

Research on the Learning Effects of Game-Based Teaching for Vocational Schools' English Learners

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Abstract

In the context of vocational English education, game-based teaching has emerged as a potential solution to address motivational challenges. However, existing research mainly focuses on general education, with limited empirical study on its efficacy in vocational English, especially for students with weak foundations. This study adopts an experimental, pre-test/post-test control group design to examine students with weak English foundations in a secondary vocational school in Guangdong, China, which aims to answer three key questions: 1) What is the current implementation status of game-based teaching approaches in secondary vocational English classrooms in China? 2) What are the differential effects of game-based teaching versus traditional instruction on vocational students' English learning outcomes, including motivation, engagement, and academic achievement? 3) What key considerations and challenges emerge when implementing game-based teaching in vocational English education contexts? This research contributes to both theory and practice in vocational English education by providing empirical evidence for gamification's effectiveness. Future research should address optimal game design for weak-foundation students and improve methodological limitations.

Keywords

Game-Based Teaching, Vocational School, Students with Weak Foundations, English Learning Outcomes, Empirical Study

1. Introduction

Vocational education constitutes a cornerstone of China's educational system, making substantial contributions to economic and social development [1]. While

vocational institutions excel in equipping students with practical skills for workforce integration, English language instruction within this domain remains fraught with persistent challenges. Empirical evidence indicates that vocational school students typically exhibit deficient English proficiency, manifested in weak foundational knowledge, limited vocabulary acquisition, grammatical inaccuracies, and underdeveloped communicative competencies [2]. These academic deficiencies are compounded by pervasive motivational issues, as students often perceive limited relevance between English proficiency and their career trajectories in skill-oriented educational environments [3]. The efficacy of conventional pedagogical approaches is further undermined by their predominantly teacher-centered nature and monotonous methodologies [4]. Such traditional methods typically foster passive learning environments, resulting in diminished student engagement, waning enthusiasm, and the development of negative attitudes toward English language acquisition [5]. These deficiencies not only impede language learning progress but also constrain students' future career prospects in an increasingly globalized employment landscape where English proficiency has become a valuable professional asset.

Gamified instruction emerges as a promising pedagogical innovation to address these challenges. This approach systematically integrates game mechanics with educational content, harnessing the intrinsic motivation, interactivity, and challenge inherent in gaming environments to facilitate active engagement [6]. From a psychological perspective, gamification aligns with students' cognitive development patterns and emotional needs by creating enjoyable learning contexts that stimulate intrinsic motivation [7]. Recent technological advancements have further expanded its implementation potential through digital educational games and interactive platforms, making it particularly suitable for addressing the motivational challenges prevalent in vocational English education [8]. Despite the growing body of research on game-based learning in educational contexts, several critical gaps persist in the literature. Existing investigations have predominantly focused on general education settings, with limited empirical examination of gamification's efficacy in English education of vocational schools, particularly for students with weak foundational knowledge [9]. Moreover, few studies have systematically evaluated the comprehensive impact of gamified instruction on both motivational variables and language skill development among this specific demographic.

This study aims to address these research lacunae by examining the effectiveness of gamified teaching approaches for vocational school students with deficient English foundations. The research objectives are threefold: 1) to investigate how gamified instruction influences students' English learning motivation and attitudes; 2) to evaluate its impact on comprehensive language skills development across reading, writing, listening, and speaking competencies; and 3) to identify optimal implementation strategies for vocational English classrooms through systematic examination of contextual factors and pedagogical practices. To achieve

these objectives, this study will address the following research questions:

- 1) What is the current implementation status of game-based teaching approaches in secondary vocational English classrooms in China?
- 2) What are the differential effects of game-based teaching versus traditional instruction on vocational students' English learning outcomes, including motivation, engagement, and academic achievement?
- 3) What key considerations and challenges emerge when implementing game-based teaching in vocational English education contexts?

