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A Gamification-Based Learning Module for Enhancing Mastery of whole Numbers 0–10 Among Students with Special Educational Needs

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A R T I C L E I N F O

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A B S T R A C T

This study aims to evaluate the effectiveness of a gamification module on basic numbers developed specifically for pupils with Special Educational Needs – Learning Disabilities (SEN-LD) in Special Education Integration Primary Schools in Southwest Penang. The module was developed using the Design and Development Research (DDR) approach, which involved three main phases: needs analysis, design and development, and evaluation. In the needs analysis phase, findings indicated that lower primary pupils experienced difficulties in mastering basic numbers from 0 to 10, highlighting the need for a more interactive learning support tool. The design and development phase focused on integrating gamification elements such as reward systems, animated characters, mission achievements, and game-based learning activities. The evaluation phase employed a quasi-experimental non-equivalent group design, where the experimental group was taught using the gamification module while the control group received conventional instruction. The results revealed a significant improvement in the experimental group's performance, demonstrating that the gamification module developed through DDR enhanced teaching and learning effectiveness. The study implies that gamified modules should be more widely adopted in special education classrooms to foster motivation, engagement, and conceptual understanding among SEN-LD pupils.

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INTRODUCTION

Teaching and learning activities in schools often highlight the use of textbooks as an important medium to ensure that pupils' mastery of knowledge aligns with the Standard Curriculum Document for primary education, particularly in the field of Special Education. According to Aziz Omar (2020), textbooks serve as the main instructional material that facilitates comprehension according to each topic, while also providing exercises for practice. This view is supported by Hanifah et al. (2020), who stated that textbooks are frequently used by teachers as a reference before, during, and after classroom teaching sessions.

Teaching sessions that incorporate play-based elements are often more enjoyable and effective for pupils. Fong Peng and Fikri Ismail (2020) highlighted that play is an effective method in teaching and learning, particularly as a strategy to integrate digital citizenship elements among secondary school students. For pupils with learning disabilities, teachers can adapt more challenging games that are aligned with the pupils' levels and learning abilities in Special Education settings.

Through the use of textbooks, Mathematics emerges as a core subject in shaping pupils' cognitive foundations, including those with Special Educational Needs – Learning Disabilities (SEN-LD) enrolled in the Special Education Integration Programme (PPKI). However, these pupils often face difficulties in understanding fundamental mathematical concepts such as whole numbers due to limited cognitive abilities, short attention spans, and inappropriate teaching aids (Azmi & Hassan, 2021). Traditional teaching methods, which are abstract, linear, and less interactive, have also been found to be less effective in supporting mastery of basic numbers from 0 to 10 (Kamaruddin et al., 2020).

In addition, textbooks serve as a guide to the content that must be mastered, while for pupils they act as a primary source of reading alongside supplementary references (Kamarulzaman Abdul Ghani, 2020). In Malaysia, textbooks are considered a key medium that interprets the philosophy, goals, objectives, and principles of the national curriculum (KPM, 2016). High-quality textbooks not only contribute to the development of knowledge but also foster character building and spiritual growth in line with the National Philosophy of Education.

To enhance the quality of teaching and learning (T&L), gamification has been introduced as a pedagogical innovation that integrates game elements such as reward systems, leaderboards, mission achievements, animated characters, and interactive activities. These elements have been shown to increase pupils' intrinsic motivation and active participation in T&L (Zainal et al., 2022). Previous studies also demonstrated the effectiveness of gamification in improving achievement in number operations and the reinforcement of basic mathematical concepts (Rahim & Ariffin, 2023). Nevertheless, there remains a lack of research focusing on the effectiveness of gamification in Special Education, particularly in teaching whole numbers at the early primary level.

Therefore, this study adopts the Design and Development Research (DDR) approach in developing a gamification module on whole numbers (0–10) for SEN-LD pupils. The needs analysis phase was conducted to identify the challenges of mastering basic numbers and to examine the suitability of the

Mathematics textbook as the main reference. The design and development phase focused on producing a gamification module grounded in relevant learning theories and incorporating interactive elements suited to the developmental level of SEN pupils. The module was subsequently evaluated in the assessment phase using a quasi-experimental design to measure its effectiveness in improving pupils' achievement and engagement. It is expected that the findings of this study will strengthen the pedagogy of Special Education Mathematics and support teachers in implementing more effective, engaging, and inclusive instructional approaches.

Background of the Study

Textbooks are the main instructional resources in teaching and learning (T&L) across schools, including within the context of Special Education for Learning Disabilities (LD). In line with the Curriculum Transformation through the Primary School Standard Curriculum (KSSR) (Revised 2017), the Ministry of Education Malaysia (MOE) emphasizes the importance of textbooks as the primary reference materials that support teachers in delivering knowledge according to students' levels of mastery (Qhairunnisa Aziz, 2021). She further argues that textbook design elements, particularly the use of text and illustrations, play a vital role in ensuring content is comprehensible to students, especially those with special educational needs.

