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Project-Based Gamification to Enhance English Language Learning

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ABSTRACT

English language learning is essential for engineering graduates, yet traditional instructional approaches often result in passive participation and reduced motivation. This study presents a project-based gamification model implemented through a 30-hour elective course, where engineering students designed and developed their own gamified tools to enhance specific aspects of English learning. Grounded in Self-Determination Theory and Flow principles, the course enabled students to develop vocabulary, grammar, idiomatic competence, and communication skills through creation-based learning. Student-developed games—such as Hangman, Idiomatrix, ELITZ, and Tweet Tweet—demonstrated increased creativity, engagement, and language retention. Assessment included project development, peer testing, and reflections. The findings indicate that student-created gamification is an innovative and effective pedagogical approach aligned with NEP 2020 priorities.

Keywords

Gamification, English Language Learning, Project-Based Learning, Engineering Education, Student Engagement

I. INTRODUCTION

English communication is a core employability competency for engineering graduates operating in global, cross-functional teams; yet lecture-centric delivery often yields low engagement and limited retention. Gamification, "the use of game design elements in non-game contexts" [1] has emerged as a pedagogical approach to address such disengagement. Research suggests that gamification improves motivation, persistence, and learning outcomes when mechanics are aligned with objectives rather than added superficially [2], [3].

Two theoretical perspectives explain these effects. Self-Determination Theory (SDT) posits that environments supporting autonomy, competence, and relatedness foster intrinsic motivation [4]. In gamification, mechanics such as progressive challenges, choice, and collaboration satisfy these needs. Flow theory emphasizes the balance of challenge and skill,

sustained by immediate feedback and clear goals [5]. When these conditions are met, learners experience deep focus and heightened performance.

For engineering students, where English is both a gateway to employability and often viewed as a non-technical hurdle, gamification offers a means of reframing language practice as active and engaging. This study introduces a structured elective course, Gamification in Education (24INO121), where students not only used gamified tools but also created them. In doing so, the course combined experiential learning [13] and project-based pedagogy [14] to foster engagement, linguistic growth, and interdisciplinary skill development.

II. LITERATURE REVIEW

Gamification has been widely explored in education, with Deterding et al. [1] defining it as the transfer of game elements such as points, levels, and badges into non-game settings. Kapp [2] and Hamari et al. [3] highlight that gamification enhances learner motivation and performance when mechanics are meaningfully embedded in learning design.

1) Theoretical Perspectives

SDT [4] frames gamification as effective when learners feel competent (through scoring systems), autonomous (through choice of tasks), and socially connected (through collaboration). Similarly, Flow theory [5] explains how clear goals and balanced challenges produce immersion. Gee [6] adds that games inherently create "learning principles" such as risk-taking, feedback loops, and progression, all applicable to classroom contexts.

2) Gamification in Language Learning

In second language acquisition (SLA), gamified tools such as Duolingo and Memrise use streaks, leaderboards, and adaptive tasks to sustain daily engagement [12]. Mayer's work on multimedia learning [11] demonstrates that multimodal, interactive inputs reduce cognitive load, making digital gamification particularly effective for language acquisition. For idioms and figurative competence, Boers [8] and Liu [10] emphasize the role of metaphor awareness and contextualized practice, which puzzle-based games can simulate. Schmitt [9] underscores vocabulary repetition with variation, aligning with gamified drills and adaptive quizzes.

3) Gaps in Literature

Despite the success of ready-made platforms, there is little research on student-created gamified tools. This approach integrates experiential learning [13] and project-based learning [14], enabling students to apply gamification principles directly while reinforcing English skills. This study addresses this gap by analyzing how engineering students designed language-learning games in a structured elective.

III. METHODOLOGY

1) Course Context and Design

The elective course, Gamification in Education (24INO121), was offered to first-year B.E./B.Tech students. Structured as a 30-hour, 1-credit course, it was divided into three modules:

1. Introduction to Gamification – principles, benefits, and case studies of gamified learning tools.
2. Designing Gamified Language Tools – vocabulary/grammar-based games, interactive storytelling, feedback loops.
3. Research and Evaluation – testing prototypes, collecting peer feedback, documenting challenges and learning outcomes.

