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GAMIFIED SCAFFOLDING AND ITS IMPACT ON STUDENTS' CRITICAL THINKING ENGAGEMENT IN EFL CONTEXTS

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Annotatsiya

Mavzu: O‘yinlashtirilgan skaffolding va uning talabalarning ingliz tilini chet tili sifatida o‘rganish (EFL) sharoitida tanqidiy fikrlash faolligiga ta’siri

Tadqiqotning maqsadi: Ushbu tadqiqotning asosiy maqsadi oliy ta’lim muassasalarida ingliz tilini chet tili sifatida o‘rganayotgan talabalarning tanqidiy fikrlash faolligini (analiz, inferensiya, baholash) oshirishda raqamli o‘yinlashtirilgan skaffolding (metodik ko‘mak) tizimlarining samaradorligini va uning kognitiv yuklama dinamikasi bilan bog‘liqligini empirik jihatdan aniqlashdan iborat.

Metodologiya: Tadqiqot aralash metodlar dizayni (mixed-methods design) asosida tashkil etilib, unda Toshkent shahridagi xalqaro universitetlarning 74 nafar EFL yo‘nalishi talabalari ishtirok etdi. Eksperimental guruh adaptiv o‘yinlashtirilgan kognitiv skaffolding platformasi (GAI-DLE) orqali, nazorat guruhi esa an’anaviy matnga asoslangan topshiriqlar yordamida o‘qitildi. Ma’lumotlar Facione tanqidiy fikrlash ko‘nikmalari testi (CCTST) va kognitiv yuklama so‘rovnomalari hamda raqamli kundaliklar (reflective diaries) tahlili orqali jamlandi.

Asosiy natijalar: Olingan natijalar shuni ko‘rsatdiki, o‘yinlashtirilgan skaffolding kognitiv arxitekturani optimallashtirish orqali ekstraneus (tashqi) yuklamani kamaytiradi va germane (ichki samarali) yuklamani oshiradi. Eksperimental guruh talabalarida tanqidiy fikrlash interpretatsiyasi, analiz va interpretatsiya ko‘rsatkichlari nazorat guruhiga nisbatan sezilarli darajada yuqori ekanligi isbotlandi ($p < 0.05$).

Amaliy qiymati: Tadqiqot natijalari EFL o‘quv dasturlari dizaynerlari uchun raqamli o‘yin mexanizmlari yordamida talabalarning oliy tartibli kognitiv ko‘nikmalarini shakllantirishga xizmat qiluvchi metodologik model bo‘lib xizmat qiladi.

Kalit so‘zlar: o‘yinlashtirilgan skaffolding, tanqidiy fikrlash, kognitiv yuklama nazariyasi, EFL konteksti, oliy tartibli fikrlash, raqamli pedagogika, germane yuklama, adaptiv qayta aloqa.

ABSTRACT

Title: Gamified Scaffolding and Its Impact on Students' Critical Thinking Engagement in EFL Contexts

Objective: This study aims to investigate the empirical efficacy of digital gamified scaffolding frameworks in enhancing higher-order critical thinking competencies (specifically interpretation, analysis, inference, and evaluation) among university-level English as a Foreign Language (EFL) learners, while monitoring concurrent cognitive load shifts.

Methods: Utilizing a mixed-methods quasi-experimental research paradigm, the study examined 74 undergraduate EFL students across international universities in Tashkent. The experimental cohort utilized an adaptive, gamified AI-supported cognitive scaffolding platform (GAI-DLE), whereas the control group was exposed to conventional non-gamified text-based scaffolding. Quantitative measurements were extracted via pre- and post-tests using the adapted California Critical Thinking Skills Test (CCTST) instruments, corroborated by qualitative thematic extraction from student digital reflective diaries.

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Key Findings: The structural integration of structural gamification elements significantly mitigated extraneous cognitive load while bolstering germane processing capacity. The experimental group exhibited statistically superior gains in inferential and analytical metrics ($p < 0.05$) compared to the baseline cohort. Gamified structures established rigid progression loops that prevented cognitive overload, stimulating self-regulated problem-solving strategies.

Practical Value: These findings deliver actionable insights for syllabus architects and digital media developers seeking to configure technology-mediated language environments that prioritize high-level cognitive engagement alongside semantic acquisition.

Keywords: gamified scaffolding, critical thinking, Cognitive Load Theory, EFL instruction, higher-order processing, digital pedagogy, germane load, adaptive loops.

