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Development of Gamification-Based Learning Media for English Part of Speech Using the DDR-MDA Framework

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Abstract

The problem of monotonous and conventional teaching methods in English classes, particularly in teaching Parts of Speech, remains a persistent issue that often leads to low student motivation and poor cognitive achievement. Therefore, the research question guiding this study is: how effective is the interactive gamification-based learning media for Parts of Speech, developed using the DDR–MDA framework, in improving junior high school students' cognitive learning outcomes. Accordingly, this study aims to design and develop an interactive gamification-based learning medium for junior high school students as an innovative solution. The method used is Design and Development Research (DDR), integrated with the MDA (Mechanics, Dynamics, Aesthetics) framework. The development stages include needs analysis through literature review and field study, lesson plan (RPP), material, and storyboard design, prototyping with expert validation, implementation using a pretest–posttest control group experimental design, and evaluation with descriptive and inferential analysis. The research subjects were 60 ninth-grade students of SMP Negeri 2 Bojongsoang, divided into experimental and control groups. Research instruments included validation sheets (LORI), pretest–posttest questions, and student response questionnaires based on TAM. Data analysis was conducted using descriptive statistics (mean, median, SD), assumption tests (Shapiro-Wilk and Levene's Test), paired t-test and independent t-test, effect size calculation (Cohen's d), and N-Gain accompanied by qualitative interpretation. The results showed that expert validation rated the medium as "very good." The experimental group achieved a significantly higher posttest average score compared to the control group ($t = 3.545$; $p < 0.001$). The effect size was categorized as large, and the N-Gain indicated moderate improvement. Student responses through TAM were also very positive (classified as "very good"). These findings confirm that gamification is effective in improving learning outcomes, motivation, and technology acceptance in English language learning.

Keywords: gamification; interactive learning media; technology acceptance model; english education; design and development research

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INTRODUCTION

The digital revolution that has taken place over the past two decades has brought significant changes to human life, including the education sector.

Technology is no longer viewed merely as a supporting tool but has become an integral part of learning systems (Ulyawati & Sugito, 2022; Williamson et al., 2020). Various innovations such as multimedia, adaptive learning, and global online interactions have shifted the learning paradigm from conventional models to more modern, collaborative, and technology-based approaches (Guacas et al., 2025; Hatija, 2024; Liu & Yu, 2022). In the developing world, ownership of digital devices including computers and smartphones and access to the internet has surged (Correa et al., 2020; James, 2021). Nevertheless, the trend of advancement notwithstanding, barriers such as infrastructure inadequacy, access disparities and low digital literacy still hinder the maximization of technology in the classrooms. According to Lufungulo et al. (2025) increasing access to technology is a necessary prerequisite for EdTech solutions to have an impact, especially in developing nations. In this context, technology integration in education is not a bargain to be negotiated but a necessity to be met in preparing learners for a digital world.

Although the discourse on digitalization in education has become stronger, classroom practices still show that conventional methods dominate, especially in junior high schools (*Sekolah Menengah Pertama/ SMP*). Based on observations, many teachers continue to rely on lectures, textbooks, and blackboards as their primary teaching media. While this approach is effective for transmitting basic knowledge, it tends to be less interactive and does not sufficiently stimulate students' active engagement (Aldhafeeri & Alotaibi, 2022; Du et al., 2020; Kozanitis & Nenciovici, 2023). Due to this, students become confused about the contents, lose their attention at once with the contents, and forget what had been taught easily. This situation affects the cognitive success of the students negatively, especially in courses, for example English, which needs a stacked conceptual understanding. The students commonly feel that the content, including Parts of Speech, is boring and too abstract to make them motivated to learn. Therefore, a gap can be clearly observed between the expectations of contemporary learning and the traditional-still prevalent-in many schools.

In the press and popular literature, numerous reports described significant upside for digital media in enhancing learning quality. Moseikina et al. (2022) assert that interactive learning media based on gamification can create a more dynamic, enjoyable, and student-centered learning environment. Levels, points, badges and leaderboards, elements of gamification, have a positive effect on the intrinsic motivation of students and make them more engaged in learning activities. Similarly, Hellín et al. (2023) reports that gamified learning environments not only increase student engagement but also facilitate learning in accordance with individual pace and style Additionally, it has been found that gamification can motivate people to overcome boredom, retain information and think more creatively to solve problems. However, the quality of learning media is not only viewed in terms of learning outcomes, but also from the perspective of students and their assessment of the learning media.

Therefore, models for evaluation such as the Technology Acceptance Model (TAM) are very applicable. TAM for technology acceptance behaviour prediction can be discussed from four perspectives: Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude Toward Using (ATU), and Behavioral Intention to Use (BI). Yan et al. (2022) reinforce that the application of gamification with TAM

can improve the quality of learning experience and that the media should be comformed to the users' needs.

Based on the identified problems, this study proposes the development of interactive learning media based on gamification for junior high school English subjects, particularly on the topic of Parts of Speech. Gamification was chosen because it has the ability to transform monotonous learning into an enjoyable, challenging, and motivating experience that encourages students to continue learning (Ampong, 2020; W. Oliveira et al., 2022). This media is expected to be implemented in classrooms as an alternative to conventional teaching methods while supporting a student-centered learning approach (Kerimbayev et al., 2023; Moseikina et al., 2022). Furthermore, evaluation of student acceptance using TAM will ensure that the media is not only academically beneficial but also practical, easy to use, and well-received by students as part of their learning process. Thus, this solution addresses the need to improve cognitive learning outcomes while strengthening adaptive, interactive, and technology-oriented learning experiences.