2) Participants

A total of 48 students from diverse engineering disciplines enrolled in the elective. They worked in small teams (5–6 members) to conceptualize, design, and present gamified tools for English learning.

3) Assessment Framework

Assessment was based on continuous evaluation rather than exams. Each team was graded on:
Conceptual Understanding (CO1): Demonstrating knowledge of gamification principles.
Design and Development (CO2): Building a functional gamified tool with clear mechanics.
Evaluation and Reflection (CO3): Testing, analyzing feedback, and documenting findings.

4) Data Collection

Two sources of data were collected:

1. *Quantitative Data:* Internal performance scores (out of 100). Distribution analysis was conducted to assess learning achievement.
2. *Qualitative Data:* Student-created project reports and reflective presentations. Four representative projects were selected as case studies:

Hangman (vocabulary and spelling)
Idiomatrix (idioms and figurative expressions)
ELITZ – Learn Modals (grammar via quiz and puzzle)
Tweet Tweet (vocabulary building through letter collection)

5) Analytical Approach

Quantitative data were analyzed using descriptive statistics (mean, distribution categories). Qualitative data were thematically analyzed for (i) language learning outcomes, (ii) application of gamification principles, and (iii) interdisciplinary skill development. Together, this mixed-method approach provided a triangulated view of the course impact.

IV. RESULTS

1) Quantitative Results

Student performance data (N=48) revealed a positive achievement profile for the elective:
Range: 58–89/100
Mean Score: 74.2

Figure 1 illustrates the score distribution, showing that two-thirds of the cohort scored above 70. This pattern suggests that the gamification elective supported both high performers and average learners, with minimal dropout or underperformance.

Table 1: Score Distribution

Category	Number of Students	Percentage
High Achievers (80+)	11	23%
Above Average (70–79)	21	44%
Average (60–69)	15	31%
Low (<60)	1	2%

2) Qualitative Results: Case Study Projects

Four representative projects highlighted the diversity of gamification applications:

Hangman (Vocabulary & Spelling)

Students built a web-based game in HTML/CSS/JavaScript . The tool encouraged deductive reasoning and vocabulary recognition, with real-time feedback for correct/incorrect guesses.
Impact: Reinforced vocabulary recall, collaborative decision-making, and debugging skills.
Limitation: Over-reliance on memorization unless integrated with contextualized word practice.

Idiomatrix (Idioms & Figurative Language)

Designed in Python (Pygame), this puzzle game used visuals and multiple-choice formats to test idiom comprehension.

Impact: Helped learners connect figurative meanings with imagery, aligning with Boers' (2000) findings on metaphor awareness.
Limitation: Difficulty balancing challenge levels; some idioms culturally unfamiliar to learners.

ELITZ – Learn Modals (Grammar Practice)

A dual-model game: (i) quiz-based multiple-choice, (ii) puzzle-style word completion .
Impact: Supported grammar retention via immediate corrective feedback and sound/visual reinforcements.
Limitation: Limited variety of sentences; future scope for adaptive grammar modules.

Tweet Tweet (Letter Collection Vocabulary Game)

A bird-character collected falling letters to form words .
Impact: Improved spelling fluency and concentration; engaging animations sustained attention.
Limitation: Technical challenges with animation smoothness on lower-end devices.

V. COURSE OUTCOMES (CO) ACHIEVEMENT

CO1 (Understanding principles): Achieved through reports explicitly describing mechanics (points, levels, feedback).

CO2 (Design and development): Validated by the creation of functional tools spanning vocabulary, idioms, and grammar.

CO3 (Evaluation): Evident in student reflections, challenge documentation, and iteration based on peer testing.

