and weaknesses of both teacher feedback and AWE feedback. The results showed that different types of feedback have great potential in facilitating student involvement in writing tasks, and they highlighted some of these pedagogical implications for promoting student engagement with teacher and AWE feedback. For learning engagement, research mainly focuses on the influencing factors of learning engagement in different feedback environments (Xu & Fan, 2019; Xu & Han, 2020) and learners' learning engagement with varying types of feedback (Han & Yang, 2021; Geng & Yu, 2023). However, research has predominantly examined individual affective engagement with single or multiple feedback sources and influencing factors of learning engagement in different feedback environments while neglecting the exploration of the affective engagement of learners in the learning process from the perspectives of collaborative learning or group learning (Phung *et al*., 2021), especially in interactive environments with multiple feedback sources such as computers, peers, and teachers, thereby neglecting deeper causal mechanisms in collaborative learning.

2.2 Studies on the Effectiveness of English Proficiency Levels

The difference in English learning proficiency levels, as an important influencing factor of academic emotions like enjoyment and boredom (Jiang & Dewaele, 2019), is crucial in impacting learners' learning performance and engagement in the collaborative learning process (Huang *et al*., 2017). Therefore, research on the influencing factors of affective engagement in collaborative learning cannot ignore the individual's English learning proficiency level.

Huang *et al*. (2017) implemented a study with a 17-month technology-enhanced collaborative storytelling activity and examined young students' pair performance, flow perception, and learning strategies in relation to English learning proficiency levels. The findings and pedagogical suggestions aimed to address the issue of proficiency differences in EFL classrooms and shed light on future implications and research of EFL collaborative storytelling activities. Teng and Wang (2023) attempted to explore the incorporation of behavioral, affective, and cognitive student engagement when measuring the learning effectiveness of content-based instruction video learning, highlighting that high-proficiency learners are more capable of referring to the bilingual caption by adopting good strategies. To address underexplored facets of feedback engagement, Tian and Zhou (2020) undertook a longitudinal naturalistic investigation tracking five Chinese EFL learners' interactions with automated peer evaluations and teacher feedback in a 17-week online writing course. Analysis of textual artifacts and semi-structured interviews revealed that high-level and low-level learners have different effects on learning engagement with self-evaluation, teachers, and peer feedback. Tsang and Dewaele (2023) confirmed a significant correlation between learning emotions, learning engagement, and learning proficiency. Based on a quadripartite construct of student engagement, Pan *et al*. (2023) examined how L2 Chinese students with high-proficiency (HP) and with low-proficiency (LP) cognitively, affectively, behaviorally, and agentically engage with teacher WCF. They found imbalances among the four dimensions of affective, cognitive, behavioral, and agentic engagement, which were mediated by the interplay of individual factors like language proficiency, writing self-efficacy, learner belief, etc.

The impact of learning levels on academic emotions and performance has drawn increasing attention from language researchers (Li, 2022). However, there is currently limited research on the relationship between English learning proficiency levels and affective engagement. Most studies focus only on individual learners' affective engagement with different feedback and the influence of a single proficiency level on affective engagement by case studies, questionnaires, self-reports, and semi-structured interviews while neglecting the exploration of the differences in affective engagement of learners in different proficiency levels.

2.3 Studies on Affective Engagement

Affective engagement, as one of the three-dimensional models of learning engagement proposed by Fredricks *et al*. (2004), mainly refers to the learner's emotional response to feedback, reflected in interest, value, and effectiveness. Affective engagement, as one

indicator of learning engagement (Fredricks *et al.*, 2004), refers to students' affective experience towards school, learning activities, and peer partners during collaborative learning. Bond and Bedenlier (2019) conceptualized affective engagement as learners' favorable affective responses to the learning environment, peer/teacher interactions, and their perceived belongingness and intellectual curiosity. As a substantive learning engagement, affective engagement is the key to influencing the quality of learning. While cognitive received more attention in the early years, more and more research in recent years has begun to focus on substantive engagement, that is, affective and behavioral engagement (Liang, 2018; Guo, 2018). Empirically, learners exhibiting heightened affective engagement demonstrated a greater propensity for positive affective states (e.g., enthusiasm, contentment), whereas those with diminished affective engagement displayed avoidance behaviors, passive coping strategies, and reduced academic volition.

