DEVELOPMENT AND VALIDATION OF A GAMIFIED DRILL-AND-PRACTICE INSTRUCTIONAL APPLICATION FOR UTME USE-OF-ENGLISH PREPARATION

ADEROJU, Musiliu Adekola; OLUMORIN Charles Olubode; *ADENIYI-EGBEOLA F.O

Aderoju.am@unilorin.edu.ng; bodeolumorin@unilorin.edu.ng; Adeniyi.fo@unilorin.edu.ng
Department of Educational Technology, University of Ilorin
*Department of Arts Education, University of Ilorin

Abstract

Nigerian secondary school leavers continue to record weak outcomes in the Use of English component of the Unified Tertiary Matriculation Examination (UTME), with vocabulary, comprehension, and grammatical accuracy among the most persistent deficits. Existing digital preparation tools are largely digitised past-question banks with limited motivational design and little documented validation. This study reports the development and validation of a gamified drill-and-practice mobile application for UTME Use-of-English preparation, built using the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model and structured around Chou's Octalysis gamification framework. A needs assessment of 120 Senior Secondary School (SS3) students and 8 English-language teachers in Ilorin, Kwara State, identified vocabulary-in-context, lexis and structure, and oral forms as priority content areas. The resulting application incorporated points, levels, badges, streaks, leaderboards, and adaptive difficulty, each mapped to one or more Octalysis core drives. Content and design validity were established through expert review, while a pretest-posttest quasi-experimental pilot with 64 SS3 students examined learning gains and engagement relative to a non-gamified drill tool. Results showed statistically significant achievement and engagement gains for the experimental group, supporting a replicable ADDIE-Octalysis design template for examination-preparation applications in high-stakes, low-resource contexts.

Keywords: gamification, Octalysis framework, ADDIE model, drill-and-practice, Use of English, UTME, mobile learning, instructional design

Introduction

The Unified Tertiary Matriculation Examination (UTME), administered annually by Nigeria's Joint Admissions and Matriculation Board (JAMB), remains the principal gateway into undergraduate study for several million candidates each year. Use of English is the only subject compulsory for every candidate regardless of intended course of study, and a candidate's overall UTME score is heavily influenced by their performance in this single paper. Despite its centrality, Use of English continues to be one of the subjects in which candidates perform poorly, with persistent weaknesses reported in vocabulary, reading comprehension, lexis and structure, and the interpretation of oral English items presented in written form.

Several interacting factors help explain this pattern. Large class sizes and under-resourced English-language instruction in many public secondary schools limit the amount of individualised practice students receive, while past-question-based revision, though widespread, tends to emphasise memorisation of answers rather than the underlying language competencies the examination is designed to assess. Reports on the wider Nigerian English-language proficiency picture echo this concern: Udeh (2025) found a strong positive correlation between undergraduates' English proficiency and their academic performance, with weaknesses in reading comprehension and academic writing identified as persistent obstacles even among students who are conversationally fluent, suggesting that the gaps surfacing at UTME level reflect a broader pattern rather than an isolated examination phenomenon. At the same time, the proliferation of smartphones among Nigerian secondary school students has

created an opportunity: mobile devices are increasingly the primary, and sometimes only, computing device available to candidates, and a growing number of UTME-preparation applications have emerged to meet this demand (Jamiu, 2026). Yet a closer look at these applications reveals a recurring limitation. Many present past questions in a simple multiple-choice format with little more than a score counter, offering minimal feedback, no adaptive sequencing, and few of the motivational features known to sustain engagement in self-directed digital learning. Where gamified elements are present, they are often superficial additions, such as a single badge for completing a quiz, rather than features designed around an explicit model of learner motivation. Few of these tools document a systematic development process, and fewer still report any form of empirical validation of either their instructional design or their learning effectiveness.

This study addresses that gap by developing and validating a gamified drill-and-practice mobile application specifically for UTME Use-of-English preparation, guided throughout by two complementary frameworks. The Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model provided the systematic instructional design process, ensuring that content selection, instructional sequencing, and assessment design were grounded in an empirical needs analysis rather than assumption. Chou's Octalysis framework provided the motivational design layer, offering eight core drives, namely epic meaning and calling, development and accomplishment, empowerment of creativity and feedback, ownership and possession, social influence and relatedness, scarcity and impatience, unpredictability and curiosity, and loss and avoidance, against which every gamification element in the application could be deliberately mapped and justified.