АННОТАЦИЯ

Тема: Геймифицированный скаффолдинг и его влияние на развитие критического мышления студентов в контексте преподавания английского языка как иностранного (EFL)

Цель исследования: Данное исследование направлено на эмпирическую оценку эффективности систем цифрового геймифицированного скаффолдинга (методической поддержки) в повышении уровня вовлеченности студентов бакалавриата в процессы критического мышления (анализ, синтез, инференция, оценка) в академической среде EFL, а также на изучение сопутствующих изменений в когнитивной нагрузке.

Методология: В рамках квазиэкспериментального дизайна со смешанными методами исследования (mixed-methods) приняли участие 74 студента языковых факультетов международных вузов Ташкента. Экспериментальная группа обучалась на базе адаптивной геймифицированной платформы искусственного интеллекта (GAI-DLE) с микроструктурным скаффолдингом, тогда как контрольная группа использовала традиционные текстовые материалы. Данные собирались с помощью стандартизированного теста критического мышления Файсионе (CCTST) и качественного контент-анализа цифровых рефлексивных дневников.

Основные результаты: Анализ данных продемонстрировал, что геймифицированный скаффолдинг оптимизирует когнитивную архитектуру обучающихся, минимизируя экстрансивную (постороннюю) нагрузку и стимулируя германную (релевантную) когнитивную активность. Экспериментальная группа показала статистически значимый рост показателей аналитического и оценочного мышления по сравнению с контрольной группой ($p < 0.05$).

Практическая ценность: Полученные выводы предлагают научно обоснованную методологическую базу для разработчиков цифровых образовательных сред и учебных планов EFL, направленных на синергетическое развитие лингвистических компетенций и когнитивных навыков высокого порядка.

Ключевые слова: геймифицированный скаффолдинг, критическое мышление, теория когнитивной нагрузки, контекст EFL, мышление высокого порядка, цифровая педагогика, германная нагрузка, адаптивная обратная связь.

INTRODUCTION

In the modern landscape of globalized higher education, preparing English as a Foreign Language (EFL) learners requires competencies extending far beyond lexical and syntactic memorization. Twenty-first-century educational imperatives mandate the cultivation of critical thinking—conceptualized as purposeful, self-regulated judgment encompassing interpretation, analysis, evaluation, and inference (Pepita, 2026). Traditional lecture-style, teacher-centric instructional modules dominant in many developing educational ecosystems often fail to sustain student cognitive curiosity and attention (Cheng, 2025). This deficiency is particularly pronounced

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within Central Asian higher education frameworks, such as in Uzbekistan, where historically rigid pedagogical approaches struggle to adapt to learner-centered paradigms (Abdullaeva, 2025).

To mitigate declining student engagement, educational researchers have turned to gamification—the implementation of game-design elements within non-game settings (Cheng, 2025; Niyazova, 2026). However, the implementation of superficial "points, badges, and leaderboards" models has drawn criticism for creating transactional motivation or causing cognitive fatigue (Gunawan, 2025).

To achieve sustained cognitive development, gamification must function as a structural scaffolding mechanism. Grounded in Vygotsky's Zone of Proximal Development (ZPD) and modern Cognitive Load Theory (CLT), gamified scaffolding dynamically positions systemic instructions, hints, and feedback to align with a learner's cognitive architecture (Abdullaeva, 2025; Ling, 2019). While prior research substantiates the positive impact of digital platforms on raw vocabulary retention and general motivation (Abdullaeva, 2025), empirical exploration tracing how gamified scaffolding specifically affects targeted dimensions of critical thinking engagement inside tertiary EFL spaces remains limited (Pepita, 2026).

This study addresses this empirical gap by examining how structured game mechanics, aligned as instructional scaffolds, optimize cognitive resources to foster higher-order processing skills among university EFL students in Tashkent.

Research Design This investigation utilized a mixed-methods quasi-experimental design spanning a duration of eight weeks during the academic semester. Quantitative metrics recorded shifts in students' critical thinking sub-skills, while qualitative tracking through digital reflective diaries captured the nuanced phenomenology of cognitive immersion and environmental experiences.

Participants & Setting The sample comprised $N = 74$ undergraduate EFL students aged 17 to 23 selected from international higher education universities in Tashkent, Uzbekistan. Participants were stratified into two groups based on initial baseline English proficiency scores (Common European Framework of Reference for Languages, CEFR B2 level) and pre-test critical thinking performance: **Experimental Group ($n = 37$):** Exposed to a Gamified AI-enabled Digital Learning Environment (GAI-DLE) configured with adaptive cognitive scaffolding (Niyazova, 2026). **Control Group ($n = 37$):** Exposed to identical thematic curricular readings and analytical prompts delivered through conventional, paper-based text structures with instructor-led verbal scaffolding. **Quantitative Evaluation:** A localized, adapted version of the California Critical Thinking Skills Test (CCTST) based on Facione's theoretical matrices (Pepita, 2026). The instrument systematically measures four target cognitive dimensions: *Interpretation*, *Analysis*, *Inference*, and *Evaluation*. Inter-item reliability was validated with a Cronbach's alpha of $\alpha = 0.81$. **Qualitative Instrumentation:** Digital reflective diaries structured via prompts designed around Cognitive Load Theory (CLT) boundaries (Abdullaeva, 2025). Qualitative corpora were examined via Interpretative Phenomenological Analysis (IPA). **Statistical Diagnostics:** Intra-group and inter-group variance were processed using paired-samples t-tests and independent-samples t-tests through SPSS software.