Methodologically, this study reinforces the proposition above by positioning Design and Development Research as the core development process and the Mechanics, Dynamics, and Aesthetics framework as the design logic that operationalizes gamification to meet the specific instructional demands of Parts of Speech. In this integration, Design and Development Research governs the systematic sequence of analysis, design, development, implementation, and evaluation, while the Mechanics, Dynamics, and Aesthetics framework directs how each Parts-of-Speech learning objective is translated into mechanics such as task structure, scoring rules, feedback, and progression; dynamics such as repeated practice, mastery-oriented progression, and learner interaction with feedback; and aesthetics such as perceived challenge, achievement, and curiosity that are pedagogically relevant to grammar learning. By foregrounding this linkage, the study articulates a clearer design rationale for the selection of specific gamification elements and explains how they are expected to function in supporting mastery of Parts of Speech, rather than treating gamification as a generic add-on.

This study shares similarities with Ishak et al. (2023) who emphasized the role of digital games in enhancing learning performance through intrinsic motivation, learning experiences, and game features; with Villegas et al. (2021), who also explored the design process of gamification and its connection with learner motivation; and with Zeybek & Saygı (2024), who conducted a literature review to highlight the positive impact of gamification in education. However, the differences lie in the research focus: Ishak et al. (2023) emphasized the identification of Digital Game-Based Learning (DGBL) design approaches (learner-centered, game-centered, and model approaches); Villegas et al. (2021) employed a qualitative approach using card sorting techniques to map motivators and game mechanics; while Zeybek & Saygı (2024) mapped general dimensions of gamification implementation through a systematic review. Meanwhile, the novelty of this study lies in comprehensively integrating motivational factors, game mechanics design, and learning outcomes into a single thematic framework, thereby not only providing descriptive insights but also offering a more applicable conceptual framework for designing effective gamified learning aligned with student characteristics.

To make this novelty more specific, the present research contributes (1) an explicit DDR–MDA design articulation for Parts of Speech, namely a transparent mapping from grammar competencies and practice needs (classification, identification-in-context, and repeated retrieval practice) to MDA decisions that determine how the game system is built and experienced by learners; (2) a design product that is not only "gamified" in general terms, but purposefully engineered to address the typical learning barriers of Parts of Speech (abstractness, low engagement, and rapid forgetting) through structured practice and immediate feedback aligned with the intended learning outcomes; and (3) an evaluation logic that triangulates effectiveness and acceptance by linking cognitive outcomes (learning gains) with TAM-based user acceptance indicators, thereby clarifying not only whether the media works, but also why it is likely to be adopted in authentic classroom use. Accordingly, the novelty is not merely the coexistence of "motivation, mechanics, and outcomes," but the provision of a context-bound, methodologically grounded, and replicable pathway for designing gamified grammar learning media using DDR as the development method and MDA as the design framework.

The primary objective of this study is to design and develop interactive gamified learning media tailored to the needs of junior high school students in learning Parts of Speech. Therefore, this study is guided by the following research question: How effective is the interactive gamification-based learning media for Parts of Speech, developed using the DDR–MDA framework, for junior high school students in improving their cognitive learning outcomes?. The developed media will then be implemented in English learning to examine its effectiveness in improving students' cognitive outcomes. Therefore, this study aims to analyze students' acceptance and responses toward the media using TAM, in order to determine the extent to which the media is accepted as an educational innovation. The contributions of this study are multifold: (1) for students, it provides an enjoyable, flexible, and motivating learning experience; (2) for teachers, it offers an innovative alternative media that supports active learning; (3) for researchers, it serves as a platform to develop competencies in designing technology-based media while testing a technology acceptance model in education; and (4) for future studies, it provides empirical references on the effectiveness of gamification in learning and its integration with TAM. (5) for instructional design practice, it provides a more explicit and transferable DDR–MDA design rationale for Parts of Speech, which can function as a concrete reference when educators wish to develop gamified media that is pedagogically aligned (learning objectives), systematically built (DDR stages), and experientially coherent (MDA logic).

METHODS

This study adopted a development flow using the Design and Development Research (DDR) method combined with the Mechanics, Dynamics, Aesthetics (MDA) Framework. The development stages began with Analysis, which involved literature study and field study to formulate user needs and problems. This was followed by Design, which consisted of learning design, lesson plans, materials,

test instruments, flowcharts, and storyboards. The next stage was Development, carried out using a prototyping method that included the creation and validation of the media until a feasible prototype was produced. The product was then tested in the Implementation phase using a Pretest–Posttest Control Group experimental design. The final stage was Evaluation, which was conducted through data analysis of test results and student questionnaires, as well as revisions of the media based on feedback. The research was conducted during the period of January 2025– May 2025, encompassing the complete DDR stages from needs analysis to product evaluation and revision.