Three research questions guided the study:

1. What content priorities for UTME Use of English emerge from a needs assessment of SS3 students and English-language teachers, and how do these inform the design of a drill-and-practice application?
2. To what extent do instructional design and English-language experts rate the content validity, instructional design quality, and gamification design of the developed application as acceptable?
3. Is there a statistically significant difference in Use-of-English achievement and self-reported engagement between secondary school leavers who use the gamified application and those who use a non-gamified digital drill tool over a four-week period?

Literature Review

Drill-and-practice has long been one of the most common applications of computer-assisted instruction, particularly for skills that benefit from repeated, spaced exposure, such as vocabulary, spelling, and grammatical pattern recognition. A recurring criticism of drill-and-practice software is that, in its plainest form, it can be repetitive and demotivating, particularly for learners who already find rote practice tedious. However, recent studies suggest that when drill-and-practice is embedded within an interactive multimedia or game-like structure, learner responses improve markedly. Najih and Futihah (2024) found that students responded favourably to a drill-and-practice multimedia model that combined repeated practice items with an interactive quiz-game interface, with students rating the resulting materials highly on both usability and interest. This is consistent with a broader pattern in the literature: the underlying pedagogical mechanism of repeated, scaffolded practice is not itself the problem; rather, the delivery format determines whether learners experience that practice as tedious or as engaging.

For UTME preparation specifically, repeated exposure to item types, particularly the format and phrasing conventions of lexis-and-structure and oral-English items, is widely regarded by Nigerian English-language teachers as valuable, since many candidates lose marks not from a lack of underlying knowledge but from unfamiliarity with how questions are framed. A gamified drill-and-practice tool is therefore well suited to this

context: it retains the repetition that builds item familiarity while embedding that repetition within a structure designed to sustain attention over the weeks of revision that precede the examination.

Gamification in Language Learning and Educational Mobile Applications

Gamification, the application of game-design elements in non-game contexts, has been extensively studied in language education. Shortt et al. (2023), in a systematic review of the literature on Duolingo, among the most widely used gamified mobile-assisted language learning (MALL) applications, with documented use by hundreds of millions of users, identified mechanisms such as streaks, hearts, experience points, and levelled progression as central to its design, though the review also noted that robust, controlled evidence of learning-outcome gains specifically attributable to these gamification elements (as distinct from the underlying content) remains comparatively limited. Within the Nigerian context, Boyinbode and Tiamiyu (2021) developed and evaluated a mobile gamification-based English vocabulary learning system aimed at secondary and tertiary learners, incorporating experience points, levels, and badges. An online evaluation involving 71 participants of varying vocabulary ability indicated improvements in both vocabulary ability and learner interest, lending support to the use of game-element-based motivation systems for English-language learning among Nigerian students specifically.

Beyond Nigeria, broader evidence on digital game-based language learning (DGBLL) points to a moderate average effect on second-language learning outcomes relative to non-game comparison conditions, with some individual studies, particularly those targeting discrete, rule-based content such as vocabulary or script recognition, reporting considerably larger effects. Uriawan et al. (2025), in a study of a gamified application for teaching Hijaiyah letters developed using the ADDIE framework, reported a very large pre-to-post improvement, explicitly noting that their result exceeded the typical range reported in comparable gamification research. Taken together, this literature suggests that gamification's effect on language-learning outcomes is real but variable, depending heavily on how faithfully game elements are matched to the underlying motivational needs of the target learners, rather than added as decorative features. This variability is precisely the gap that a structured motivational framework such as Octalysis is intended to close, by requiring designers to justify each game element in terms of a specific driver of human motivation rather than convention or trend.

Theoretical Framework for the Study

This study integrates two frameworks operating at different levels of the design process. ADDIE provided the procedural backbone, the sequence of activities through which the application moved from concept to validated product, while Octalysis provided the motivational architecture, the set of design heuristics used to decide which gamification elements to include and why. The two frameworks were not used sequentially, with ADDIE first and Octalysis applied afterwards as decoration; rather, Octalysis-based questions were embedded within each ADDIE phase, consistent with the approach demonstrated in prior ADDIE-gamification integrations (Tsagaris & Chatzikyrkou, 2026; Uriawan et al., 2025). Table 1 summarises how the eight Octalysis core drives were operationalised within each ADDIE phase for this project.

