



Developing Quizizz-Based Smart Games Integrating Banyumasan Local Wisdom to Support Early Childhood Character Development



Nur Hafidz¹*, Musyafa Ali¹, Ahmad Aji Jauhari Ma'mun¹, Sefti Wijayanti¹

¹ Early Childhood Islamic Education, Faculty of Islamic Studies, Nahdlatul Ulama University, Purwokerto, Indonesia

* corresponding author: nurchafidz@gmail.com

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ABSTRACT

The rapid advancement of digital technology has not been fully integrated into early childhood character education, even though this stage is crucial for building moral values and personality. This study aimed to develop Smart Game Activities based on the Quizizz application incorporating Banyumasan local wisdom to instill values of honesty, discipline, self-regulation, and cooperation in early childhood. The research followed a quasi-experimental pretest–posttest design with nonequivalent groups (experimental group $n = 15$, control group $n = 16$) and applied purposive non-random sampling to ensure homogeneity across classes. Ethical clearance was obtained from the Institutional Review Board of Universitas Muhammadiyah Purwokerto (Approval No. UMP/EDU/2025/0412), and parental consent was secured for all participants. The developed product integrates child-friendly UI/UX features such as narrated audio instructions, large touchable buttons, and animated feedback icons to enhance engagement and accessibility. Expert validation from three specialists (media, early childhood character, and pedagogy) yielded an average score of $M = 3.47$ (very feasible), and the instrument reliability reached $\alpha = 0.872$, indicating high internal consistency. Ten valid items were retained to measure children's character indicators (honesty, discipline, self-regulation, and cooperation). Statistical analysis confirmed the assumptions of normality and homogeneity, with equivalent pretest results between groups ($p = 0.889$). Post-intervention, the experimental group achieved an average *N-Gain* of 75.34% (high category), significantly outperforming the control group's 36.64% (medium category) with an independent *t*-test result of $p < 0.001$. These findings indicate that Quizizz-based Smart Game Activities effectively foster early childhood character through a culturally grounded, interactive, and ethically designed digital learning experience.

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1. Introduction

National data shows that violence against children continues to occur at significant rates. According to the Online Information System for the Protection of Women and Children (SIMFONI-PPA) managed by the Ministry of Women's Empowerment and Child Protection (KemenPPPA), there were 14,039 cases of violence against women and children



recorded as of July 3, 2025, representing a sharp spike in that short period. These figures confirm that thousands of children experience this form of violence each year, with many victims being adolescents, but also toddlers and young children (Umum & Perempuan, 2025).

The Indonesian Child Protection Commission (KPAI) reported 2,057 child protection complaints throughout 2024, dominated by issues of problematic parenting and sexual violence, as well as the need for referral and psychoeducational services for victims. This demonstrates that the problem is not just numbers, but also the need for character-building interventions and healthy parenting (Ratri & Atmojo, 2024).

Impacting the need for character programs is that these figures provide two important signals for interventions starting in early childhood (PAUD). First, because the home and parenting environment are among the most common locations for violence, character-building programs (e.g., empathy, emotional control, communication, and reporting danger) must target children from an early age and involve families. Second, the high incidence of sexual violence and parenting conflicts demands a safe, interactive, and easily adopted learning format for teachers and parents. This is where the Quizizz-based educational game, which promotes local values (Banyumasan), has the potential to be effective. Its interactive quiz format can teach protective behaviors and positive social norms without causing re-traumatization.

Character is an important foundation in developing a child's personality from an early age. Childhood is a golden age, the starting point for instilling positive moral values and character (Yuarini Wahyu Pertwi, Miranu Triantoro, Indriyani, Dina, 2025). Good character education at an early age can have a long-term impact on children's attitudes, behavior, and emotional intelligence (Aslan, 2024). Therefore, a learning approach that is fun, contextual, and capable of effectively internalizing character values is needed. On the other hand, local wisdom contains rich cultural values that are relevant for character development in children (Hiola & Muis, 2025). The integration of local wisdom values into traditional games has proven effective in improving social skills and gross motor skills in early childhood. Furthermore, local wisdom-based learning models are also effective in shaping the character of early childhood (Prayitno et al., 2022).

One promising local wisdom-based learning approach for early childhood character education is through smart games—interactive, technology-based educational games that engage children in playful learning experiences. The use of digital platforms such as the Quizizz application enables teachers to deliver material in an enjoyable and participatory manner (Islami & Rohita, 2022). When such games are developed with local wisdom elements, children are not only entertained but also internalize cultural values that shape their identity and character, including cooperation, responsibility, empathy, and love for their cultural environment (Batubara, 2017; Septiwiharti & Mutawakkil, 2023).