RESULTS

Following the eight-week intervention, the data collected from the CCTST instrument revealed distinct variations between the two educational treatments. The independent-samples t-test evaluated the absolute post-test mean differences between the experimental and control cohorts.

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Critical Thinking Dimension	Baseline Pre-Test (EG)	Post-Test Mean (EG)	Baseline Pre-Test (CG)	Post-Test Mean (CG)	Statistical Significance (p-value)
Interpretation	12.4	16.8	12.6	13.9	$p < 0.05$
Analysis	10.1	15.2	10.3	11.8	$p < 0.01$
Inference	9.4	14.1	9.5	10.6	$p < 0.01$
Evaluation	8.8	13.5	8.9	10.2	$p < 0.05$

Table 1: Comparative Pre- and Post-Test Performance Metrics Across Groups (EG: Experimental Group; CG: Control Group).

The experimental group displayed statistically significant progress across all targeted dimensions, with the most pronounced leaps manifesting in **Analysis** and **Inference**. This suggests that the structural elements embedding the cognitive scaffolds directly facilitated deeper processing of foreign language texts.

Qualitative Phenomenology The Interpretative Phenomenological Analysis (IPA) of student diaries yielded three predominant themes mapping the internal cognitive shifts of the participants: The statistical and phenomenological evidence gathered in this study indicates that gamified scaffolding can serve as an effective mechanism for fostering critical thinking skills within EFL learning environments. These findings support previous research highlighting how digital game-based learning environments function as cognitive spaces for practicing analytical reasoning (Pepita, 2026).

The primary pedagogical mechanism driving these outcomes is explained by **Cognitive Load Theory (CLT)**. As observed in recent empirical studies of Uzbek learners, the architectural framework of gamified systems optimizes cognitive resources by dividing complex textual processing into sequenced micro-tasks (Abdullaeva, 2025). This systematic division effectively reduces *extraneous cognitive load*—the mental effort spent navigating confusing or unstructured instructional methods—allowing learners to dedicate their working memory to *germane cognitive load*, which supports schema construction, deep interpretation, and analytical thinking (Abdullaeva, 2025; Niyazova, 2026). Furthermore, the data shows that the experimental group's high engagement scores were tied to the psychological principles of **Self-Determination Theory**. Meaningful gamified scaffolding addresses three core learning needs: *autonomy* (allowing students to choose their analytical pathways), *competence* (providing rapid, adaptive feedback loops), and *relatedness* (fostering collaborative interaction) (Ling, 2019; Niyazova, 2026). This balanced environment helps lower the affective filter. In traditional, teacher-centered classrooms common in some regional ecosystems, fear of making public mistakes can lead to high language anxiety and passive behavior (Cheng, 2025; Gulshodaxon, 2025). By reframing failure as an iterative learning loop (where an incorrect analytical step results in hints and a prompt retry rather than a low grade), the gamified

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platform supports exploratory risk-taking, which is essential for developing critical evaluation and inference skills (Ling, 2019; Pepita, 2026).

CONCLUSION

This study demonstrates that gamified scaffolding, when deliberately aligned with curricular goals, can significantly enhance critical thinking engagement among university EFL learners. The empirical evidence shows that dividing analytical tasks into structured, game-informed steps optimizes students' cognitive load, resulting in measurable improvements in text analysis, inference, and evaluation skills.

Pedagogical Implications Curriculum Design: EFL syllabus designers should move away from superficial gamification models (such as simple point systems) and instead focus on integrating adaptive cognitive scaffolds that adjust to student performance in real time. **Blended Learning Models:** Educational institutions can implement gamified frameworks within a flipped classroom design. This approach allows students to practice foundational textual analysis independently before attending higher-order group discussions.

Limitations & Future Directions While these findings offer useful insights into the Central Asian educational context, the scope of this study was limited to a sample of 74 students over an eight-week period. Future research should examine larger, more diverse student groups across multiple regions to assess the long-term retention of these critical thinking gains. Additionally, further exploration is needed to determine how varying levels of instructor involvement affect the success of digital gamified scaffolds.

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