Affective engagement in collaborative learning and its influencing factors have garnered significant attention in the field of second language writing. Learners with different group structures have rich learning experiences in a collaborative learning environment, leading to complex emotional states and affecting their affective engagement in collaborative learning (Linnenbrink-Garcia *et al.*, 2011). Few studies have been done on affective engagement alone in foreign language research, especially in collaborative learning. Group interaction is more likely to stimulate strong emotions in learners and significantly impact their affective engagement (Hiver *et al.*, 2021; Payant & Zuniga, 2022). Research on the factors influencing affective engagement in collaborative learning is still relatively limited. The collaborative pattern has been found to have better cognitive engagement effects. However, few have been done on the impact of learners' affective engagement during the collaborative learning process (Chen *et al.*, 2023).

From an ecological perspective, second language learners are situated in a diverse interactive system formed by multiple ecological factors such as teachers, students, and human-computer interaction (Van Lier, 2000). In such a system, affective engagement plays a crucial role in enabling learners to actively and creatively interact with others (Pekrun *et al.*, 2002).

Researchers have found that English learners at different proficiency levels in a collaborative learning environment will interact with multiple feedback sources simultaneously, and learners of different levels regulated their learning process and achieved affective engagement through their perception and action of environmental affordance (Park & Lim, 2019; Xu & Long, 2022).

Some researchers at home and abroad have explored the factors that influence learners' affective engagement in a collaborative learning environment. Fan (2019) studied the effects of task types on college English learners' affective engagement, behavioral engagement, cognitive engagement, and social engagement in peer interaction. The results showed that in terms of affective engagement, the decision-making task elicited more discourse and interaction. Zhang *et al.* (2021) used structural equation modeling to explore the effects of three affective factors, anxiety, motivation, and willingness to communicate (WTC), on English collaborative learning engagement. However, the study involved three types of emotional factors and did not profoundly explore the complexity of emotions in collaborative learning. Li *et al.* (2018) found that both learners' individual factors (such as second language proficiency) and external factors (such as classroom environment) can affect levels of learning enjoyment and anxiety. Enjoyment exhibits more vital communicative ability and is more influenced by external factors (especially teacher factors), while anxiety is more influenced by personal factors (Jiang & Dewaele, 2019; Li *et al.*, 2021).

Research on the effects of interactive feedback and English learning proficiency on affective engagement is still relatively limited. Zhang *et al.* (2023) used social network analysis to explore the impact of emotional experiences under different interactive modes on affective engagement in collaborative learning. However, this study did not probe the differences in emotional experiences between groups and individuals and affective engagement among learners at different proficiency levels. Furthermore, research on single or different types of feedback sources has found that the perception of specific feedback sources by different learners shows a dynamic changing trend, which further affects the learners' uptake, evaluation, and engagement in feedback (Koltovskaia, 2020; Tian & Zhou, 2020), but they did not shed light on the differences in the

affective engagement among learners at different proficiency levels. Cai (2023) explored the mechanism of the effect of perceived environmental support on affective engagement among low-level second language learners but did not delve into the perception and engagement of learners at different proficiency levels towards various feedback sources. To conclude, cross-research on affective engagement and learning levels among learners in different feedback environments is relatively rare.

3. Research Methodology

3.1 Research Questions

The research aims to explore the effects of interactive feedback and English learning proficiency levels on Chinese learners' affective engagement during English collaborative learning. The following research questions are addressed in this study:

1) Do different interactive feedback patterns impact learners' affective engagement in English collaborative learning?

2) Do different English learning proficiency levels impact learners' affective engagement in English collaborative learning?

3) How do interactive feedback and English learning proficiency levels interactively influence learners' affective engagement?

3.2 Participants

The participants in this study were 72 non-English undergraduate students in a Chinese university, of which 37 were male (51.4%), 35 were female (48.6%), and the average age of them was 23.26 (SD = .46). All of them had experience participating in English collaborative learning.

3.3 Procedures

The research involved five steps and the specific procedures were planned as follows:

(1) Quick Placement Test

Each participant of the experiment would be administered "The Oxford Quick Placement Test" to test their general language proficiency for grouping. The Quick Placement Test-Version 2, designed by Oxford University Press, tested the student's English learning proficiency for grouping according to different English learning proficiency levels.

(2) Group divisions

According to the types of interactive feedback patterns, Class A was treated as a teacher-peer group (receiving feedback from teachers and peers), while Class B was treated as an AWE-teacher-peer group (receiving feedback from Correction Network, teachers, and peers). According to the principle of in-group heterogeneity and out-group homogeneity, each group includes three students with two high-proficiency (HP) and one low-proficiency (LP). The one-way ANOVA results showed no significant difference in the proficiency level between groups A and B (F = .041, p > .05).