However, despite the great potential of smart games and quiz-based learning platforms like Quizizz, there remains a significant gap in content development that integrates local cultural values and validated character constructs particularly for early childhood learners. Most existing Quizizz implementations focus on academic knowledge or language learning (Edwards et al., 2006; Herawati et al., 2020), while studies that combine validated character education scales with local wisdom narratives are still scarce. To date, no study has systematically developed and tested Banyumasan local-wisdom-based content for early childhood character formation using a controlled design (Islamic et al., 2024).

This gap underscores several urgent issues in Indonesian character education (Ratri & Atmojo, 2024): (1) The need for early and systematic character development in facing global socio-cultural challenges. The lack of interactive, technology-based learning media

that integrate local wisdom with moral and social-emotional competencies. (2) The underutilized potential of Quizizz as a fun, accessible, and adaptable learning medium in early childhood contexts. The essential role of local-culture-based education in strengthening children's moral identity and cultural pride amid globalization (Hidayati & Aslam, 2021; Marwany et al., 2022).

Therefore, this research develops Smart Game Activities of Banyumasan Local Wisdom based on the Quizizz application to address these needs. This innovation combines the strengths of interactive technology with rich local cultural values, aiming to holistically nurture children's character—helping them internalize responsibility, cooperation, and love for local traditions in meaningful, developmentally appropriate ways.

2. Method

This study employed the Research and Development (R&D) method with the waterfall flow model in its development phase. This model was chosen because it provides a systematic framework for producing empirically tested educational products that are suitable for implementation in early childhood education institutions. The product developed is a Smart Game Activity based on Banyumasan local wisdom through the Quizizz application to stimulate the character of early childhood. The Borg and Gall development model has a relatively long stage because it includes 10 implementation steps: (1) Analysis of Research Potential and Problems, (2) Research Data Collection, (3) Research Product Design, (4) Product Design Validation, (5) Product Usage Trial, (6) Product Revision, (7) Product Trial, (8) Design Revision, (9) Product Revision, and (10) Mass Production (Bartlett & Burton, 2024; Moleong, 2020; Sugiyono, 2016).

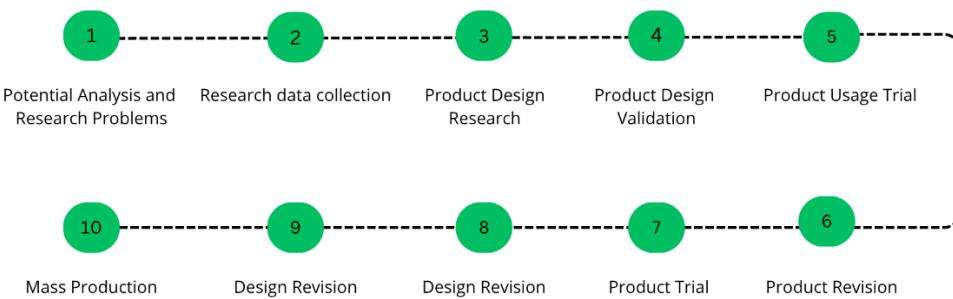


Figure 1. Research Flow Chart

The first stage, Potential and Problems. The potential and problems stage was conducted in two early childhood education units: RA Rumah Kreatif Wadas Kelir and RA Muslimat NU 13 Sokaraja. Initial observations indicated that both institutions had utilized digital media in some learning activities, but there were no digital games integrated with Banyumasan local wisdom to stimulate children's character. Teachers also expressed the need for engaging, interactive media that integrated local values into learning. The selection of these two locations was based on the following considerations:

- a. RA Rumah Kreatif Wadas Kelir has a progressive learning culture, is open to media innovation, and uses technology intensively. This situation was suitable for the experimental group due to teacher readiness and adequate facilities for using Quizizz.
- b. RA Muslimat NU 13 Sokaraja has relatively stable characteristics, with limited digital media use, making it suitable as a control group to obtain an objective comparison of product effectiveness.

The second stage, data collection and solution formulation. The results of the needs analysis formed the basis for formulating an initial solution design, namely the Smart Game Activity concept based on Banyumasan local wisdom values. This served as the basis for developing media that was not only engaging but also encompassed character education. Several activities conducted at this stage included a literature study related to character education, local wisdom-based learning, digital educational games, and the principles of media development for early childhood education (PAUD). Interviews with PAUD teachers were conducted to explore content needs, the suitability of the material to children's developmental stages, and the challenges of using digital media in the classroom. Observations of children's learning interactions, including responses to digital games and their ability to follow simple instructions, were conducted. Data from this stage served as the basis for developing an initial product concept to align with child development theory, character learning needs, and PAUD learning design principles.