The research population consisted of ninth-grade students at SMP Negeri 2 Bojongsoang. The study was conducted at SMP Negeri 2 Bojongsoang, Bojongsoang District, Bandung Regency, West Java Province, Indonesia**.** The research sample was taken from two classes, namely class IX-1 and IX-2, each consisting of 30 students. The sampling technique used purposive sampling, with one class designated as the experimental group (receiving treatment in the form of gamification-based learning media) and one class as the control group (without treatment) for the purpose of comparing learning outcomes.

In terms of institutional context, SMP Negeri 2 Bojongsoang is a public junior high school with accreditation A; this context was considered to ensure that the developed media and its implementation aligned with real classroom conditions. Field-study findings also indicated that (i) teachers tended to rely on conventional media (e.g., worksheets and textbooks) and (ii) school supporting facilities for technology-based learning were limited; therefore, the media was designed to be practical and feasible under such constraints. At the same time, students' access readiness supported the intervention because students generally possessed personal devices, enabling the use of a gamification-based learning medium that requires digital access. The research instruments consisted of:

a. Validation Instrument: involving material and media experts using the Learning Object Review Instrument (LORI) (Lockyer et al., 2009) to assess content quality, alignment with learning objectives, motivation, and media interaction.
b. Test Instrument: in the form of pretest and posttest, with a test blueprint arranged according to the part of speech material.
c. Student Response Instrument: in the form of a Likert-scale questionnaire (1–5) measuring perceptions of usefulness, ease of use, attitudes toward the media, and behavioral intention to use the media.
d. Test Validation Instrument: used to assess the feasibility of test items before being applied in the assessment.

Instrument administration was conducted in a standardized sequence. First, expert validation of the prototype was completed prior to classroom implementation; feedback from experts was used to revise the product iteratively until the prototype was deemed feasible for use in learning activities. Second, the pretest was administered before any instructional treatment to measure students' initial understanding; the pretest consisted of 40 multiple-choice items with an administration time of approximately 60 minutes. Third, the intervention was delivered in the experimental group according to the lesson plan, while the control group received instruction without the gamification-based media; both groups followed planned instructional stages in their respective conditions. Fourth, the

posttest was administered after the completion of instruction in both groups using the same format (40 multiple-choice items) to allow direct comparison of learning gains between groups. Finally, the student response questionnaire was administered at the end of learning to capture students' perceptions of the gamification-based media, and the questionnaire was developed based on the Technology Acceptance Model (TAM).

The data analysis technique in this study was carried out both quantitatively and qualitatively. Data from expert validation results were analyzed using a rating scale to determine the level of feasibility of the media and materials, categorized from very poor to very good based on percentage scores (Sugiyono, 2019).

$$p = \frac{\text{Score from Data Collection}}{\text{Ideal Score}} \text{ x } 100\%$$

Description:

P: Percentage value,

Ideal Score: Highest score × number of respondents × number of items,

Score from Data Collection: Total score obtained from each collected item

For interpretation, the expert validation percentage was classified as follows: 0–20 (Very Poor), 21–40 (Poor), 41–60 (Fair), 61–80 (Good), and 81–100 (Very Good). Next, students' learning outcomes were analyzed using descriptive statistics, including calculations of the mean, median, minimum–maximum values, and standard deviation. The formula for the mean is as follows:

$$\bar{X} = \frac{\sum X_i}{n}$$

Description:

$\bar{X}$: Mean (average)

X_i: i-th score

n: Number of data points

Assumption tests, such as the normality test (Shapiro-Wilk) and the homogeneity of variance test (Levene's Test), were done to make sure that more testing could be done. The inferential analysis used a paired t-test to compare the results of the pretest and posttest in one group, an independent sample t-test to find differences between the experimental and control groups, and Cohen's d to find the size of the treatment effect.

$$d = \frac{\bar{x}_1 - \bar{x}_2}{s_{pooled}}$$

d=0.2: Small effect

d=0.5: Medium effect

d≥0.8: Large effect

All data analyses were performed using statistical software such as SPSS version XX or Microsoft Excel to ensure accuracy. Additionally, students' responses to the learning media were analyzed using a Likert scale, converted into quantitative form, and then categorized into five levels ranging from very poor to very good. For interpretation, the student-response percentage was classified as follows: 0–20 (Very Poor), 21–40 (Poor), 41–60 (Fair), 61–80 (Good), and 81–100 (Very Good). Finally, learning outcomes were also analyzed using the N-Gain test.

The results obtained from this analysis provided the researcher with insights into the effectiveness of the gamification-based learning media.

RESULTS & DISCUSSION

Research Findings

Based on the literature review, gamification in learning has been proven to address common problems such as boredom, low learning interest, and limited student motivation. The literature also emphasizes the importance of interactive media to encourage students to become more active, motivated, and receptive to learning materials in line with technological advancements. One reference Dimitriadou et al. (2021) recommends that teachers integrate game elements into the learning process to create a more enjoyable learning environment. From the field study conducted at SMP Negeri 2 Bojongsoang, it was found that student learning outcomes tended to be low because teachers predominantly relied on simple media such as worksheets and textbooks, without optimally utilizing digital media. Nevertheless, students' conditions strongly supported the implementation of gamification, as 100% of them owned personal gadgets, and 85.1% preferred modern learning media over traditional ones. In addition, 57.4% of students strongly agreed that educational games could help them understand lessons, although 53.2% of teachers still rarely used technology in teaching. These data reinforce the urgency of developing interactive gamification-based learning media.