(3) Tasks arrangements

Participants were required to complete a composition within 40 minutes, and the researcher converted the draft into an electronic version. The initial draft was first uploaded to the correction website for error feedback and annotation. Based on this, teachers and students annotated the omission of errors and scored the composition according to the scoring standard. Then, each student needed to conduct self-correction according to corrective feedback and discuss their doubts with the teacher and peers in the group. The discussion time was about 30 to 45 minutes, and all discussion data was collected with the help of the Tencent Meeting Screen recording function.

(4) Data cleaning

The discussion video is transcribed into text data using the software Feishu and manual proofreading. Normalize the collected data by revising misspelled words, cleaning up meaningless information, and converting emotions or the pause into corresponding text with emotional meaning to accurately capture learners' affective tendencies.

(5) Participants interviews

After the group discussion, some participants would be asked to complete an interview for qualitative data about their emotional changes during the collaborative learning process and their attitudes toward different feedback sources and their peer members.

3.4 Data Processing and Analysis

The data analysis in this study consisted of three steps. Firstly, Python natural language processing was used to analyze the discussion data to calculate sentiment values. The difference between positive and negative

emotions was considered as the affective engagement of that sentence. Then, a qualitative data analysis was conducted by NVivo12 Plus. The researcher imported the cleaned data into NVivo 12 plus and used free coding to establish nodes (The Cohen Kappa coefficient was 0.92). 18 emotion nodes were identified: approval, pride, confidence, pleasure, interest, comfort, admiration, inspiration, gratefulness, confusion, doubt, anxiety, embarrassment, hesitation, guilt, dissatisfaction, oppression, and helplessness. After repeatedly reading, adjusting, or modifying, two primary nodes and 18 secondary nodes were finally formed, including 536 positive codes (63.58%) and 307 (36.42%) negative codes. Finally, UCINET 6 was used to construct learners' affective social networks and to clarify the characteristics and internal relationships of affective engagement. This study converged UCINET ted the emotional node data into a binary matrix, judged the tightness of emotions by network density, explored the importance of each emotion in the entire network diagram by node size, and pointed to the dynamic transformation of emotions based on the aggregation between nodes.

4. Results and Discussion

4.1 Learners' Affective Engagement in Different Interactive Feedback Patterns

In order to investigate the effect of interactive feedback patterns on the affective engagement of English collaborative learning, this study used SPSS 26 to calculate the emotional values of each group's discussion text under the two interactive feedback patterns. One-way ANOVA was conducted on the affective engagement under the two feedback conditions.

Firstly, the homogeneity of variance test ($p > .05$) met the prerequisites of the one-way ANOVA. Secondly, the result indicated significant differences in the affective engagement of the two interactive feedback patterns during collaborative learning (F = 136.707, $p < .05$). The affective engagement in the EG was significantly higher than that of CG (14.59 > 11.46), suggesting that the AWE-teacher-peer feedback had a more significant effect on improving affective engagement compared to traditional teacher-peer feedback. It aligns closely with Zhang and Hyland's (2018) foundational argument that hybrid feedback environments stimulate emotional participation through diversified input.

In addition, the types of emotions in EG (18) were more abundant than those of CG (15). Based on the quantitative criteria of the number of turns of discussion by Xu and Kou (2017), there were significant differences in discussion turns between the two interactive feedback patterns (F = 70.937, $p < .001$), with EG demonstrating significantly more conversational turns than CG (245.8 > 210.6). It indicated that learners in EG were more actively involved in communication and interaction in collaborative learning. It further validated the effect of interactive feedback patterns on affective engagement and learning achievement, further corroborating Zhang and Jiang's (2022) experimental evidence that human-machine collaborative feedback increases cognitive-behavioral engagement compared to teacher-only models and suggesting a proportional relationship between feedback source multiplicity and emotional dynamism.

In the process of collaboration, learners in the AWE-teacher-peer feedback pattern developed deep engagement based on an ecological perspective (Han & Gao, 2021). In this study, this kind of learning engagement is reflected in learners' affective engagement with teachers, peers, or online correction systems and their absorption and self-modification with corrective feedback during the discussion process. This observation substantiates Nassaji and Swain's (2000) mediation hypothesis, wherein learners received supportive help from their peers in the interaction, thus validating the view that the deep engagement for learners in a multiple interactive environment is related to multiple feedback sources provided by the environment for learners (Xu & Long, 2022). Conversely, the teacher-peer feedback pattern exhibited constrained emotional flows characterized by three limitations: hierarchical feedback orientation, low emotional reciprocity, and affective dependency on instructor validation. Learners in the teacher-peer feedback pattern paid more attention to self-correction. A lack of attention to the interactive feedback and emotions of other members resulted in lower affective engagement. Based on the semi-structure interview, learners gave more trust in teacher feedback since teacher feedback can provide more detailed and specific modification suggestions in terms of reasoning, article structure, expression in sentences (Jiang,

2023), lacking attention to the interactive feedback, and emotions of their peers, resulting in overall lower affective engagement.