The third stage involved designing and developing an innovative product. Researchers designed and developed a prototype Quizizz-based educational game that included interactive game activities based on local cultural values. This represents a learning innovation that utilizes a widely known application but is modified with local content specifically for early childhood. This research was conducted at two PAUD institutions in Banyumas Regency, Central Java, Indonesia. The product design planning stage follows the principles of media design for early childhood, such as simple and bright visuals, easy language, immediate feedback, and short, systematic gameplay.

Stage four, Product validation. Product validation was conducted by three experts: the Learning Media Expert; who assessed the technical aspects, aesthetics, interactivity, display validity, and feasibility of the Quizizz platform for early childhood education. The Child Development Expert; who assessed the suitability of the material for the cognitive, social-emotional, and character development stages of early childhood. The Early Childhood Education Learning Methods Expert; who assessed the game's alignment with learning theory, competency suitability, and the integration of local cultural values into character education. The instrument used a Likert scale, and the results were analyzed to determine the feasibility of the product design.

The validation of the children's character questionnaire instrument was tested for quality through: Validity testing using Pearson Product Moment correlation. Questionnaire items were declared valid if the calculated r -value was greater than the table r -value. Reliability testing using Cronbach's Alpha. The instrument was declared reliable if the Cronbach's Alpha value was greater than 0.70, the standard for internal consistency.

Stage five, Product evaluation and revision. Based on the results of the initial trial and input from teachers and experts, the product was refined to make it more effective and enjoyable for use by early childhood children. Revisions were made based on expert recommendations, including adjusting the game's complexity level, simplifying visual instructions, adding variations of local Banyumasan characters, improving navigation colors and icons, and adjusting character indicators to make them more measurable. Revisions at this stage ensured that the product met content validity standards before being tested with children.

Stage Six, Product Trial (Limited Test). The limited trial was conducted at the Wadas Kelir Creative House Kindergarten (RA Rumah Kreatif Wadas Kelir) and the Muslimat 13 Sokaraja Kindergarten (RA Muslimat 13 Sokaraja) to gauge children's initial responses to the product. Data was collected through observations of behavior, child participation, and teacher responses. Observation data was used for technical revisions, such as enlarging icons, shortening text, or clarifying the voice of instructions.

Stage Seven, Product Revision. Further revisions were conducted after the limited trial. At this stage, the product was refined to be ready for use in field trials, particularly those related to (Emzir, 2019; Hafidz et al., 2022).

Table 1. Experimental and Control Pre - Post Tes

Group	Pretest	Treatment	Posttest
Experimental (RA Wadas Kelir)	O ₁	X (Quizizz Smart Game)	O ₂
Control (RA Muslimat NU 13)	O ₁	—	O ₂

This design was used because class divisions in early childhood education institutions did not allow for randomization. Therefore, existing research groups (intact groups) were used as they were. A pretest was conducted to determine the children's initial character abilities before the treatment was administered. Effectiveness was assessed by improving children's character, as measured by a character questionnaire that had been tested for validity using Product Moment and reliability using Cronbach's Alpha. Stage Nine, Product Refinement. The final stage was to refine the product based on: statistical analysis results, teacher input during implementation, observations of children's behavior during play, evaluation of the game's effectiveness in developing character. The final product was a Quizizz-based Smart Game incorporating Banyumasan local wisdom, with valid, practical, and effective qualities for use in PAUD learning.

Research data collection was conducted through: a) Initial observations to identify the need for local wisdom-based character learning. b) Interviews with teachers regarding challenges, needs, and readiness to use digital media. c) Early childhood character questionnaires to measure changes in learning outcomes before and after treatment. d) Documentation of learning activities. e) Expert validation instrument to assess product feasibility.

Data analysis in this study was conducted using two approaches:

- Development data analysis. In the development stage, qualitative data obtained through observation and interviews were analyzed using data reduction, data presentation, and conclusion drawing. This process was carried out to organize field findings, identify user needs, and ensure the product design aligns with the developmental characteristics of early childhood. Meanwhile, quantitative data resulting from expert validation were analyzed using a feasibility percentage technique to determine the quality of the product design, resulting in assessment categories that describe the feasibility level of the Quizizz-based smart game media before further testing.
- Product effectiveness data analysis: The researchers conducted a series of inferential statistical analyses to ensure that the developed game had a significant impact on children's character development. Several tests were conducted, including: 1) A normality test was conducted first to ensure that the pretest and posttest data were normally distributed. 2) A homogeneity test to determine the equality of variance between the experimental and control groups. These two initial tests are essential prerequisites before proceeding to parametric testing. 3) After meeting these assumptions, the researchers used an Independent Sample *t*-test to compare the posttest scores of the two groups to obtain an objective picture of the effectiveness of the treatment. 4) Analysis of learning outcomes was conducted using gain scores to determine the magnitude of changes in character abilities before and after treatment in each group. 5) To strengthen the interpretation of the significance of the effect, the

researchers calculated Cohen's d effect size, which provides a quantitative measure of the strength of the impact of smart games on early childhood character development.