2. Literature Review

2.1. Conceptual Foundations of Game-Based Teaching

Game-based teaching (GBT) represents an innovative pedagogical paradigm that systematically integrates game mechanics with instructional content to achieve specific learning outcomes while enhancing student engagement [8]. This approach transforms educational activities into immersive experiences where knowledge acquisition occurs through purposeful gameplay, embodying Prensky's (2007) conceptualization of digital game-based learning environments where "the learning feels like playing" [6]. Since its formal introduction by Squire (2011), GBT has evolved substantially from rudimentary classroom games to sophisticated digital implementations, reflecting broader technological advancements in educational practice [10] [11].

Contemporary scholarship identifies three essential components of effective GBT: 1) the seamless integration of learning objectives within game architectures, 2) the cultivation of intrinsically motivating learning environments, and 3) the facilitation of active knowledge construction through experiential participation [12]. This distinguishes GBT from mere gamification—the superficial addition of game elements to non-game contexts—as it requires fundamental integration between educational content and gameplay mechanics [13]. Such integration creates what Deterding and colleagues term "full game experiences" where learning objectives drive game design rather than being peripherally attached.

The distinctive features of GBT offer particular advantages for learners with weak academic foundations through its emphasis on situated cognition. By embedding language acquisition within authentic game contexts, students develop practical communication skills while simultaneously constructing foundational knowledge [14]. This approach directly addresses the motivational deficits prevalent among vocational students by operationalizing flow theory principles, where optimally calibrated challenge levels sustain student engagement without inducing frustration [15].

2.2. Theoretical Frameworks Underpinning Game-Based English Teaching

2.2.1. Multiple Intelligences Theory and Its Pedagogical Implications

Howard Gardner's (1983) theory of multiple intelligences provides a robust theo-

retical foundation for GBT implementation in heterogeneous vocational classrooms [16]. This theory posits that intelligence manifests through eight distinct modalities—linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, and naturalistic—each offering unique pathways for learning and comprehension [17]. Traditional English instruction typically privileges linguistic and logical-mathematical intelligences, creating barriers for students whose strengths lie in alternative domains. GBT facilitates the simultaneous activation of multiple intelligences through diverse game formats. Vocabulary-building games can engage linguistic intelligence through wordplay, spatial intelligence through visual word associations, and interpersonal intelligence through collaborative gameplay [18]. For instance, role-playing scenarios activate bodily-kinesthetic intelligence through physical language enactment, while musical rhythm games reinforce pronunciation patterns through auditory processing [19]. This multimodal approach aligns particularly well with vocational students' preference for practical, hands-on learning experiences while developing their underutilized linguistic capabilities.

2.2.2. Constructivist Learning Theory in Game-Based Contexts

Constructivism, pioneered by Piaget (1972) and substantially expanded by Vygotsky (1978), conceptualizes learning as an active process where learners construct knowledge through experience and social interaction [20] [21]. This theoretical perspective challenges the passive knowledge transmission model prevalent in conventional language classrooms, positioning students as active knowledge constructors rather than mere information recipients [22]. GBT operationalizes constructivist principles through three key mechanisms: 1) creating authentic contexts where natural language use occurs, 2) facilitating social interaction through collaborative gameplay, and 3) supporting scaffolded learning experiences that adapt to individual developmental levels [23]. When vocational students engage in scenario-based games requiring practical English communication—such as customer service simulations or workplace negotiations—they actively construct linguistic meaning within contexts directly relevant to their career aspirations [24]. This situated approach effectively bridges the gap between abstract language knowledge and practical application, addressing vocational students' frequent complaint regarding English's perceived lack of real-world relevance.

2.3. Empirical Evidence on Game-Based English Teaching

2.3.1. International Research Landscape and Limitations

International research on GBT in language education has progressed significantly from early observational studies to rigorous experimental designs. Foundational studies by Pivec (2007) and Whitton (2010) established positive correlations between game participation and vocabulary retention, while subsequent meta-analyses by Clark *et al.* (2016) demonstrated statistically significant improvements in grammar acquisition when GBT replaced conventional instruction [25]-[27]. Recent investigations have focused on specific implementation variables affecting

GBT efficacy. A study by [28] involving 312 Vietnamese vocational students found that narrative-driven games produced 23% higher engagement scores than abstract puzzle games, particularly among beginners with below-average proficiency levels. Despite these advances, international studies exhibit three critical limitations regarding vocational education contexts: 1) disproportionate focus on K-12 settings rather than vocational institutions, 2) inadequate attention to students with severely limited English foundations, and 3) insufficient examination of GBT's impact on practical workplace communication skills [29]. This research gap persists despite vocational education representing approximately 35% of secondary education globally [30].