4.2 Learners' Affective Engagement in Various English Learning Proficiency Levels

To explore the impact of English learning proficiency levels on the affective engagement of English collaborative learning, this study calculated the emotional values of each group's discussion text under the two English learning proficiency levels through SPSS 26. One-way ANOVA was used to compare learners' affective engagement.

Firstly, the homogeneity of variance test ($p > .05$) met the prerequisites of the one-way ANOVA. Secondly, the result revealed significant differences in the affective engagement of the two English learning proficiency levels during collaborative learning (F = 80.732, $p < .001$). It showed that the level of affective engagement in the high-proficiency level was significantly higher than that of the low-proficiency level (17.11 > 10.66). The study revealed significant disparities in affective engagement between high and low-proficiency learners, corroborating prior assertions that second language (L2) proficiency mediates affective engagement in collaborative learning (Pan *et al*., 2023). Consistent with Li (2022) and Tsang & Dewaele (2023), our results confirm that high-proficiency learners exhibited markedly higher affective engagement values compared to their low-proficiency counterparts.

Furthermore, the high-proficiency level (17) exhibited more types of emotional experiences than the low-proficiency level (15). There were significant differences in turns of discussion in the group between the two English learning proficiency levels (F = 45.475, $p < .001$), with the high-proficiency level demonstrating significantly more conversational turns than the low-proficiency level (87.28 > 57.09). It indicated that learners with high proficiency levels were more actively involved in communication and interaction in collaborative learning, which further validated the effect of English learning proficiency levels on affective engagement and learning achievement. These observations align with the Control-Value Theory (Pekrun & Perry, 2014), which posits that the perceived controllability of learning objectives and self-assessment accuracy modulate academic emotional tendencies.

Analysis of discussion transcripts revealed that high-proficiency learners felt better about self-assessment of the controllability of collaborative learning. They participated more actively in discussions to express their own opinions or knowledge. However, low-proficiency learners paid more attention to their performance and ability obtained from teachers and peers, demonstrated passivity in participating in group discussions, and did not dare to question or refute others. This discovery extends Li's (2021) conclusion that self-assessment and perceived control were antecedents of negative emotions. In contrast, the low number of discussion turns of low-proficiency learners indicated that they were more passive in participating in collaborative learning. Emotional tendencies were less positive, dominated by anxiety and confusion. Semi-structured interviews corroborated this. Low-proficiency learners generally believed that collaborative learning tasks were challenging and required a lot of time and energy to participate in interactive communication. Lower self-control could undermine learners' motivation to participate in collaborative learning (Pekrun, 2006), leading to lower affective engagement.

4.3 Interaction Effect of Interactive Feedback and English Learning Proficiency Levels on Affective Engagement

To investigate the interaction effect of interactive feedback patterns and English learning proficiency levels on the affective engagement of English collaborative learning, this study used UNIANOVA to compare the affective engagement of different English learning proficiency levels under the two interactive feedback patterns. The results showed that there were significant differences existing in the affective engagement of the two English learning proficiency levels under different interactive feedback patterns (F = 19.237, $p < .001$).

In addition, in order to explore the dynamic features of emotional transformation, UCINET 6 was used to calculate the outdegree and indegree of the emotion nodes. Outdegree and indegree represented the release and transfer of emotions, respectively. The outdegree and indegree emotions indicated a dynamic, multi-directional flow in the collaborative learning emotions between learners in the group, echoing Zhou and Han's (2018)

conclusion on reasonable evaluation feedback mechanisms stimulating students' affective engagement: students who had high positive emotions in group collaborative learning could actively participate in learning activities.