Through this series of analyses, this study not only assessed differences in scores statistically but also assessed the extent of the product's contribution to children's character development, thus ensuring scientifically justified conclusions about effectiveness. (Aprilia et al., 2025).

3. Result and Discussion

Potential and Problem Analysis

Observations and interviews at the RA Rumah Kreatif Wadas Kelir and the RA NU 13 Sokaraja Muslimat indicate that teachers are aware of the importance of character education, but the media they use is still conventional, making it less engaging for students. There is a lack of digital interactive learning media that integrates Banyumasan local wisdom as part of culture-based learning. Teachers expressed the need for media that is more relevant to children's cultural environment, easy to use, and able to stimulate character aspects in a fun way. These findings provide a strong basis for designing a smart game based on the Quizizz app.

Information Collection

Information collection through literature review and in-depth interviews yielded two important findings: (1) the digital game learning model is effective in increasing motivation and engagement in early childhood, and (2) the integration of local wisdom into learning can strengthen cultural identity and character values. Information on child development was used to tailor game content to the cognitive and socio-emotional stages of children aged 5–6 years. Meanwhile, information related to Banyumasan culture was used to select relevant content such as simple ngapak language, local cultural icons, traditional games, and local short stories (Adrianus Benufinit & Malaikosa, 2024).

Initial Product Development

The initial product is the "Banyumasan Smart Game" in the Quizizz application. Development included creating a storyboard, selecting visual icons with a Banyumasan feel, creating game questions with character indicators (discipline, self-confidence, honesty, and cooperation), and providing interactive feedback. The content is simple, visually appealing, and includes audio instructions to help children follow the gameplay. The initial product is deemed to meet the pedagogical requirements for Early Childhood Education (PAUD), but still requires expert validation before being piloted (Trisnawati & Fauziah, 2019).

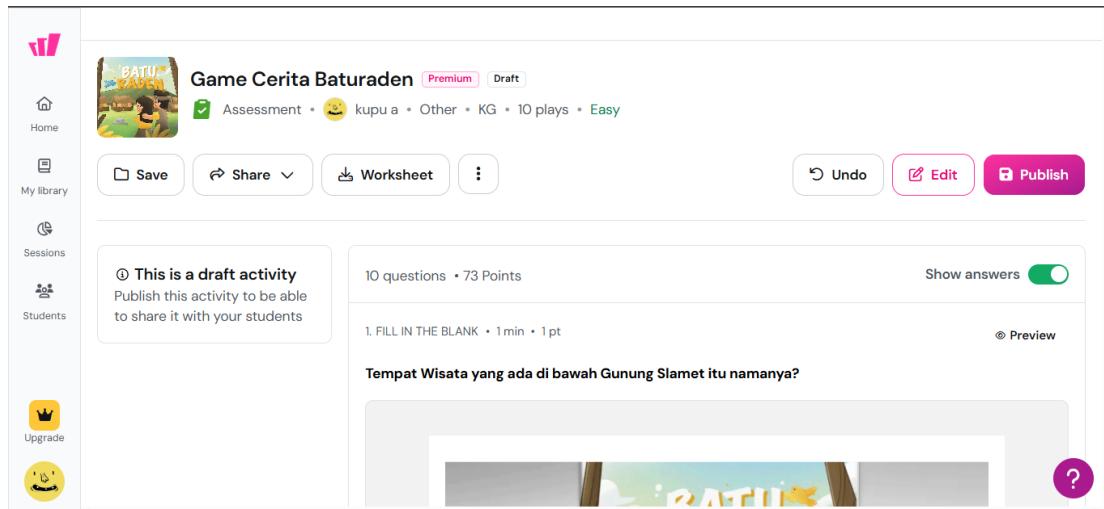


Figure 2. Banyumasan Smart Game

The selected stories, the Baturraden Legend and the Pelus River Story, are part of Banyumasan local wisdom, rich with character education values. There are 20 questions, each worth 10 points; each correct answer earns 100 points. When the stories were packaged as an interactive game through the Quizizz app, the children demonstrated high enthusiasm. They enjoyed playing while learning, actively answering questions, and engaging in discussions with their peers. This demonstrates that a digital-based approach combined with local cultural values can be an innovative solution for building character in early childhood, while supporting the school's goal of instilling a holistic, intelligent, and Islamic education (Citra & Rosy, 2020).