Through needs analysis, it was concluded that gamification media could serve as a practical solution. Students already possessed adequate devices (gadgets) and were ready to make use of technology-based media. Therefore, the researchers designed gamification media for English subjects, specifically for the topic of *Part of Speech*. Expert validation of the material showed a feasibility level of 92.25%, thus categorizing the material as "very good" for implementation within the media. In the learning design stage, the Direct Instruction model was applied, including phases of orientation, presentation, structured practice, guided practice, and independent practice. The gamification media was designed so that students could directly interact with the materials, complete quizzes, receive instant feedback, and remain motivated through the use of badges and a leveling system. This is in line with the principles of gamification, which prioritize motivation, interactivity, and progressive achievement.

The development stage utilized software such as CorelDRAW X7 for designing visual assets, Camtasia for video editing, Unity as the main development platform, and Visual Studio 2017 for scripting. The final product consisted of a learning media package that included a login page, instructions, learning objectives, text and video materials, eight levels representing parts of speech, interactive quizzes with feedback, as well as a badge and reward message system at the end of each level. The media was further enhanced with audio, animations, and other interactive elements to increase engagement.

The design stage in the development of the gamification-based interactive learning media was carried out after the needs analysis. At this stage, the researchers prepared an initial design in the form of flowcharts and storyboards. The flowchart

illustrated the learning process systematically using symbols and diagrams to make the sequence easy to understand (Figure 1).

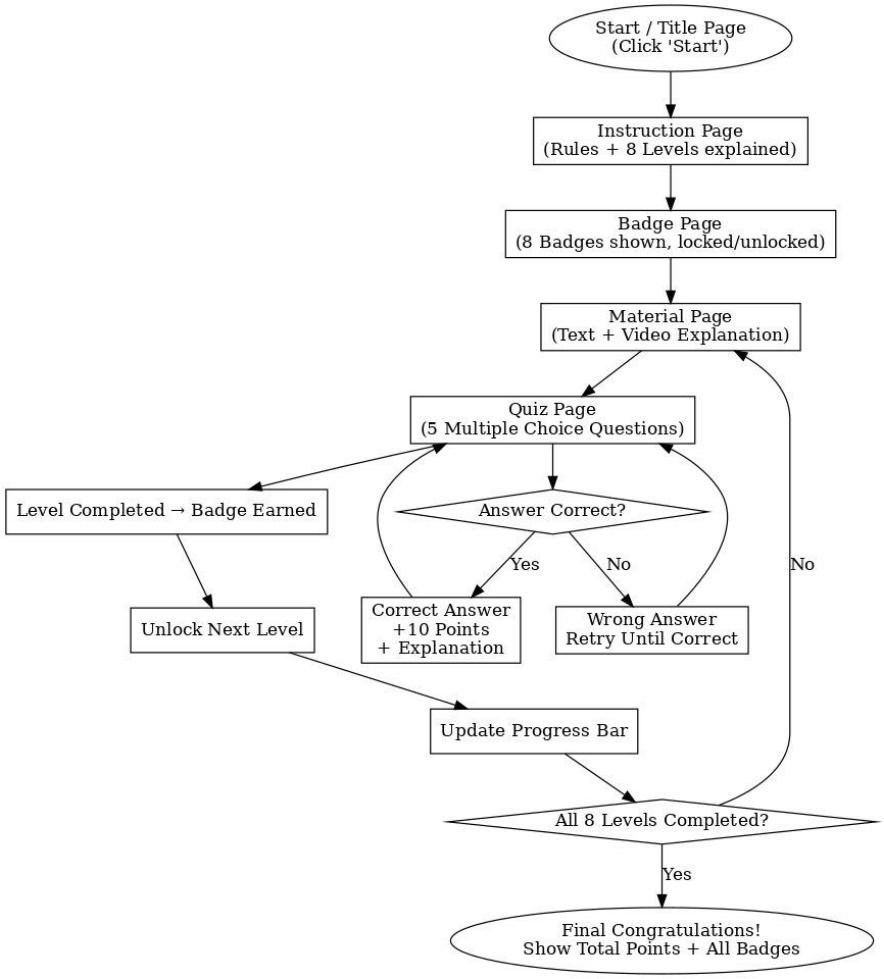

Figure 2. Media Flowchart

Based on Figure 1, the flowchart illustrates that this interactive gamified learning medium is designed to provide a systematic yet enjoyable learning experience. The process begins from the Start/Title page, followed by an Instruction page explaining the rules and the structure of the eight learning levels. Next, learners are directed to the Badge page, where eight badges are initially locked and will only be unlocked when a level is successfully completed. Afterward, learners access the content page, which provides text and video explanations as preparation before attempting the quiz.

On each quiz page, learners are given five multiple-choice questions. Incorrect answers prompt repetition until the correct one is chosen, ensuring mastery of the material. Correct answers immediately reward learners with +10 points along with an explanation, while progress is automatically recorded on the progress bar. Completing one level grants a new badge as an achievement marker and motivation, and unlocks access to the next level. In this way, gamification is integrated through the combination of challenges (quiz), rewards (points and badges), and step-by-step progress (progress bar and level system).