Table 2: Course Outcomes And Evidence

Course Outcome	Description	Evidence from Projects
CO1	Understand gamification principles	Reports articulating mechanics (points, levels, badges)
CO2	Design gamified tools	Hangman, Idiomatrix, ELITZ, Tweet Tweet
CO3	Evaluate effectiveness	Reports, peer feedback, testing cycles

VI. DISCUSSION

The study's results reinforce existing literature on the effectiveness of gamification [1]–[3]. The strong distribution of scores, with 67% above 70, mirrors findings from Hamari et al. [3] that gamification improves persistence and measurable outcomes. By situating design within SDT [4] and Flow [5], the elective created conditions for sustained motivation: autonomy (choice of mechanics), competence (progressive scoring), and relatedness (team collaboration).

For language learning, student projects validated theories in SLA. Idiomatrix operationalized Boers' [8] metaphor-awareness approach by linking idioms with visual prompts. ELITZ demonstrated Mayer's [11] multimedia principles, using visual and auditory cues to reinforce grammar. Hangman and Tweet Tweet mirrored Schmitt's [9] emphasis on vocabulary repetition with feedback.

The unique contribution of this study lies in shifting gamification from consumption to creation. Learners not only practiced English but also designed gamified tools, aligning with Kolb's experiential cycle [13] and project-based learning outcomes [14]. This dual-layered approach cultivated both linguistic proficiency and interdisciplinary competencies (coding, teamwork, reflection).

Limitations include the small cohort size and absence of standardized pre/post-tests, but the positive outcomes suggest that student-created gamification can be a scalable model for English learning in engineering education.

VII. CONCLUSION AND FUTURE WORK

This study examined the impact of a project-based elective, Gamification in Education (24INO121), on English language learning for engineering undergraduates. The results indicate that integrating gamification into language pedagogy significantly enhanced student engagement, assessed performance, and creativity. Quantitative findings showed that 67% of students achieved

scores above 70, while qualitative evidence demonstrated diverse student-designed prototypes addressing vocabulary (Hangman), idioms (Idiomatrix), grammar (ELITZ), and spelling (Tweet Tweet).

The findings reinforce existing research that gamification, when aligned with Self-Determination Theory and Flow principles, provides learners with autonomy, competence, and relatedness, leading to sustained motivation. In this study, the unique innovation was that learners not only used gamified tools but also created them. This approach yielded dual benefits: improving English proficiency and equipping students with interdisciplinary competencies such as coding, problem-solving, and teamwork.

Pedagogical Contributions

Demonstrates that gamification can move beyond vocabulary apps to student-created tools, thereby embedding project-based learning into English education.
Provides a replicable model for other engineering institutions to integrate active learning, interdisciplinarity, and assessment through creation.
Highlights the potential of gamification as both a pedagogy and an assessment strategy.

Note on AI and Learning Analytics

Basic gameplay analytics such as accuracy patterns, number of attempts, time spent per challenge, and error types provide a promising foundation for AI-driven adaptivity in future versions of the course. These features can enable personalized difficulty levels, automated feedback, and predictive insights that enhance learner engagement and performance.

Limitations

While the outcomes of the elective were highly positive, several limitations must be acknowledged. First, the evaluation relied primarily on internal course scores and qualitative reflections; no formal pre- and post-language proficiency tests (such as CEFR-based assessments) were administered to measure linguistic gains objectively. Second, the duration of the course (30 hours) constrained the depth of iteration and refinement possible in student-created games. Third, students' prior exposure to coding varied considerably, influencing the sophistication and technical quality of the final prototypes. Fourth, the study involved a single cohort of 48 engineering students, limiting generalizability across programs and institutions. Future implementations will incorporate standardized assessment tools, longitudinal tracking, and collection of gameplay analytics to enhance reliability and validity.

Future Work

Future cycles of the course will integrate CEFR-aligned pre- and post-assessments to measure vocabulary, grammar, and communicative competence more systematically. Gameplay analytics such as accuracy rates, error frequencies, time-on-task, and progression curves will be captured to support AI-driven adaptation and personalized learning. Cross-disciplinary collaborations with Computer Science, AI, and Psychology departments will be explored to enrich design complexity and research depth. The next iteration will focus on improving user interface design, accessibility, mobile responsiveness, and level progression mechanisms. A digital repository of student-created

gamified tools will also be established to support long-term institutional adoption and cross-cohort reuse.

VIII. REFERENCES

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