Table 1

Mapping of ADDIE Phases to Octalysis Core Drives in Application Development

ADDIE Phase	Primary Activity	Octalysis Core Drive(s) Foregrounded	Example Application Feature
Analysis	Needs assessment with SS3 students and English teachers; content-priority identification	Epic Meaning and Calling (CD1); Development and Accomplishment (CD2)	Diagnostic placement quiz framed as a "UTME Readiness Check" that assigns an initial proficiency band
Design	Sequencing of content modules; design of progression structure and reward schedule	Development and Accomplishment (CD2); Ownership and Possession (CD4); Scarcity and Impatience (CD6)	Topic "islands" on a visual map that unlock sequentially; customisable avatar unlocked through points
Development	Build of item bank, feedback system, and interface	Empowerment of Creativity and Feedback (CD3); Unpredictability and Curiosity (CD7)	Immediate, explanation-based feedback after each item; randomised "bonus question" at unpredictable points in a session
Implementation	Pilot deployment with experimental and comparison groups over four weeks	Social Influence and Relatedness (CD5); Loss and Avoidance (CD8)	Class-level leaderboard updated daily; daily practice streak that resets if a day is missed
Evaluation	Expert content/design validation; pretest-posttest achievement and engagement comparison	All eight core drives assessed via expert rubric	Structured validation rubric items mapped to each core drive, completed by instructional design and English-language experts

This mapping served two purposes. First, it ensured that gamification elements were not arbitrary; each feature could be traced back to a specific motivational rationale, consistent with the recommendation, drawn from the broader gamification literature, that the strength of gamification's effect on learning outcomes varies considerably depending on which game elements are used and how they are combined, rather than being a uniform effect of "gamification" as a whole (Bai et al., 2020). Second, it provided the structure for the expert validation rubric described in the Methodology section: rather than asking experts to rate "the gamification" as an undifferentiated whole, each of the eight core drives was assessed separately, allowing the development team to identify which drives were well realised and which required revision.

Within this framework, the application's content, the actual UTME Use-of-English material, was treated as the substrate upon which the Octalysis-mapped features operated. Drill-and-practice items were not abandoned in favour of game mechanics; rather, the repeated practice items identified as valuable in the literature (Najih & Futihah, 2024) were embedded within the motivational structure summarised in Table 1, so that the repetition itself became the mechanism through which points were earned, levels were unlocked, and streaks were maintained.

Methodology

This study adopted a Research and Development (R&D) design guided by the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model. The study combined the development and validation of a gamified drill-and-practice instructional application with a quasi-experimental evaluation of its effectiveness in improving students' achievement and engagement in UTME Use-of-English. The developmental component focused on producing a functional mobile learning application, while the evaluative component examined the experta rating of the developed dapplications

The participants comprised aecstudents and English Language teachers drawn from selected public secondary schools in Ilorin, Kwara State, Nigeria. During the analysis stage, 120 SS3 students and eight experienced English Language teachers participated in a needs assessment designed to identify content areas in which learners experienced the greatest difficulties. A diagnostic achievement test adapted from UTME Use-of-English questions and semi-structured interviews with teachers were used to collect data. The findings revealed that lexis and structure, oral forms, and vocabulary-in-context were the most challenging areas for students and therefore received greater emphasis during the development of the instructional application.

The application was subsequently designed and developed following the ADDIE model. Instructional content was organised into progressive learning modules with varying levels of difficulty, while gamification features were incorporated using Chou's Octalysis Framework as the guiding motivational model. A storyboard and wireframe were developed to guide the design process before the application was programmed. The resulting mobile application, named *UTME English Quest*, contained 480 drill-and-practice items distributed across major UTME Use-of-English content areas. To enhance learner engagement and motivation, the application integrated several gamification elements including points, badges, levels, leaderboards, streaks, adaptive challenges, rewards, and instant feedback mechanisms.

To determine the validity of the developed application, six experts comprising three Educational Technology specialists and three English Language specialists evaluated the application using a structured validation rubric. The rubric assessed content validity, instructional design quality, and the appropriateness of the gamification features incorporated into the application. Ratings were made on a four-point scale ranging from "Not Achieved" to "Fully Achieved." The Content Validity Index (CVI) was computed for each evaluation category, with a minimum value of 0.70 considered acceptable for validation purposes.

The implementation phase involved a four-week pilot study using 64 SS3 students who were randomly assigned to either an experimental group (n = 32) or a comparison group (n = 32). Students in the experimental group utilised the gamified drill-and-practice application, while those in the comparison group used a conventional non-gamified digital drill-and-practice tool. Participants in both groups engaged with their assigned applications for a minimum of twenty minutes daily, five days per week, throughout the study period. Application usage logs were monitored to ensure compliance with the treatment requirements.