To further explore the features of affective engagement in English collaborative learning, the emotional nodes coded from the learners' collaborative learning were binarized into a matrix to draw an affective network figure in English collaborative learning. In this study, nodes represent different emotions. The size of the node in the network is positively correlated with the degree of centrality of emotions, representing the importance of emotions in the entire affective engagement network (Li & Ren, 2021). In the two low-proficiency figures, "approval" was in the central position while "confidence" was in the central nodes in the two high-proficiency figures.
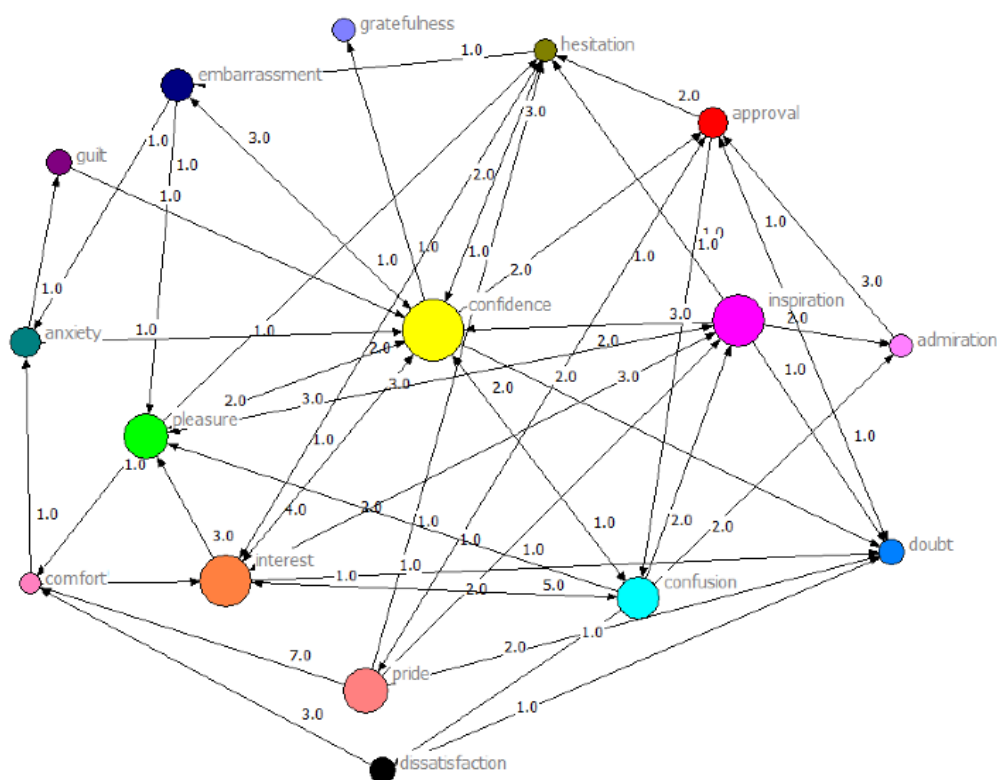