Product Validation Results

1. Media Expert Validation

The media expert stated that the smart game's appearance aligns with the characteristics of early childhood learning, particularly in terms of color, icon size, and navigation. However, the expert recommended simplifying some interactive buttons to avoid confusion for children. Several visual elements were also recommended to be enlarged to improve accessibility. Overall, the expert rated the game as "very appropriate" after minor revisions.

2. Child Development Expert Validation

The child development expert assessed that the game's content aligns with children's developmental needs, particularly because local cultural content is presented in child-friendly visuals and language. The game's instruments are considered capable of stimulating character development through activities of choosing, responding, and observing. The expert's main recommendation was to clarify some verbal instructions to avoid ambiguous interpretations. After revisions, the expert declared the product to be "appropriate and appropriate for child development."

3. Learning Method Expert Validation

The learning method expert assessed that the game aligns with the play-based PAUD approach and active learning. The integration of Banyumasan local wisdom is considered to strengthen children's character development in a meaningful context. The expert recommended strengthening character indicators in each test item. After the revision, the

expert stated that the product was in the category of “very suitable for use in the PAUD learning process.”

Validation Results for the Quizizz App Learning Media

Expert validation was conducted to ensure that the media used in the research on the effectiveness of the Quizizz app-based Smart Game Activities of Banyumasan Local Wisdom was appropriate, relevant, and suited to the characteristics of early childhood. The validation involved three experts:

1. Media Expert, along with Umi Khomsyiatun, M.Pd., to assess technical aspects, readability, and item suitability for digital-based media.
2. Child Character Development Expert, Dr. Heru Kurniawan, M.A., to review and assess the media's relevance to early childhood character development indicators.
3. Learning Methods Expert, Endah Kusumaningrum, M.Pd., to assess the media's suitability with the pedagogical approach, language clarity, and feasibility of implementation in learning.

These criteria align with recent instrument development research that uses similar categories to determine product feasibility ([Rukajat & Makbul, 2022](#); [Sutijan et al., 2015](#)). The validation results from the three experts can be seen in the following table 2:

No	Validator	Rated aspect	Average Score	Category	Improvement Suggestions
1	Media Expert	Suitability of the instrument with the Quizizz media, readability, appearance	3.4	Very Worthy	Use simpler wording and add visual examples to make items easier to understand.
2	Child Character Development Expert	Relevance of indicators to aspects of discipline, responsibility, cooperation, religiosity, and love of culture	3.7	Very Worthy	Add items that measure children's cooperation in group activities.
3	Learning Methods Expert	Suitability of instruments to learning objectives, integration of indicators, clarity of language	3.3	Very Worthy	Correct the wording of several items to avoid multiple interpretations and adapt the terms to the language of early childhood.

Overall average = 3.47 (Very Decent).

Based on the validation results, the average score from the three validators was in the range of 3.26–4.00, thus declaring the research instrument highly suitable for use. Input from the experts was then accommodated, including improving item wording, adding collaboration indicators, and simplifying the language. Thus, this research instrument met content validity and was ready for use in the field trial phase.

Validity and Reliability Test of Research Instruments

The early childhood character development instrument was quantitatively tested for validity and reliability using SPSS. This testing is essential to ensure that the instrument's items consistently and accurately measure the intended constructs ([Sugiyono, 2019](#)).

Instrument validity was analyzed using Pearson Product Moment correlation with SPSS, with the following criteria: The instrument is said to be valid if the calculated r value $>$ r table (at a significance level of 0.05). Items with a sig. (p) value $<$ 0.05 are also declared valid (Amalia & Hardini, 2020).

This research instrument consists of 12 statements designed to measure early childhood character development through teacher observations while children participate in digital games based on Banyumasan local wisdom. The instrument uses a Likert scale of 1–5 (1 = very inappropriate, 5 = very appropriate). The validity test process was conducted using the corrected item-total correlation technique using SPSS. The decision-making criteria refer to the requirement that an item is declared valid if the correlation coefficient (r_{count}) \geq 0.30 and is significant at the 5% confidence level ($p < 0.05$). Items with $r_{count} < 0.30$ are declared invalid (Sihotang, 2023).

The calculation results show that out of 12 items, there are 10 valid items and 2 invalid items. Valid items are items number 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10. While item number 11 ("Children tidy up equipment after playing activities") and item number 12 ("Children do not make a mess or disturbance during digital playing activities.") are declared invalid because the correlation value is low ($r_{hitung} < 0.30$) and not significant. Thus, of the 12 test items created, only 10 items were used in the study.