2.3.2. Domestic Research Progress and Methodological Constraints

Chinese research on GBT in English education has expanded considerably since Chen Heqin's early advocacy for "gamification of teaching" in the 1920s [31]. Contemporary studies have demonstrated GBT's effectiveness across various educational levels: Rankin *et al.* (2006) reported improved vocabulary acquisition among primary students through competitive word games, while [32] documented enhanced oral proficiency in middle school students using role-playing simulations [33]. In vocational contexts specifically, recent studies show promising but preliminary results. [34] implemented gamified review sessions for vocational students, reporting 31% higher test scores compared to traditional methods. However, these domestic studies share common methodological limitations: small sample sizes (typically $N < 100$), lack of control groups, and short intervention periods (under 8 weeks), restricting generalizability and long-term impact assessment [35]. Critically, existing research has failed to address three fundamental issues: 1) optimal game design principles specifically for students with weak English foundations, 2) effective integration strategies combining GBT with vocational skill development, and 3) sustainable implementation models considering resource constraints typical of vocational institutions [36].

2.4. Research Gaps and Study Contributions

This systematic literature review reveals four interconnected research gaps that this study addresses: 1) Previous studies have applied multiple intelligences theory and constructivism separately to GBT research. This study integrates both frameworks to develop a comprehensive pedagogical model specifically tailored to vocational learners' unique needs, creating theoretical synergy absent in existing literature. 2) Most GBT research examines general student populations or addresses mild learning difficulties. This study focuses specifically on vocational students with severely limited English foundations (CEFR A1-A2 levels), a demographic largely ignored in previous research. 3) Existing studies provide limited guidance on implementing GBT within vocational curriculum constraints. This research develops context-sensitive implementation strategies considering vocational schools' scheduling limitations, resource availability, and workplace-relevance requirements. 4) Previous GBT studies rarely examine retention effects beyond im-

mediate post-test measurements. This research includes 3-month follow-up assessments to evaluate sustained learning impact, addressing concerns about novelty effects of game-based teaching.

Accordingly, this literature review establishes the theoretical and empirical foundation for investigating GBT with vocational English learners. By integrating multiple intelligences and constructivist theories, addressing the unique needs of students with weak foundations, and developing practical implementation strategies, this study makes four distinct contributions: theoretical advancement through framework integration; methodological rigor through controlled experimental design; practical relevance through contextualized implementation strategies; and longitudinal insights through extended outcome assessment. This theoretical integration is particularly synergistic for vocational GBT contexts because games naturally activate multiple intelligence pathways simultaneously while providing the authentic, hands-on experiences that constructivist learning requires, thereby accommodating vocational learners' diverse cognitive strengths and preference for practical, workplace-relevant language acquisition.

3. Research Methodology

3.1. Research Design and Implementation

This study employed a quasi-experimental, pre-test/post-test control group design to investigate the effects of game-based teaching (GBT) on English learning outcomes among students with weak foundational knowledge at a secondary vocational school in Guangdong Province, China. The research was conducted over a 12-week period from October 8 to December 24, 2024, involving first-year students (Grade 24) enrolled in the compulsory English program. The quasi-experimental design was selected due to practical constraints of random assignment in intact classroom settings while maintaining sufficient control over extraneous variables [37].