Data were collected using a 40-item achievement test and a 12-item student engagement questionnaire. The achievement test was administered as both pretest and posttest to determine students' learning gains, while the engagement questionnaire measured behavioural, emotional, and cognitive engagement following the intervention. Descriptive statistics, including mean and standard deviation, were used to analyse the needs assessment and expert validation data. Independent-samples t-tests were employed to determine significant differences in achievement and engagement between the experimental and comparison groups at the 0.05 level of significance. Cohen's d was further computed to determine the magnitude of observed effects.

Ethical approval for the study was obtained from the relevant educational authorities before data collection commenced. Participation was voluntary, and informed consent was obtained from relevant stakeholders. Confidentiality and anonymity were maintained throughout the study, and all information collected was used strictly for research purposes.

Results

1. What content priorities for UTME Use of English emerge from a needs assessment of SS3 students and English-language teachers, and how do these inform the design of a drill-and-practice application?

Diagnostic instrument results from the 120 SS3 students showed the lowest mean scores in lexis and structure (M = 41.2%), oral forms presented in written format (M = 38.7%), and vocabulary-in-context items within comprehension passages (M = 45.6%), compared to higher mean scores in sentence completion/synonyms-antonyms (M = 58.3%) and summary writing (M = 56.1%). Teacher interviews converged on the same three areas, with all eight teachers independently identifying oral forms as an area where students performed poorly even when they appeared to know the underlying phonological rules, attributing this to unfamiliarity with how such knowledge is tested in a written, multiple-choice format rather than to a lack of the knowledge itself. This pattern directly informed the prioritisation decision described in the Design phase: lexis and structure, oral forms, and vocabulary-in-context were allocated 60% of the items in the resulting item bank, with the remaining three content areas sharing the remaining 40%.

A secondary finding from teacher interviews concerned existing digital tools. All eight teachers reported that students used at least one UTME-preparation application, most commonly past-question repositories, but six of the eight teachers expressed the view that students treated these tools as memorisation aids, learning to recognise specific past questions rather than developing the underlying competence, a concern that directly motivated the inclusion of explanation-based feedback (CD3) and the use of newly-written items, modelled on but not duplicating past questions, in the developed application.

Table 2 summarises the content validity index (CVI) values for each rubric section, alongside mean expert ratings (on the four-point scale described in the Methodology) for each of the eight Octalysis core drives.

Table 2

Expert Validation Results: Content Validity Indices and Octalysis Core Drive Ratings (N = 6)

Validation Section / Core Drive	M (SD)	CVI
CD1 – Epic Meaning and Calling	3.50	—
CD2 – Development and Accomplishment	3.83	—
CD3 – Empowerment of Creativity and Feedback	3.67	—
CD4 – Ownership and Possession	3.17	—
CD5 – Social Influence and Relatedness	3.00	—
CD6 – Scarcity and Impatience	3.17	—
CD7 – Unpredictability and Curiosity	3.33	—
CD8 – Loss and Avoidance	2.83	—
Content Validity (overall)	3.58 (0.38)	.89
Instructional Design Quality (overall)	3.46 (0.41)	.83
Gamification Design (overall)	3.31 (0.47)	.79

All three rubric sections exceeded the .70 acceptability threshold, with content validity rated highest (CVI = .89) and gamification design rated lowest, though still acceptable (CVI = .79). Among the eight core drives, development and accomplishment (CD2, M = 3.83) and empowerment of creativity and feedback (CD3, M = 3.67) received the highest ratings, reflecting strong expert endorsement of the points/level/badge system and the explanation-based feedback. Loss and avoidance (CD8, M = 2.83) received the lowest rating; written comments from two experts indicated that the streak-freeze mechanic, while conceptually sound, was not sufficiently visible within the interface during their review, a usability issue rather than a conceptual one. Social influence and relatedness (CD5, M = 3.00) also received comparatively modest ratings, with one expert noting that the class-level leaderboard, visible only

within a single school, offered limited social comparison value for schools with small SS3 cohorts. These findings were used to generate a short list of refinements, primarily interface adjustments to increase the visibility of the streak-freeze feature and a proposal to extend the leaderboard across participating schools in any future scaled deployment, rather than fundamental redesigns

Research Question three: Is there a statistically significant difference in Use-of-English achievement and self-reported engagement between secondary school leavers who use the gamified application and those who use a non-gamified digital drill tool over a four-week period?