This process continues until all eight levels are completed. At the final stage, the system displays a Final Congratulations message summarizing the total points earned and all badges collected. Through this flow, learners not only study the material on parts of speech but are also motivated by visual rewards and clear progress tracking. Badges function as symbols of achievement, points add a competitive element, and levels provide a progressively challenging experience—ultimately enhancing intrinsic motivation, active engagement, and acceptance of technology in the learning process.

Meanwhile, the storyboard was created as an initial visual framework of the media, outlining the main pages such as the start page, instructions, badges, materials, quizzes, answer explanations, and the final display. The storyboard ensured that the development process was more structured, as each element had already been designed according to its function and intended learning objectives. This design stage was crucial as a guideline before the production process to ensure the creation of interactive, gamified media that aligned with user needs (Figure 3).

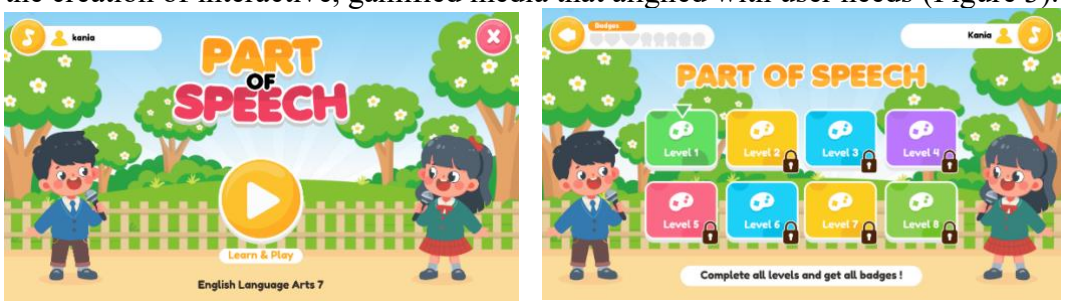

Figure 4. Initial Display of the Product

At the implementation stage, the interactive gamification-based learning media that had been previously validated was applied to ninth-grade students at SMP Negeri 2 Bojongsoang, with a total of 60 respondents. The procedure was divided into four phases that are pretest, learning activities, posttest, and questionnaire. The 40-item pretest was administered to assess students' prior knowledge of the part of speech topic. Subsequently, learning in the experimental class was conducted using the gamification-based media, while the control class received instruction through the lecture method. After the learning session, both groups completed the posttest using the same set of questions to evaluate the effectiveness of each method. Also, the students were requested to complete the TAM (Technology Acceptance Model) questionnaire to evaluate their reactions toward the learning media.

The result of the evaluation showed that the interactive gamification-based learning media was influential to students learning out come. Based on descriptive statistical analysis, the mean scores of both the experimental group and the control group increased from pretest to posttest. From the descriptive statistics it can be seen that the pretest-posttest increases in both groups, but more in the experimental group. In the experimental group, the average score increased from 26.90 in the pretest to 35.33 in the posttest. The median also rose significantly from 27.00 to 36.00, which implies that the majority of the participants got higher scores after the treatment. The standard deviation rose from 3.99 to 4.78, reflecting a slight increase in the dispersion of the posttest scores. Furthermore, the lower bound raised from

17 to 24 and the upper bound enhanced from 32 to 40, representing an overall improvement in performance. In the control group, the mean score increased from 26.47 on the pretest to 31.81 on the posttest. The median rose from 26.00 to 32.00, which also reflects improvement, although not as strong as in the experimental group. The standard deviation decreased from 3.92 to 3.60, suggesting that posttest scores in the control group were more consistent. The minimum score increased from 19 to 23, and the maximum score rose from 34 to 37. Overall, these results indicate that gamification had a stronger positive effect on the experimental group than on the control group, as reflected in the larger gains in both the mean and median scores.

Normality Test, shows the results of the Shapiro–Wilk normality test for both groups at the pretest and posttest stages. In the experimental group, the pretest scores were normally distributed ($W = 0.936$, $p = 0.070$), since the p-value was greater than 0.05. However, the experimental group's posttest scores were not normally distributed ($W = 0.890$, $p = 0.0049$), as the p-value was below 0.05, indicating a significant deviation from normality. In the control group, both the pretest and posttest scores met the assumption of normality. The pretest data showed a normal distribution ($W = 0.973$, $p = 0.573$), and the posttest data were also normally distributed ($W = 0.944$, $p = 0.099$), with both p-values exceeding 0.05. The findings suggest that most of the datasets follow a normal distribution, with the only exception being the posttest scores in the experimental group, which showed a non-normal pattern. Overall, most of the data are normally distributed, despite a slight deviation in the posttest of the experimental group. Posttest data from the experimental group were still deemed acceptable to proceed with the inferential analysis used in this study (the t-test), given that the sample size per group was 30 students and the literature emphasizes that mean-based parametric models are generally robust to departures from normality, except when there are highly influential outliers. Therefore, the t-test results can still be interpreted, but with particular caution regarding the potential presence of outliers in the experimental group's posttest scores (Knief & Forstmeier, 2021).