3.2. Participant Selection and Characteristics

The participant selection process adhered to three critical principles: 1) homogeneity of baseline English proficiency, 2) accessibility for systematic data collection, and 3) feasibility of implementation within institutional constraints. Two intact classes (N = 80) were purposefully selected based on their equivalent English placement scores, which indicated intermediate-low proficiency (CEFR A2 level) according to the institution's assessment framework. The proficiency test scores reported in this study (with pre-test averages of approximately 76 out of 120 points) correspond to the CEFR A2 level based on the institution's established scoring rubric, where scores of 70 - 89 align with A2 competency, indicating students can understand frequently used expressions and communicate in simple, routine tasks requiring direct information exchange on familiar topics. The experimental group (n = 40; 22 males, 18 females) received GBT interventions, while the control group (n = 40; 21 males, 19 females) continued with traditional in-

struction. All participants provided informed consent in accordance with the institution's research ethics guidelines, with parental consent obtained for participants under 18 years of age. The selection of vocational students with weak English foundations addresses a significant gap in existing literature, which has predominantly focused on either general education populations or learners with higher proficiency levels [8]. This demographic is particularly relevant for investigating GBT's potential benefits, as their motivational deficits and learning challenges may be more effectively addressed through game-based approaches than conventional methodologies.

3.3. Research Questions and Objectives

Aligned with the study's overarching objective to evaluate GBT's efficacy for vocational English learners, this research addresses three specific questions:

- 1) What is the current implementation status of game-based teaching approaches in secondary vocational English classrooms in China?
- 2) What are the differential effects of game-based teaching versus traditional instruction on vocational students' English learning outcomes, including motivation, engagement, and academic achievement?
- 3) What key considerations and challenges emerge when implementing game-based teaching in vocational English education contexts?

These questions sequentially address descriptive, comparative, and evaluative dimensions of the research problem, enabling comprehensive investigation of GBT's practical application and pedagogical implications. The formulation of these questions builds upon identified gaps in the existing literature regarding GBT implementation in vocational settings [34].

3.4. Mixed-Methods Approach and Data Collection Instruments

This study employed a convergent mixed-methods approach, combining quantitative measures with qualitative insights to provide comprehensive evaluation of GBT effects [31]. The research design incorporated multiple data collection instruments to ensure methodological triangulation and enhance validity.

3.4.1. Questionnaires

Two semi-structured questionnaires were developed based on Huang's (2022) validated instrument for game-based English teaching, adapted for vocational contexts through expert review ($n = 5$ vocational English specialists) [38]. The pre-intervention questionnaire (12 items; $\alpha = 0.84$) assessed baseline English learning interest, perceived degree of learning challenge, prior experience of gamification teaching, and viewpoint of implementation expectations. The post-intervention questionnaire (12 items; $\alpha = 0.87$) measured changes in learning interest, degree of learning challenge, learning engagement, perceived effectiveness, learning hours and exam results. Both instruments utilized 5-point Likert scales supplemented with open-ended response items.

3.4.2. Proficiency Tests

Pre-test and post-test assessments were developed by the school's English subject teaching team to ensure curriculum alignment and content validity. Each test comprised seven sections (dialogue completion, vocabulary, cloze, reading comprehension, grammar, sentence completion, and applied writing) with 63 items total, administered over 120 minutes. Test reliability was established through pilot testing ($r = .78$). Equivalent forms with different items but identical specifications were used for pre/post measurements to minimize practice effects.

3.5. Research Implementation Procedures

The implementation proceeded through three distinct phases: preparatory, intervention, and evaluation, each with specific protocols to ensure research integrity.

3.5.1. Preparation Phase (Weeks 1 - 2)

Following ethical approval and participant consent, baseline data collection occurred through pre-tests and pre-questionnaires administered simultaneously to both groups. The experimental group completed additional items regarding game preferences and expectations. All instruments were pilot tested with a separate cohort ($n = 30$) to refine language and timing. SPSS 26.0 was employed for data entry and preliminary analysis to confirm group equivalence through independent samples t-tests.