Figure 1. The Affective Network of HP in AWE-teacher-peer Feedback

In Figure 1, the negative emotion nodes such as "doubt," "hesitation," and "anxiety" were relatively small and scattered at the margin of the entire network. The "confidence" node was the largest and was located at the center of the network. Emotions such as "pleasure," "interest," "inspiration," "pride," and "confusion" were relatively large and were located in the sub-central position of the network. The network of the high-proficiency under AWE-teacher-peer feedback, with 17 nodes, its network density (0.50) was higher than that of the other three patterns, indicating that the internal affective interaction was more complex and more diverse in positive and negative emotions than other patterns. The result showed that the high-proficiency under the AWE-teacher-peer feedback pattern resulted in smooth internal information communication. Members actively participated in discussions to resolve their puzzles and problems in dealing with learning affordance provided by the environment. In contrast, other members took the initiative to give feedback on the ideas and questions raised by members, and mutuality was high. When learners expressed "puzzle" or "doubt" to members, such as "我看不出来怎么改" or "这个词可以这么用吗," the peers would respond with interest or inspiration such as "你是不是想表达" or "这里我认为应该是." Therefore, this group produced a sense of belonging and enthusiasm in the group, which promoted their cooperation quickly.
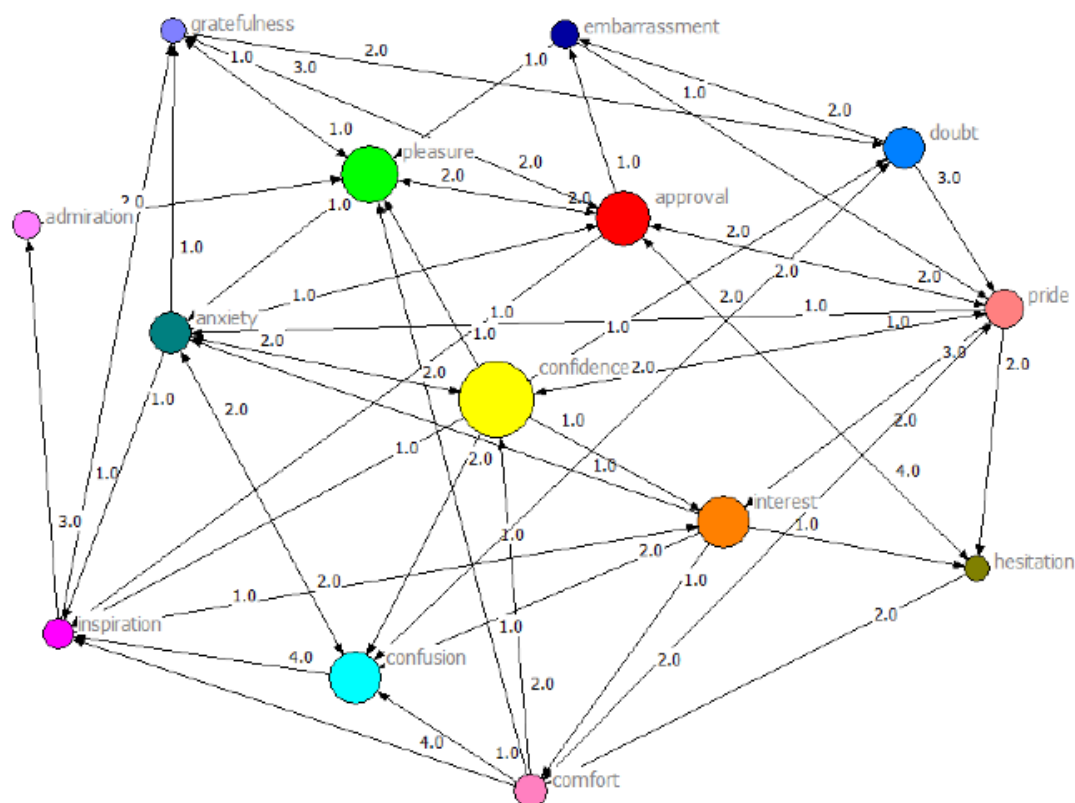
Figure 2. The Affective Network of HP in Teacher-peer Feedback

In the network of high proficiency under the teacher-peer feedback pattern (Figure 2), the negative emotion nodes such as "doubt," "hesitation," and "doubt" were relatively small and scattered at the margin of the network, with the "confidence" node at the center of the network. Emotions such as "pleasure," "interest," "approval," "pride," "anxiety," and "confusion" were relatively large and were located in the sub-central position. There were no "guilt" or "dissatisfaction" nodes; the number of nodes was 15 and network density was 0.441, less than the first pattern, exhibiting that the communication and interaction between emotions and the complexity of the network were slightly lower. During the discussion, learners often tended to respond positively to others with positive emotions such as approval, pride, interest, etc. The interaction between learners was frequent, and the expression and conversion of emotions increased accordingly. When learners expressed a sense of pride towards their members, such as "咱们组同学提出的问题都很好，从内容和结构上来说很棒!", other peers were more likely to give a positive response, "同意!大家都好厉害!" The learning affordance provided by the environment promoted interaction and communication

among learners, and everyone actively participated in learning tasks, thereby achieving ideal learning outcomes and further enhancing emotional engagement. It further validated Zhang *et al.'*s (2023) findings on dynamic characteristics of emotions in collaborative learning.

High-proficiency learners received more abundant learning resources in both interactive feedback patterns, which could better explain the finding that no significant difference existed in affective engagement between high-proficiency learners under different interactive feedback patterns, indicating that high-proficiency learners have a stronger ability to regulate foreign language learning emotions, which leads to better learning outcomes (Yu *et al*., 2015). At the same time, it validates the feasibility of learning affordance in triggering positive learning engagement, as proposed by Van Lier (2004): the emergence of learning affordance in the learning environment came from the interaction effects between environmental factors (immediate affordance) and individual factors (mediated affordance). As long as there is enough target language information in the environment, learners can