After the validity test, the next step is the reliability test to determine the internal consistency of the instrument. The reliability test was conducted using the Cronbach's Alpha method using 10 items that were declared valid. The calculation results showed that the Cronbach's Alpha value = 0.872. According to the reliability criteria (Zayrin et al., 2025), the instrument is declared reliable if the Alpha value \geq 0.70. With this value, this instrument is in the very reliable category, meaning the consistency of answers between items is very good and the instrument can be trusted for use in further research. From this, this research instrument is suitable for use to measure the character development of early childhood in the context of digital game-based learning of Banyumasan local wisdom.

Analysis of Research Findings

This study used a Randomized Controlled Trial (RCT) pretest–posttest with a control group design model using two groups: the experimental group (receiving treatment: the Quizizz application) and the control group (regular learning method). The researcher used a non-randomized purposive sampling technique, this technique is used to determine the experimental and control classes that are relatively homogeneous and in accordance with the research objectives (Yam, 2024).

The main instrument of this study was a child character development questionnaire consisting of 10 statements with a Likert scale of 1–5. The score range that respondents could obtain was 10 to 50, where a minimum score of 10 indicated that the child's character development was in the lowest category, while a maximum score of 50 indicated that the child's character development was in the highest category; the higher the score obtained, the better the observed character development of the child. The number of members of the experimental group was 15 children of RA Rumah Kreatif Wadas Kelir while the control group was 16 children of RA Muslimat NU 13 Sokaraja. The statistical tests conducted in this study were as follows:

Assumption Test Classic

Before conduct hypothesis testing, especially formerly done testing assumptions classic for results analysis fulfil condition statistics Parametric. The classical assumption tests

used include normality and homogeneity tests. The *Shapiro-Wilk* test is used to determine whether the data are normally distributed. Data are considered normal if the significance value is > 0.05 . Furthermore, the Levene test is used to determine the similarity of variances between groups. Data are considered homogeneous if the significance value is > 0.05 . Once the assumptions of normality and homogeneity are met, the analysis can proceed with parametric tests.

Balance Test (Independent Sample *t*-test)

Balance test beginning done For ensure that condition beginning group experiments and groups control is at in condition equivalent before given treatment. Analysis using the independent sample *t*- test on second pretest score The decision-making criteria are if the significance value (p-value) is > 0.05 , then there is no significant difference between the experimental and control groups. Thus, both groups are considered equivalent at the initial conditions of the study.

***N-Gain* Score Test**

To determine the effectiveness of the treatment, *N-Gain* Score analysis was used, namely a comparison between the actual score increase and the maximum possible score increase that could be achieved. The results of the *N-Gain* calculation are then interpreted based on the following categories: high (≥ 0.70), medium (0.30 – 0.69), and low (< 0.30). This analysis provides an overview of how much improvement in children's skills or character is obtained after participating in learning with the Quizizz-based Smart Game Activities model compared to the control group.

Analysis Statistics

1. Assumption Test Classic

The normality test in this study used the Shapiro-Wilk test because the number of respondents in each group was fewer than 50. The results showed that in the experimental group, the pretest significance value was 0.550 and the posttest significance value was 0.134, both of which were greater than 0.05, indicating that the students' character value data in the experimental group were normally distributed. Similarly, in the control group, the pretest and posttest significance values were 0.760 and 0.123, respectively, which also exceeded 0.05, confirming that the character value data in the control group were normally distributed. Since all datasets met the assumption of normality, parametric statistical tests could be applied, ensuring that the data analysis results were valid, representative, and suitable for generalization.

The homogeneity test in this study was conducted using the pretest data of the experimental and control groups to ensure that both groups had equivalent initial conditions before the treatment was given, so that any differences observed in the posttest could be attributed to the treatment, such as the use of the Quizizz application. Based on the Test of Homogeneity of Variances (*Levene's Test*), the significance value of the pretest data was 0.897, which is greater than 0.05, indicating that the variance of character value data between the experimental and control groups was the same or homogeneous. Therefore, the assumption of homogeneity was fulfilled, making the interpretation of the statistical test results more valid and allowing differences in group means to be more confidently attributed to the effect of the treatment rather than differences in data variability.