Table 3

Pretest, Posttest, and Gain Scores by Group

Group	Pretest M (SD)	Posttest M (SD)	Gain M (SD)	n
Experimental (UTME English Quest)	18.43 (3.21)	26.87 (3.04)	8.43 (2.66)	30
Comparison (non-gamified drill tool)	18.10 (3.35)	21.65 (3.18)	3.55 (2.41)	31

Of the 64 students who began the pilot, 61 completed all four weeks with sufficient compliant practice days (experimental group, n = 30; comparison group, n = 31); three students (two from the experimental group, one from the comparison group) were excluded due to extended absence unrelated to the study. Table 3 presents pretest, posttest, and gain scores for both groups on the 40-item Use-of-English achievement instrument.

Pretest scores did not differ significantly between groups, $t(59) = 0.40$, $p = .689$, confirming baseline equivalence. Posttest scores were significantly higher in the experimental group, $t(59) = 6.28$, $p < .001$, Cohen's $d = 1.62$. The difference in gain scores between groups was also statistically significant, $t(59) = 7.51$, $p < .001$, Cohen's $d = 1.94$, indicating a very large effect by conventional benchmarks. This magnitude is broadly consistent with, though somewhat smaller than, the very large effect reported for the ADDIE-developed Hijaiyah-letters application (Cohen's $d = 4.87$) (Uriawan et al., 2025), and exceeds the moderate effects typically reported for digital game-based language learning more generally.

Table 4 summarises the post-intervention engagement scale results.

Table 4

Post-Intervention Engagement Scale Scores by Group (5-point scale)

Engagement Subscale	Experimental M (SD)	Comparison M (SD)	Cohen's d
Behavioural Engagement	4.21 (0.52)	3.28 (0.61)	1.64
Emotional Engagement	4.35 (0.48)	3.11 (0.69)	2.07
Cognitive Engagement	4.08 (0.55)	3.45 (0.58)	1.11
Overall Engagement	4.21 (0.46)	3.28 (0.55)	1.85

Overall engagement was significantly higher in the experimental group, $t(59) = 7.18$, $p < .001$, Cohen's $d = 1.85$. All three subscales showed statistically significant differences favouring the experimental group ($p < .001$ in all cases), with the largest effect observed for emotional engagement ($d = 2.07$) and the smallest, though still large, for cognitive engagement ($d = 1.11$). Usage logs provided a behavioural corroboration of the self-report engagement data: students in the experimental group completed a mean of 26.4 practice sessions over the four-week period (against a required minimum of 20), compared to a mean of 20.7 sessions in the comparison group, suggesting that

a meaningful proportion of experimental-group students engaged in voluntary practice beyond the required minimum, consistent with the higher behavioural engagement scores reported in Table 4.

Discussion

This study set out to develop and validate a gamified drill-and-practice application for UTME Use-of-English preparation, using ADDIE as the developmental framework and Octalysis as the motivational design framework, and to compare its effects against a non-gamified digital drill tool over a four-week pilot. First, the needs-assessment findings reinforce a point that has been made in the broader Nigerian English-language literature: the gap between Nigerian students' underlying language knowledge and their performance on formal assessments is, in part, a gap in format familiarity rather than a gap in linguistic competence per se (Udeh, 2025). Teachers consistently described students who appeared to possess the relevant phonological or grammatical knowledge but performed poorly on oral-forms items specifically because they had not encountered that knowledge tested in a written, multiple-choice format. This finding has a direct design implication that goes beyond this study: digital UTME-preparation tools that present only generic content, without attention to the specific item formats and phrasing conventions used by JAMB, may be addressing the wrong problem for a meaningful subset of students. The drill-and-practice format, often dismissed as pedagogically unambitious, may in fact be well matched to this specific problem, provided it is paired with explanation-based feedback so that format practice does not collapse into pure memorisation, a concern that six of the eight participating teachers raised about existing tools.

The quasi-experimental results, a gain-score difference of Cohen's d = 1.94 favouring the gamified application, and an overall engagement difference of d = 1.85, are large by conventional standards and are broadly consistent with the pattern observed in other ADDIE-developed gamified applications for discrete, format-sensitive content, most notably the very large effect reported for a Hijaiyah-letters application also developed using ADDIE (Uriawan et al., 2025), though smaller in magnitude. They are also considerably larger than the moderate average effects reported in broader meta-analytic and review work on digital game-based language learning. Several factors plausibly contribute to this gap. The comparison condition in this study was not a no-treatment control but an existing non-gamified digital drill tool already in informal use by Nigerian students, meaning the comparison reflects gamified versus non-gamified digital practice specifically, rather than digital practice versus no digital practice, which may produce a larger contrast than studies comparing a novel intervention to traditional, non-digital instruction.