Table 1. Paired t-Test

Group	t-statistic	p-value	Conclusion
Eksperimen	8.73	0.0000000013	Significant improvement
Kontrol	16.40	0.00000001	Significant improvement

The paired t-test results in Table 5 show that both the experimental and control groups experienced significant improvement from pretest to posttest. In the experimental group, the t-statistic was 8.73 with a p-value of 0.0000000013, while the control group achieved a t-statistic of 16.40 with a p-value < 0.00000001. This confirms that both groups showed significant learning gains.

Table 2. Independent Sample t-Test

Group	Mean Posttest	Std Dev	t-stat	p-value	Conclusion
Experimental	35.33	4.78	3.545	0.00079	Significant difference
Control	31.81	3.60			

The independent sample t-test in Table 6 reveals a significant difference between the experimental and control groups. The experimental group achieved a higher posttest mean (35.33) compared to the control group (31.81), with a t-statistic of 3.545 and a p-value of 0.00079. This confirms that the improvement in the experimental group was significantly greater than in the control group.

Table 3. Cohen's d Test

Indicator	Value	Interpretation
Cohen's d	0.903	Large

Table 7 shows the Cohen's d value of 0.903, which falls into the large category. This indicates that the implementation of gamification had a strong effect on improving student learning outcomes.

Table 4. Student Response Data

No	Statement	Ideal Score	Obtained Score	Percentage
1.	Perceived Usefulness	150	125	83%
2.	Perceived Ease of Use	150	121	81%
3.	Attitude toward use	150	128	85%
4.	Intention to use	150	120	80%
Average		150	120	80%
Overall Average		150	124	82%

Based on Table 8, students' responses toward the gamification-based media show positive results. In the aspect of Perceived Usefulness, a score of 125 or 83% was obtained, which falls into the Very Good category. The aspect of Perceived Ease of Use scored 121 or 81%, also classified as Very Good. Furthermore, the Attitude aspect reached a score of 128 or 85%, which is in the Very Good category as well. Meanwhile, the Intention to Use aspect obtained a score of 120 or 80%, which is also considered Very Good. Overall, the average student response was 124 with a percentage of 82%, categorized as Very Good.

The next step was to use Pearson's product moment correlation method to look at the relationship or correlation between the components after applying the rating scale formula to look at the students' answers and get to the results above. There are four parts: Perceived Usefulness, Perceived Ease of Use, Attitude, and Intention to Use. The study found that these four parts were related in a good way. Perceived Ease of Use had a correlation value of 0.141 with Perceived Usefulness; Perceived Usefulness had a correlation value of 0.455 with Attitude; Perceived Ease of Use had a correlation value of 0.452 with Attitude; Perceived Usefulness had a correlation value of 0.681 with Intention to Use; and finally, Attitude had a correlation value of 0.425 with Intention to Use. Since all the correlation values were above the r-table and close to 1 with positive indications, it means that the relationship is stronger.

After gathering data from pretest scores, posttest scores, media trials, and surveys, it was determined that the gamification-based interactive learning media positively influenced the enhancement of students' learning outcomes in English topics. You can observe this by looking at the students' average scores. In the experimental class, the average score on the pretest went from 68 to 83, and in the control class, it went from 83 to 94. The fact that the average scores went up shows

that the pupils were able to understand the content through the gamification medium that was created. The questionnaire answers also showed that this medium made students more interested in learning. The questionnaire data indicates that the learning media received a rating of "Very Good," confirming its suitability as instructional material in the educational process. In general, it can be said that the gamification-based interactive learning media not only helped students understand and learn better, but also sparked their interest in learning and made them more likely to accept it. This means that it could be used in English classes for junior high school students.

The control class got an average score of 0.469 based on the N-Gain calculation, while the experimental class got an average score of 0.647. Hake's classification says that the control class's N-Gain value is in the medium range, and the experimental class's N-Gain value is also in the medium range but close to the high range (Fathurohman et al., 2023). The difference in N-Gain scores reveals that the experimental class, which used gamification-based interactive learning media, did better than the control class, which did not use such media. This shows that using gamification media can help students learn better, especially when it comes to making English material easier to understand and more interesting. According to Hake's classification, N-Gain values are commonly interpreted as low (< 0.30), medium (0.30–0.70), and high (> 0.70) (Tahya et al., 2022). Thus, the control group's N-Gain of 0.469 indicates that students achieved about 46.9% of the maximum possible improvement, while the experimental group's N-Gain of 0.647 indicates about 64.7% of the maximum possible improvement. Although both gains fall within the "medium" category, the experimental group's N-Gain is substantially closer to the "high" threshold and exceeds the control group by 0.178, suggesting a more efficient learning improvement under the gamification-based media compared with conventional instruction. In qualitative terms, this means the intervention does not merely produce statistically significant gains, but also yields a practically meaningful advantage in learning progress, as students in the experimental condition realized a larger proportion of their attainable improvement during the intervention period.