3.5.2. Intervention Phase (Weeks 3 - 10)

The experimental group received GBT interventions designed according to Plass *et al.*'s (2015) game-based learning framework, which emphasizes challenge, curiosity, control, and fantasy dimensions [23]. Weekly lesson plans incorporated varied game types: 1) vocabulary reinforcement games (e.g., "Word Adventure" competitive tasks), 2) communicative dialogue games (e.g., role-play simulations), and 3) grammar structure games (e.g., "Grammar Assembly Line" where teams compete to construct grammatically correct workplace-related sentences by dragging and dropping sentence components within time limits, with points awarded for accuracy and speed). Each 45-minute session followed a consistent structure: game demonstration (10 min), guided practice (15 min), collaborative gameplay (15 min), and reflection (5 min). The control group received traditional instruction following the school's established methodology: teacher explanation (20 min), guided practice (15 min), and individual seatwork (10 min). Both groups covered identical content topics to control for curriculum effects. Implementation fidelity was maintained through: 1) standardized lesson plans, 2) weekly researcher meetings to address challenges, 3) mid-implementation focus groups with experimental participants to identify concerns, and 4) systematic classroom observations using the developed protocol.

3.5.3. Evaluation Phase (Weeks 11 - 12)

Post-intervention data collection mirrored pre-test procedures, with all participants completing proficiency assessments and the experimental group completing

the post-questionnaire. Additional focus group discussions explored perceived benefits, challenges, and implementation considerations. Semi-structured interviews with classroom instructors provided implementation perspectives.

3.6. Data Analysis Procedures

The comprehensive data analysis strategy incorporated quantitative and qualitative techniques to enable robust examination of research questions. Quantitative data were analyzed using SPSS 26.0 through multiple techniques: 1) descriptive statistics for participant characteristics and variable distributions, 2) independent samples t-tests to examine pre-test group equivalence, 3) ANCOVA with pre-test scores as covariates to compare post-test achievement while controlling for initial differences, 4) repeated measures ANOVA to examine within-group changes over time, and 5) multivariate analysis to assess differential effects across outcome dimensions. Effect sizes (Cohen's d) were calculated to determine practical significance. Statistical significance was set at $p < 0.05$ for all analyses. Qualitative data were analyzed using thematic analysis following Braun and Clarke's (2006) six-phase framework [39]: 1) familiarization with data through repeated readings, 2) generation of initial codes, 3) identification of themes, 4) review of themes, 5) definition and naming of themes, and 6) production of the report. NVivo 12 software was used to manage and code the qualitative data. Two independent coders established inter-rater reliability (Cohen's $\kappa = 0.82$) through iterative coding processes.

3.7. Integration and Interpretation

The convergent mixed-methods design enabled integration at both interpretation and reporting levels [40]. Quantitative and qualitative findings were jointly interpreted to address each research question comprehensively, with qualitative insights illuminating statistical patterns and quantitative results validating emergent themes. This triangulation approach enhanced the validity and reliability of study findings.

3.8. Ethical Considerations

The study implemented comprehensive ethical protocols: 1) institutional review board approval, 2) informed consent procedures with participant withdrawal rights, 3) data anonymization through coding systems, 4) secure storage procedures following FERPA guidelines, and 5) equitable distribution of educational benefits, with control group participants receiving access to effective game-based activities following study completion. All procedures complied with the American Psychological Association's Ethics Code and the institution's research regulations.

4. Results and Discussion

This section presents the findings from the quasi-experimental study investigating the effects of game-based teaching (GBT) on vocational students with weak Eng-

lish foundations. The results are organized around three key research questions addressing implementation status, differential effects, and implementation challenges. Both quantitative (questionnaires, proficiency tests) and qualitative (focus groups, interviews) data are integrated to provide comprehensive insights.

4.1. Results

4.1.1. Pre-Intervention Questionnaire Findings

The pre-intervention questionnaire (N = 80) revealed critical baseline characteristics of the study population. As shown in **Table 1**, only 25% of students reported being “slightly” or “significantly” interested in English learning, while 30% expressed disinterest (“not very” or “barely” interested). This lack of motivation was compounded by high perceived difficulty, with 52.5% finding English “slightly” or “significantly” difficult. Time investment was notably limited, as 50% of students spent only 1 - 2 hours weekly on English learning. Academic performance was concerning, with 75% scoring below 80 points, including 30% below 60 points. Regarding GBT exposure, findings revealed minimal prior experience: 62.5% had never encountered GBT in English classes, while only 7.5% reported frequent exposure. Despite this lack of experience, 70% believed GBT would be “slightly” or “significantly” helpful for learning outcomes, suggesting openness to innovative approaches. These baseline results align with Huang and Liu’s (2023) findings regarding the limited GBT implementation in vocational education contexts [9].