Conclusion

This study developed and validated UTME English Quest, a gamified drill-and-practice mobile application for UTME Use-of-English preparation, using ADDIE as the procedural development framework and Octalysis as the motivational design framework, with each Octalysis core drive mapped to a specific feature within a specific ADDIE phase. A needs assessment involving 120 SS3 students and 8 English-language teachers identified lexis and structure, oral forms, and vocabulary-in-context as priority content areas, directly shaping the resulting item bank. Expert validation by instructional design and English-language specialists found the application's content validity, instructional design, and gamification design all acceptable, while also identifying specific, addressable refinements at the level of individual core drives. A four-week quasi-experimental pilot comparing the gamified application to an existing non-gamified digital drill tool found statistically significant and large differences favouring the gamified application in both Use-of-English achievement gains and self-reported engagement. Beyond the specific application developed, this study offers a replicable template, the systematic pairing of ADDIE's procedural phases with Octalysis's eight core drives, for developers working on examination-preparation tools in similarly high-stakes, format-sensitive assessment contexts, in Nigeria and in comparable educational systems elsewhere. Future research should extend the pilot duration to cover a full revision cycle, include multiple schools across different regions and

resource levels, incorporate a pre-intervention engagement baseline, and examine whether the achievement gains observed here translate into improved performance on the actual UTME, which was beyond the scope of the present study's timeline.

Acknowledgments and Declaration of Conflict of interest

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References

Bai, S., Hew, K. F., & Huang, B. (2020). Does gamification improve student learning outcome? Evidence from a meta-analysis and synthesis of qualitative data in educational contexts. *Educational Research Review*, *30*, Article 100322. https://doi.org/10.1016/j.edurev.2020.100322

Boyinbode, O., & Tiamiyu, A. (2021). A mobile gamification English vocabulary learning system for motivating English learning. *IOSR Journal of Mobile Computing & Application*, *8*(3), 33–48. https://doi.org/10.9790/0050-08033348

Branch, R. M. (2009). *Instructional design: The ADDIE approach*. Springer. https://doi.org/10.1007/978-0-387-09506-6

Chou, Y. (2015). *Actionable gamification: Beyond points, badges, and leaderboards*. Octalysis Media.

Ding, Y., & Toran, H. (2025). Application of ADDIE as an instructional design model in the teaching and rehabilitation of children with autism: A review. *International Journal of Learning, Teaching and Educational Research*, *24*(1), 87–115. https://doi.org/10.26803/ijlter.24.1.5

Jamiu, B. (2026, February 8). *JAMB 2026: List of educational mobile apps you can use to prepare for UTME*. Legit.ng. https://www.legit.ng/nigeria/1696159-jamb-2026-list-educational-mobile-app-prepare-utme/

Lozano, A. S., Canlas, R. J. B., Coronel, K. M., Canlas, J. M., Duya, J. G., Macapagal, R. C., Dungca, E. M., & Miranda, J. P. P. (2023). A game-based learning application to help learners practice mathematical patterns and structures. *International Journal of Computing Sciences Research*, *7*, 1–15. https://doi.org/10.25147/ijcsr.2017.001.1.156

Najih, A., & Futihah, A. (2024). Interactive game model in drill and practice learning to increase student learning achievement. *Journal of Multimedia Trend and Technology*, *3*(1), 9–15. https://doi.org/10.35671/jmtt.v3i1.46

Tsagaris, A., & Chatzikyrkou, M. (2026). Integrating gamification with ADDIE instructional design for educational robotics: A usability evaluation. *European Journal of Educational Research*, *15*(2), 465–480. https://doi.org/10.12973/eu-jer.15.2.465

Udeh, J. C. (2025). English language proficiency as a determinant of academic performance in Nigerian universities. *Currents in African Literature and the English Language*, *12*.

Uriawan, W., Firmansyah, D., Mulyana, D., Pratama, D. H. F., Lerian, A. J., & Wiguna, F. S. (2025). *Gamification-based learning method for Hijaiyah letters* (arXiv:2602.03851). arXiv. https://doi.org/10.48550/arXiv.2602.03851