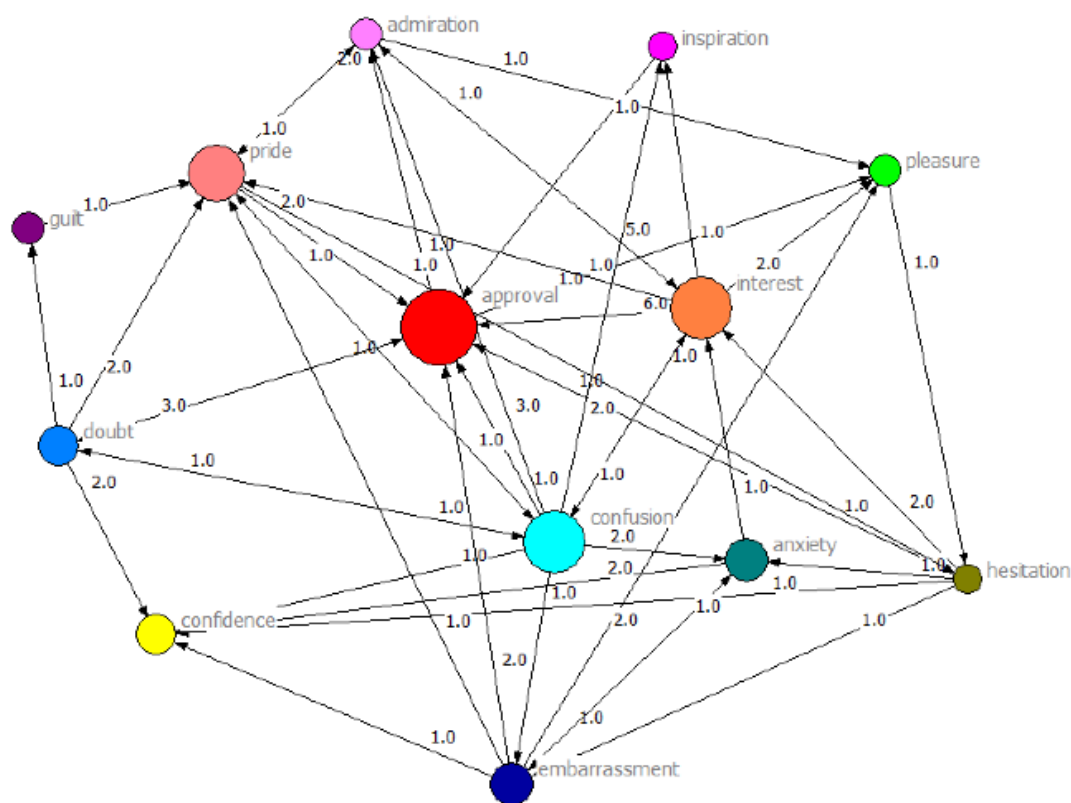adapt to this information and take appropriate   actions in interaction.

Figure 3. The Affective Network of LP in AWE-teacher-peer Feedback

The network density of the low-proficiency under the AWE-teacher-peer feedback pattern was 0.367. There were 13 emotional nodes: The "approval" was the largest node and was at the center of the network, closely linked to various emotional experiences in the network. Emotions of "interest", "pride", "anxiety", and "confusion" were relatively large and were in the sub-central position of the network. "Admiration", "inspiration", "guilt" and "doubt" were the most minor nodes, distributed at the edge of the network. Compared to the teacher-peer feedback pattern, low-proficiency learners in the AWE-teacher-peer feedback pattern received more feedback sources. They had access to more relevant information and learning opportunities through participating in collaborative learning. However, they required assistance from teachers and peers to make use of and internalize the information, thus further confirming the viewpoint that environmental affordance motivated learners to perceive learning information and engage in learning activities, which brought further affordance, higher-level activities, and more differentiated perceptions (Van Lier, 2004).
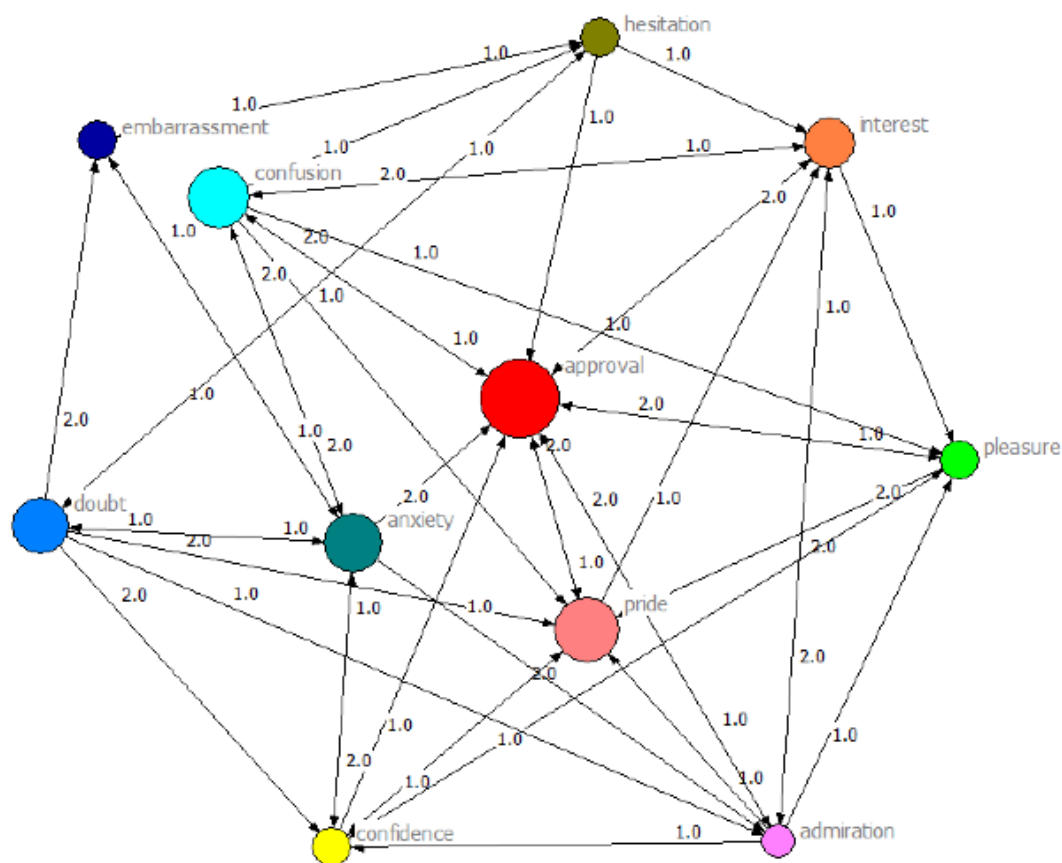
Figure 4. The Affective Network of LP in Teacher-peer Feedback