Discussion

The results of this study show that interactive gamification-based learning media can improve student learning outcomes and interest in English learning, particularly in the topic of parts of speech. These findings are consistent with Nadeem et al. (2023) and Septiana & Fadhilah (2024), who emphasized that integrating game elements into learning can create a more enjoyable learning atmosphere while increasing student engagement. In addition, Xiao & Hew (2024) also stated that gamification can enhance intrinsic motivation through the provision of challenges, rewards, and interactive learning experiences. Literature studies and needs analysis in this research also revealed students' readiness to utilize digital media, with the majority preferring technology-based learning. These results support the report of Velaora et al. (2022), which stated that today's students have high digital literacy, making digital game-based learning more easily accepted. In particular, the learning mechanism can be explained as follows: the media

structures Parts of Speech into level-based micro-units and repeatedly prompts learners to identify word classes within contextualized sentences. Each response is followed by immediate explanatory feedback, and incorrect answers must be revised and attempted again until the correct option is achieved. This design operationalizes mastery-oriented learning and retrieval practice. These features are pedagogically relevant for grammar instruction because they strengthen conceptual categorization, such as differentiating nouns from adjectives when they appear in sentence contexts, reduce misconceptions through targeted corrective explanations, and increase time-on-task through goal-directed repetition supported by progress indicators, including points, badges, and level progression. At the same time, the observed improvement is unlikely to be uniform across learners. It may be mediated by students' engagement and sustained time-on-task during quiz cycles and moderated by learner characteristics, including baseline learning motivation, digital literacy competence, and modality preference (visual or auditory), given the multimedia and interactive nature of the developed media.

The product developed through the stages of design, validation, and implementation featured interactive quizzes, a leveling system, and badges that effectively motivated students. Previous research by Hellín et al. (2023) showed that badge and level features in gamification can increase engagement and foster a sense of achievement. From the statistical perspective, this study demonstrated a significant improvement from pretest to posttest in the experimental group, with a Cohen's d effect size of 0.903, categorized as large. This finding is consistent with Bolat & Taş (2023), who reported that gamification in formal learning contexts can have a significant impact on students' cognitive achievement. Student responses based on the TAM model were also very positive, with an average of 82% categorized as "very good," along with a positive correlation among the components of Perceived Usefulness, Ease of Use, Attitude, and Intention to Use. These findings strengthen Almaiah et al. (2022), who explained that perceived ease of use and perceived usefulness of a technology are the main determinants of user acceptance in digital educational innovations. In practical terms, a Cohen's d of 0.903 indicates that the mean performance of the experimental group is about 0.9 standard deviations higher than that of the control group. In other words, the average student who learned with the gamification media would be expected to achieve a higher posttest score than roughly 82 percent of students in the control group (Cohen's U3 is about 0.82). In addition, the probability that a randomly selected student from the experimental group outperforms a randomly selected student from the control group is about 74 percent. This practical impact is also reflected in the raw-score difference, where the experimental group obtained a mean of 35.33 out of 40, compared with 31.81 out of 40 in the control group, indicating a meaningful instructional advantage beyond statistical significance. Regarding the assumption tests, the experimental group's posttest scores were not normally distributed (Shapiro–Wilk p value below 0.05). This pattern can be explained by score clustering near the upper limit of the test (a ceiling effect) and reduced score variability after mastery-oriented practice. Specifically, repeated attempts supported by immediate explanatory feedback tend to move many learners toward similarly high scores, thereby producing a negatively skewed distribution rather than a symmetrical bell-shaped curve.

Furthermore, the N-Gain analysis confirmed that the application of gamification provided learning outcome improvements within the moderate to high category. This conclusion aligns with Chans & Portuguez Castro (2021), who found that gamification not only enhances material comprehension but also fosters sustained learning motivation. Thus, this study does not stand alone but reinforces empirical evidence from various previous studies. Gamification media has been proven effective in improving material comprehension, fostering motivation, building positive attitudes, and encouraging student acceptance. This confirms that gamification deserves to be used as an innovative alternative in English learning at the junior high school level. Importantly, the relative learning gain corroborates this interpretation: the experimental group's average N-Gain (0.647) exceeded the control group's (0.469) by 0.178 (approximately 38% higher normalized improvement), meaning that learners using the gamified media achieved a larger proportion of the maximum possible improvement during the same instructional period, even though both values remain within the "medium" category.

The interactive gamification-based learning media developed in this study still has several limitations. In terms of content, the material presented only covers part of English learning, meaning its use needs to be combined with other methods or resources to achieve more comprehensive student understanding. Nevertheless, this limitation does not reduce its effectiveness in increasing both motivation and learning outcomes. This finding is in line with Rivera & Garden (2021), who emphasized that gamification can be a solution to enhance student engagement, but limited content needs to be supplemented in order to achieve more comprehensive learning objectives. A further limitation of this study is that it did not explicitly measure or statistically control potential moderator and mediator variables, such as students' baseline motivation, digital literacy competence, and preferred learning modality. These factors may influence both technology acceptance as conceptualized in the Technology Acceptance Model and the magnitude of learning gains. Therefore, future research should incorporate these variables by administering validated pre-intervention motivation instruments, using digital literacy inventories, and conducting subgroup or interaction analyses. Such procedures are necessary to examine differential effects across learner profiles and to clarify the causal pathway through which gamification contributes to students' achievement.