2. Independent *t*-test

After the treatment was implemented in the experimental group using a Quizizz-based smart game, students' character scores showed a meaningful improvement compared to those of the control group, which used conventional learning methods. The results of the Independent Samples *t*-test indicated that before the treatment, there was no significant difference between the experimental and control groups, as shown by a *t*-value of 0.140, which was smaller than the *t*-table value of 2.045 ($\alpha = 0.05$, $df = 29$), and a significance value of $0.889 > 0.05$. This finding confirms that both groups had equivalent initial character levels prior to the intervention. Following the treatment, the experimental group demonstrated notable improvements in character aspects such as discipline, honesty, self-confidence, and cooperative skills, providing empirical evidence that the Quizizz-based smart game effectively enhanced early childhood students' character development.

3. N Gain Score Test

The gain score analysis showed that the improvement in the experimental group was substantially higher than that of the control group, indicating that the treatment made a significant contribution to children's character development. Based on the *N-Gain* criteria, the experimental group achieved an average *N-Gain* score of 75.34%, which falls into the high category, with scores ranging from a minimum of 57.89% to a maximum of 84.21%. In contrast, the control group obtained an average *N-Gain* score of 36.64%, categorized as medium, with minimum and maximum scores of 21.05% and 43.33%, respectively. Referring to the effectiveness interpretation criteria, the experimental group's gain score indicates that the use of Quizizz-based media was quite effective to effective in improving character development, while the conventional learning media used in the control group tended to be less effective.

To strengthen these findings, an Independent Samples *t*-test was conducted on the *N-Gain* scores to determine whether the observed differences were caused by the treatment or occurred by chance. The results of *Levene's Test* showed a significance value of 0.226 (> 0.05), indicating that the *N-Gain* data from the experimental and control groups were homogeneous. Furthermore, the *t*-test results based on the equal variances assumed showed a significance value of 0.000 (< 0.05), which means there was a statistically significant difference in effectiveness between the Quizizz-based learning media and conventional media. Thus, it can be concluded that the use of Quizizz significantly improved the character development of early childhood education students compared to conventional learning methods (Deviana & Sulistyani, 2021).

Effect Size Test

Based on the results of the independent samples *t*-test on the *N-Gain* percentages, the obtained *t*-value was 25.879 with 29 degrees of freedom, calculated using $n_1 = 15$ and $n_2 = 16$ ($df = n_1 + n_2 - 2$). The mean difference between the experimental and control groups was 48.70589 with a standard error difference of 1.88205, from which the pooled standard deviation was estimated at approximately 5.24. These results indicate a very large separation between the two groups in terms of improvement, with the experimental group showing substantially higher gains than the control group.

To evaluate the practical significance of this difference, the effect size was calculated using *Cohen's d*. Based on the mean difference and the pooled standard deviation, the effect size was $d = 9.30$, which represents an extremely large effect, meaning the difference between groups was more than nine standard deviations. Because *Cohen's d* can be slightly biased in small samples, a correction using *Hedges' g* was applied, resulting in

a corrected effect size of $g \approx 9.06$. This finding confirms that the Quizizz-based learning intervention had a very strong and meaningful impact on improving students' learning outcomes, both statistically and practically, far exceeding normal variability between students.

Discussion

The results of this study indicate that the development of a Smart Game Based on Banyumasan Local Wisdom through Quizizz significantly improved the character of early childhood children. This finding is evident in the significantly higher *N-Gain* achieved in the experimental group compared to the control group, as well as the very large effect size ($g = 9.06$), indicating that the implementation of a digital game based on local culture has a strong and consistent impact on children's character development. This achievement reinforces the view of Alvarado Molina (Alvarado Molina et al., 2022) that children's character can develop optimally when they are guided through relevant, meaningful learning experiences that stimulate independent decision-making.

These results also align with the findings of [Aygün Akgül](#), [Tonguç Osman Mutlu](#) ([Eğitimi et al., 2021](#)), which confirm that digital games with gamification mechanisms can stimulate prosocial behavior, improve concentration, and foster independence in children in solving learning challenges. In the context of this research, the challenges of the Quizizz game, contextualized within Banyumasan culture, bring children closer to local values such as cooperation (*gugur gunung*), honesty (*temen*), and discipline. This integration of local wisdom not only makes learning activities more enjoyable but also strengthens cultural identity, which has been under-represented in digital early childhood education media.

Specifically, the findings of this study complement those of [KomalaSari & Saripudin](#) ([KomalaSari & Saripudin, 2019](#)), which emphasized the importance of contextual value education in digital media. However, previous research tended to develop story- or video-based media, while this study introduces a new alternative in the form of a smart cultural game through Quizizz, specifically designed to stimulate children's character in an active, interactive, and measurable way. Thus, this study provides a theoretical contribution in expanding the concept of digital character education by incorporating elements of local wisdom into a gamified assessment platform.