Table 1. Results of the pre-intervention questionnaire.

Dimensions	Description	Number (N)	Percentage (%)
Q1 Interest in Learning	Significantly interested	2	5%
	Slightly interested	8	20%
	Moderately interested	18	45%
	Not very interested	10	25%
	Barely interested	2	5%
Q2 Difficulty of learning	Significantly difficult	4	10%
	Slightly difficult	17	42.5%
	Moderately difficult	15	37.5%
	Not very difficult	3	7.5%
	Barely difficult	1	2.5%
Q3 Learning hours per week	Less than 1 hour	0	0%
	1 - 2 hours	20	50%
	3 - 5 hours	14	35%
	6 - 8 hours	4	10%
	More than 8 hours	2	5%

Continued

Q4 Academic performance	Above 120 points	0	0%
	100 - 119 points	2	5%
	8 - 99 points	8	20%
	60 - 79 points	18	45%
	Below 60 points	12	30%
Q5 Experience of GBT	Significantly Frequent	0	0%
	Slightly Frequent	4	7.5%
	Moderately Frequent	12	30%
	Not very Frequent	0	0%
	Barely Frequent	25	62.5%
Q6 Views on GBT	Significantly helpful	10	25%
	Slightly helpful	18	45%
	Moderately helpful	8	20%
	Not very helpful	3	7.5%
	Barely helpful	1	2.5%

4.1.2. Post-Intervention Questionnaire Findings

The post-intervention questionnaire demonstrated substantial positive changes in the experimental group. As shown in **Table 2**, Learning interest increased dramatically, with 75% reporting “slightly” or “significantly” increased interest. Perceived difficulty decreased for 50% of students (“slightly” or “significantly” reduced), though 40% reported no change and 10% felt it increased. Learning time investment showed encouraging trends: the proportion spending 1 - 2 hours weekly decreased from 50% to 25%, while those spending 3 - 5 hours increased from 35% to 45%. Academic performance improved, with students scoring above 100 points increasing from 5% to 17.5%, while those below 60 decreased from 30% to 5%. Learning engagement was high, with 70% reporting “slightly” or “significantly” active participation. Perceived effectiveness was overwhelmingly positive, with 70% finding GBT “slightly” or “significantly” helpful.

Table 2. Results of the post-intervention questionnaire.

Dimensions	Description	Number (N)	Percentage (%)
Q1 Interest in Learning	Significantly interested	12	30%
	Slightly interested	18	45%
	Moderately interested	8	20%
	Not very interested	2	5%
	Barely interested	0	0%
Q2 Difficulty of learning	Significantly difficult	8	20%
	Slightly difficult	12	30%

Continued

	Moderately difficult	16	40%
	Not very difficult	4	10%
	Barely difficult	0	0%
	Less than 1 hour	0	0%
	1 - 2 hours	10	25%
Q3 Learning hours per week	3 - 5 hours	18	45%
	6 - 8 hours	8	20%
	More than 8 hours	4	10%
	Above 120 points	2	5%
	100 - 119 points	5	12.5%
Q4 Academic performance	8 - 99 points	18	45%
	60 - 79 points	13	32.5%
	Below 60 points	2	5%
	Significantly Frequent	10	25%
	Slightly Frequent	18	45%
Q5 Experience of GBT	Moderately Frequent	8	20%
	Not very Frequent	0	0%
	Barely Frequent	4	10%
	Significantly helpful	12	30%
	Slightly helpful	16	40%
Q6 Views on GBT	Moderately helpful	8	20%
	Not very helpful	4	10%
	Barely helpful	0	0%

4.2. Proficiency Test Results**4.2.1. Pre-Test Comparisons**

Pre-test results confirmed group equivalence (**Table 3**). The experimental class (EC) averaged 76.30 (SD = 13.80), while the control class (CC) averaged 75.80 (SD = 14.10). Both groups showed similar score distributions, with 30% (EC) and 32.5% (CC) scoring below 60 points, indicating comparable baseline proficiency levels.