On the other hand, this media has several significant strengths. Its attractive and interactive user interface, supported by multimedia elements such as video, audio, images, animation, and text, accommodates both visual and auditory learning styles. The use of interactive quiz questions equipped with level and badge systems also encourages competitive spirit, as similarly found by Hellín et al. (2023), who highlighted that points, levels, and badges are key elements that increase learning motivation. In addition, its flexible accessibility anytime and anywhere makes it suitable for distance learning, consistent with Oliveira et al. (2021), who emphasized the role of gamification in supporting e-learning. Students' learning experiences also become more meaningful since the media is equipped with interactive quizzes that facilitate teacher evaluation and video materials that serve as additional guidance, especially for the topic of parts of speech. However, technical obstacles were also encountered in implementation, such as installation

issues in the computer lab due to malfunctioning WinRAR software. This problem can be solved by reinstalling using alternative software. Another challenge is the lengthy development process of gamification-based media, as also noted by Klemke et al. (2020), who stated that gamification development requires complex planning and design. From a pedagogical standpoint, the combination of video–text explanations and interactive quizzes with explanatory feedback can be interpreted as a form of multimodal scaffolding (Dodds & Kharrufa, 2024); this design may lower extraneous cognitive load for students who benefit from visual or auditory representations and can help students with lower digital literacy by providing clear navigational cues and immediate system responses, which in turn may strengthen Perceived Ease of Use and sustain learning engagement.

The implications of this study are quite strategic for both Informatics Engineering and education. From the Informatics Engineering perspective, this study demonstrates how software tools (CorelDRAW, Camtasia, Unity, Visual Studio) can be integrated into the development of gamification-based educational media. This opens opportunities for further research on optimizing game engines, interactive algorithms, user interface design, and the integration of mobile- and cloud-based technologies to make media more flexible, lightweight, and scalable. From an educational perspective, this study highlights the importance of pedagogical innovations that combine learning theories (such as Direct Instruction) with interactive digital technology. The findings showing significant improvements in both motivation and learning outcomes indicate that gamification can serve as an effective alternative learning model, relevant to the digital literacy of today's generation, and able to bridge the gap between technology-savvy students and teachers who still rely on conventional practices. Thus, this study has dual implications: providing real contributions to the development of technological solutions in Informatics Engineering while also offering innovative strategies for classroom teaching practice. Accordingly, the educational implication is not merely that gamification is effective, but that its impact likely depends on the extent to which game mechanics are coherently aligned with instructional sequencing, including the stages of Direct Instruction, and on learners' individual characteristics. Therefore, subsequent development and evaluation should examine student engagement as a potential mediating factor and consider baseline motivation and digital literacy as moderating variables. In addition, the intervention should be replicated in schools with varying levels of technological infrastructure in order to strengthen external validity and improve the generalizability of the findings.

CONCLUSION

This study found that developing and using interactive gamification-based learning media for English (Parts of Speech) at SMP Negeri 2 Bojongsoang had a strong positive impact on students' learning quality and motivation. The experimental group achieved higher post-test scores than the control group, with a substantial effect size (Cohen's d = 0.903) and an N-Gain categorized as moderate to high. The Technology Acceptance Model (TAM) also indicated highly positive

student responses: on average, 82% of students were rated “very good,” and the correlation analysis showed a strong positive relationship among perceived usefulness, perceived ease of use, attitude, and intention to use. These findings suggest that gamification not only improves students’ cognitive achievement but also strengthens motivation, engagement, and technology adoption in the learning process. In response to the research focus on the effectiveness of DDR, MDA based interactive gamified media for improving cognitive learning outcomes in Parts of Speech, the developed media can be considered effective because it produced a significant post-test difference between the experimental and control groups and yielded a practically meaningful learning impact. Theoretically, the results support the view that mapping Mechanics, Dynamics, Aesthetics within the DDR process can serve as a coherent design logic for creating grammar practice that is more engaging and mastery-oriented. The findings also reinforce the TAM framework by confirming that perceived usefulness and perceived ease of use are positively associated with attitude and intention to use in the context of language learning media.

The content coverage was limited to Parts of Speech, the implementation involved only one school with two classes selected through purposive sampling, and potential variables that could moderate or mediate the intervention’s effects, such as initial motivation, digital literacy, and learning modality preferences, were not measured or controlled. Therefore, the findings should be generalized with caution. Future research is recommended to broaden the content beyond selected areas of English in order to provide students with a more comprehensive understanding. Technical barriers, such as software installation, should be anticipated through alternative solutions to ensure smoother implementation. Further development may also prioritize mobile and cloud-based integration to improve flexibility, scalability, and accessibility. From a practical standpoint, teachers are encouraged to adopt gamification as a complementary strategy to conventional methods, as it has proven effective in bridging students’ digital readiness with teaching practices that remain largely traditional. To make these recommendations more operational, future development should include expanding the material to other grammar topics and language skills within a consistent level structure, providing more portable installation packages or web/mobile versions to reduce installation issues in school labs, preparing a teacher implementation guide that outlines instructional steps, time allocation, and achievement indicators, and replicating the trial across schools with varying infrastructure to strengthen external validity.

OPEN CONTRIBUTORSHIP

Kania Athallah Yuhen: Conceptualization, Methodology, Data curation, Resources, Writing - original draft. Maria Seraphina Astriani: Conceptualization, Supervision, Validation, Writing - review & editing.

DATA AVAILABILITY

Data supporting this study are openly available from the Zenodo Repository at https://doi.org/10.5281/zenodo.16930539

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