Furthermore, the effectiveness of this game can also be explained through the perspective of self-determination theory ([Ryan & Deci, 2020](#)). Quizizz-based games enable children to fulfill three key psychological needs: autonomy (choosing their own answers), competence (completing the game and receiving immediate feedback), and relatedness (interacting and encouraging peers). Research has shown that these three aspects contribute to the development of positive character traits such as independence, sportsmanship, and responsibility. In traditional learning, these three aspects are often hampered by the teacher-centered nature of activities.

The research also shows that children are highly responsive to games based on regional culture. This supports [Yumriani](#) ([2022](#)) argument that educational media based on local wisdom has the power to instill character values because these values are not merely understood cognitively but experienced as part of one's identity. A key advantage of this research is the combination of local wisdom and digital gamification in a single structured intervention model through Borg & Gall's R&D, resulting in a product that is not only content-valid (through expert testing) but also proven effective in the field.

In terms of novelty, this study makes several important scientific contributions by systematically integrating Banyumasan local wisdom into the Quizizz game, an approach

that has not been applied in previous studies that generally relied on generic or purely academic content; developing a character-specific assessment instrument tailored to a local digital game context that has been proven valid and reliable; demonstrating that digital games can strengthen children's cultural identity rather than weaken it, countering common criticisms of digitalization in early childhood education; and producing an extremely large effect size that indicates a very strong intervention effect, exceeding the outcomes reported in most prior studies. Therefore, this research not only adds empirical evidence regarding the effectiveness of digital games in learning but also introduces a new perspective that digital gamification can be harmoniously integrated with local wisdom as a powerful means of cultural revitalization and character development from an early age.

4. Conclusion

Quizizz, a smart game based on Banyumasan local wisdom, has proven effective in developing the character of early childhood, particularly in the areas of independence, honesty, cooperation, responsibility, and discipline. Product development followed the Borg and Gall R&D stages, resulting in a learning medium validated by three experts, instrumentally reliable, and with a highly significant impact on strengthening children's character, as evidenced by the high *N-Gain* value and the very large *Hedges' g* effect size. These findings confirm that digital media contextualized with local cultural values can provide relevant, meaningful, and powerful learning experiences for developing children's character from an early age.

This study has several limitations that require consideration. First, the study was conducted only at two early childhood education institutions in the Banyumas region, so the findings cannot be broadly generalized to different regions or institutions with different characteristics. Second, the limited sample size means that variations in children's character may not be fully represented. Third, learning effectiveness was measured over a relatively short period of time, thus not providing a picture of the sustainability of character change over the long term. Furthermore, the use of Quizizz as the primary platform makes learning highly dependent on device availability and network stability, which in practice can be a challenge in some early childhood education institutions.

Based on this, this study recommends several things. Further development can be carried out by expanding the research area, involving more early childhood education institutions with diverse socio-cultural backgrounds to strengthen the generalizability of the findings. Future research can also integrate longitudinal observation aspects to determine whether the character changes that occur can be maintained long-term. Furthermore, the development of local culture-based game features can be expanded to other, more flexible platforms that do not rely on internet connections, making them suitable for institutions with limited digital resources. Early childhood education teachers are also recommended to begin adopting digital games based on local culture as an alternative for character learning, as they have been proven to increase motivation, positive interactions, and awareness of cultural values in children. This research makes an important contribution to the world of early childhood education, particularly in connecting digital gamification with the revitalization of local wisdom as a means of character building.

Based on the research results, the use of Smart Game Activities based on the Quizizz application with Banyumasan local wisdom has proven effective in developing the character of early childhood. Therefore, teachers are advised to utilize this medium as an alternative, interactive learning medium that is both fun and rich in local cultural values. Curriculum

developers can also consider integrating local wisdom-based media into character education strategies in early childhood education (PAUD). Further research is recommended to test the effectiveness of this medium in a broader school context and explore its impact on other aspects of development, such as children's social-emotional intelligence and creativity.

Author Contributions

In this study, Nur Hafidz played a major role in conceptualizing the research idea, developing the methodology, conducting the formal analysis, and writing the original draft of the manuscript. He was also responsible for the administration of the research project. Ahmad Aji Jauhari Ma'mun contributed to the conceptualization of the research, provided the necessary resources, supervised the research process, and was actively involved in the review and editing process. Meanwhile, Septi Wijayanti played a role in field investigation activities, curated research data, and participated in the review and editing of the manuscript to ensure it was more systematic and in accordance with academic standards. All authors collaborated actively according to their respective areas of expertise, provided feedback to each other, and have approved the final version of this article for publication.

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Conflict of interests

The author declares that there is no conflict of interest in this research.

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