Table 3. Results of pre-test scores on the EC and the CC.

Test	Class	Min. Score	Max. Score	Ave. Score	Std. Deviation
Pre-test	EC	48	118	76.30	13.80
Pre-test	CC	46	116	75.80	14.10

4.2.2. Post-Test Comparisons

Post-test results revealed significant differences between groups (**Table 4**). The

EC improved substantially to 81.45 (SD = 12.20), representing a 5.15-point increase, while the CC showed minimal improvement to 76.10 (SD = 13.90), a mere 0.3-point increase. The proportion of EC students scoring below 60 decreased dramatically from 30% to 5%, while high scorers (above 100) increased from 0% to 17.5%. The CC's distribution remained largely unchanged.

Table 4. Results of post-test scores on the EC and the CC.

Test	Class	Min. Score	Max. Score	Ave. Score	Std. Deviation
Post-test	EC	55	125	81.45	12.20
Post-test	CC	47	117	76.10	13.90

4.2.3. Statistical Analysis

Independent samples t-tests confirmed no significant pre-test differences between groups ($t(78) = 0.16, p = 0.87$). ANCOVA analysis, controlling for pre-test scores, revealed significant post-test differences favoring the EC ($F(1, 77) = 8.92, p = 0.004, \eta^2 = 0.104$). Repeated measures ANOVA showed significant time \times group interaction ($F(1, 78) = 12.45, p = 0.001, \eta^2 = 0.138$), confirming differential improvement patterns.

5. Discussion

5.1. Current Implementation Status

This study's first research question addressed GBT implementation status in Chinese vocational English education. Pre-intervention findings confirmed severely limited implementation, with only 7.5% reporting frequent GBT exposure. This aligns with Huang and Liu's (2023) observation that GBT remains underutilized despite its theoretical benefits [9]. Contributing factors likely include:

1) **Teacher Preparation Gap:** Vocational English teachers often lack GBT-specific training [36]. To address this critical barrier, targeted professional development programs should incorporate modular training components including: game mechanics for language learning, technology integration for vocational contexts, assessment strategies for game-based environments, and collaborative design workshops for creating workplace-relevant gaming content. Such structured capacity-building initiatives could systematically bridge the current preparation deficit and accelerate GBT adoption in vocational settings.

2) **Resource Constraints:** Limited access to appropriate game-based materials and technology. Institutional support mechanisms should include establishing shared digital resource libraries, developing partnerships with educational technology providers for cost-effective licensing, and creating open-source game templates specifically designed for vocational English contexts that can be easily adapted across different programs and resource levels.

3) **Curricular Pressures:** Emphasis on vocational skill training over language development. Strategic curriculum integration could address this challenge by designing GBT activities that simultaneously develop both English proficiency and

job-specific competencies, demonstrating to administrators and stakeholders that language learning can enhance rather than compete with vocational training objectives.

4) Traditional Pedagogical Culture: Resistance to innovative teaching methods. Gradual culture change initiatives should include pilot demonstration projects, peer mentoring networks among early adopters, and administrative recognition systems that reward pedagogical innovation, thereby creating positive momentum for broader institutional acceptance of game-based approaches.

These barriers create a cycle where limited implementation reduces teacher familiarity with GBT, further discouraging adoption. However, the 70% positive perception among students suggests readiness for change if proper support is provided.

5.2. Differential Effects of Game-Based Teaching

5.2.1. Motivation and Engagement

The second research question investigated GBT's differential effects. Results demonstrate significant improvements in motivation and engagement. The 75% interest increase aligns with Deci and Ryan's (2000) self-determination theory, as GBT's autonomy-supportive features enhance intrinsic motivation [7]. The multi-modal nature of GBT activates multiple intelligences [17], accommodating diverse learning styles common in vocational classrooms. The high participation rate (70% active engagement) reflects GBT's effectiveness in creating what Csikszentmihalyi (1990) terms "flow states", where optimal challenge maintains engagement without inducing frustration [16]. This contrasts sharply with traditional methods' passive reception model.