The network of low-proficiency under teacher-peer feedback patterns had 11 nodes with 0.291 density, less than other interaction patterns. "Approval" played an essential role in the network, and the correlation between nodes decreased obviously compared with the other three networks. "Interest", "pride", "anxiety", and "confusion" were relatively large and were in the sub-central position of the network. The negative emotions "anxiety" and "confusion" became important nodes and a high degree of "doubt" appeared in the last pattern, indicating that negative emotions played a more important role compared with high-proficiency. For low-proficiency learners, the learning affordance that they could receive was less and had less promotion effect on their affective engagement. Their ability to perceive and apply learning affordances from the environment was relatively weak; on this account, they extracted less learning information and other information from multiple feedback sources than high-proficiency learners. This further validated the view that learners at different language proficiency levels could take action to regulate the learning process by perceiving learning-promoting factors in the environment (Park & Lim, 2019).

5. Conclusion

This study investigates the effects of interactive feedback and English learning proficiency levels on Chinese English learners' affective engagement in collaborative learning, revealing the following three key findings: 1) learners in the AWE-teacher-peer feedback pattern demonstrated higher affective engagement, richer emotion nodes, and more frequent emotion transitions than learners in the teacher-peer feedback pattern, with a more dynamic and complex affective engagement network; 2) English learning proficiency levels had a significant effect on learners' affective engagement, with the highest affective engagement of high-proficiency learners in AWE-teacher-peer feedback and the lowest affective engagement of low-proficiency learners in teacher-peer feedback. High-proficiency learners had higher self-assessments of the controllability of learning and academic emotions; 3) interactive feedback and English learning proficiency levels had an interactive effect on learners' affective engagement in

collaborative learning. The density and complexity of the affective engagement network decrease sequentially from high-proficiency learners in AWE-teacher-peer feedback and high-proficiency learners in teacher-peer feedback to low-proficiency learners in AWE-teacher-peer feedback and low-proficiency learners in teacher-peer feedback, with a corresponding decrease in the degree of transformation and interactions between emotions.

The following implications may deserve English teachers' consideration when employing group classroom activities. Considering the impact of interactive feedback patterns and English learning proficiency levels on affective engagement, teachers should set up groups and interactive feedback patterns scientifically according to learners' personality characteristics and language levels and make use of proper multiple feedback for error correction and guidance. Furthermore, teachers should optimize the supply of learning affordance from the aspects of teaching content and teaching methods, promptly identify the direction of interaction in collaborative learning, and make appropriate interventions to help students perceive learning affordance suitable for their learning needs and take appropriate action.

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