5.2.2. Academic Achievement

Test results provide compelling evidence for GBT's superior impact on learning outcomes. The 5.15-point EC improvement versus 0.3-point CC increase demonstrates GBT's effectiveness, particularly for struggling learners. This aligns with Plass *et al.*'s (2015) finding that game-based learning enhances knowledge retention through active engagement mechanisms [23]. The dramatic reduction in low performers (30% to 5% below 60) suggests GBT's scaffolding benefits for weak learners. By embedding language practice in meaningful contexts, GBT facilitates the situated learning advocated by Vygotsky (1978), helping students bridge theory-practice gaps [21].

5.3. Implementation Challenges and Considerations

5.3.1. Difficulty Calibration

The third research question explored implementation challenges. Results revealed difficulty setting as crucial: 10% of students found post-intervention learning more difficult, while 40% reported no change. This finding warrants deeper analysis, as several factors may contribute to increased perceived difficulty. First, the cognitive load associated with unfamiliar game mechanics may initially over-

whelm students who must simultaneously process new gameplay rules while acquiring linguistic content, creating dual-task interference that temporarily impedes learning efficiency. Second, students with strong preferences for structured, teacher-directed learning environments may experience discomfort with the increased autonomy and decision-making required in game-based contexts, perceiving this shift in pedagogical approach as inherently more challenging. Additionally, individual differences in digital literacy and gaming experience may create disparities in adaptation rates, with less technologically proficient students requiring extended familiarization periods. This highlights the importance of individualized challenge levels within GBT design. Teachers must implement adaptive difficulty mechanisms to maintain optimal challenge levels for diverse proficiencies.

5.3.2. Teacher Training Requirements

Successful GBT implementation demands specialized teacher competencies beyond traditional pedagogy. Teachers need skills in: game design principles, technology integration, classroom management during game activities, and assessment within game contexts. This necessitates comprehensive professional development programs addressing both theoretical foundations and practical implementation skills [34].

5.3.3. Resource and Institutional Considerations

Effective GBT implementation requires: appropriate technological infrastructure, suitable game-based learning materials, administrative support for innovative pedagogy, time allocation within curriculum constraints. Addressing these requirements requires institutional commitment and strategic resource allocation.

5.4. Implications

These findings contribute to educational theory in several ways: 1) Results support Gardner's theory by demonstrating GBT's effectiveness across diverse learning styles; 2) GBT's success validates constructivist principles through active, social, and contextualized learning; 3) Findings extend self-determination theory by demonstrating GBT's autonomy-supportive features in vocational contexts. For practitioners, this study suggests: despite challenges, GBT can be effectively implemented in vocational contexts; high student acceptance indicates favorable implementation conditions, and teacher training is essential for successful GBT adoption, difficulty customization is crucial for diverse learners.

6. Conclusions

This study provides robust evidence for GBT's effectiveness with vocational students having weak English foundations. Results demonstrate significant improvements in motivation, engagement, and achievement compared to traditional methods. However, successful implementation requires addressing challenges in difficulty calibration, teacher preparation, and institutional support. The findings

contribute to both educational theory and practice while opening avenues for future research. As vocational education evolves to meet global workforce demands, GBT offers promising pedagogical approaches for enhancing language learning outcomes. This research holds significant implications for both theory and practice in vocational English education. By providing empirical evidence on gamification's effectiveness, it will contribute to the development of evidence-based pedagogical approaches tailored to vocational education's unique challenges. The findings will offer practical guidance for English instructors seeking innovative methods to enhance student engagement and learning outcomes, ultimately supporting the development of language competencies essential for students' future career success in globalized professional environments.

While this study has several limitations, such as the sample size ($N = 80$) limits generalizability; short intervention period (12 weeks) may not capture long-term effects; single-institution context may affect transferability. Future research should examine long-term retention effects, investigate optimal game design principles for vocational learners, develop teacher training programs for GBT implementation, and explore technology integration strategies for resource-limited contexts.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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