The mastery of basic mathematical concepts, such as whole numbers, is crucial for developing problem-solving and critical thinking skills. For students with learning disabilities (LD) enrolled in the Special Education Integration Programme (PPKI), the teaching of number concepts is often challenging due to limited memory capacity, delayed cognitive development, number confusion, and difficulties in interpreting abstract mathematical concepts (Azmi & Hassan, 2021). Therefore, teachers are required to employ more concrete and engaging approaches to facilitate students' understanding and application of number concepts in daily life.

However, traditional teaching methods that remain widely practiced in special education classrooms are found to be less effective, as they fail to emphasize visual, interactive, and motivational aspects (Kamaruddin et al., 2020). In addition, teaching aids used are often not adapted to students' cognitive levels and learning styles, which causes them to lose focus and struggle to master the learning content (Roslan et al., 2021).

To address these issues, gamification has been identified as a promising instructional innovation. Gamification incorporates game elements such as rewards, levels, challenges, leaderboards, avatars, and mission narratives to enhance student motivation and engagement (Zainal et al., 2022). In the context of special education, gamification has the potential to improve focus, comprehension, and student interaction in a more enjoyable manner (Rahim & Ariffin, 2023). Although numerous studies have confirmed the effectiveness of gamification among mainstream students, there remains a significant gap in research focusing on the design and evaluation of gamified modules specifically tailored for PPKI students with learning disabilities, particularly in mastering basic number concepts (Salleh & Mokhtar, 2024).

In this regard, the present study adopts the Design and Development Research (DDR) approach to develop a gamified module suited to the needs of Year One students with learning disabilities. The needs analysis phase identifies current T&L challenges, including difficulties faced by students in learning whole numbers (0–10) and the supporting role of mathematics textbooks. The design and development phase involves constructing the gamified module based on learning theories and instructional design principles, integrating game elements tailored to students' cognitive abilities. Finally, the evaluation phase assesses the effectiveness of the developed module through a quasi-experimental method in terms of students' mastery of number concepts and learning engagement. The findings are expected to contribute to pedagogical practices in special education by providing systematic, adaptive, and learner-friendly instructional materials.

LITERATURE REVIEW

Throughout history, games have been an integral part of human life and are not in conflict with mathematics (Uğurel & Moralı, 2008). According to Umay (2002, p. 280): "Most games are mathematics, and mathematics itself is entirely a game." Reasoning, creative thinking, inference, and interaction—the fundamental structures of mathematics—can also be identified within the structure of games. This makes games a suitable element to be integrated into mathematics instruction (Hacısalihoğlu-Karadeniz, 2017; Ke & Clark, 2020; Tokac et al., 2019).

Therefore, the use of games in the teaching of mathematics can make learning more enjoyable and effective (Beyhan & Tural, 2007). The entertaining world of games has been found to positively influence students' attitudes toward mathematics, enhance learning motivation, and promote active classroom participation (Deng et al., 2020; Gök, 2020; Moon & Ke, 2020). Recent studies further demonstrate that game-based learning in mathematics not only improves cognitive outcomes such as skills and knowledge, but also has positive effects on affective domains, including interest, motivation, attitudes, and overall student engagement (Frontiers, 2023).

In the context of special education, the effectiveness of gamification in learning environments is increasingly supported by contemporary research. For example, the study Evaluating the Effectiveness of Gamified Learning in Special Education Classrooms (2024) reported that the implementation of gamification enhanced engagement, motivation, and academic achievement in special education classrooms (ResearchGate, 2024). Similarly, the study Exploring the Readiness of Teachers in the Use of Mobile Gamification (2024) revealed that special education teachers remain less systematically prepared to implement mobile gamification, particularly in managing the behavior of students with learning disabilities. This highlights the importance of considering teacher readiness and professional support when developing gamification modules (Prademic Press, 2024).

Within the framework of Design and Development Research (DDR), these findings form the foundation for designing gamification modules that are not only engaging but also responsive to the specific needs of students with learning

disabilities. The needs analysis phase addresses existing challenges in mathematics learning and teacher readiness, while the design and development phase incorporates appropriate game elements into the module. Finally, the evaluation phase measures the effectiveness of the module in terms of both student achievement and engagement.

METHODOLOGY

Problem Statement

Although the Year One Mathematics Textbook (KSSR Revised 2017) serves as the primary reference material in the Special Education Integration Programme (PPKI), pupils with Special Educational Needs – Learning Disabilities (SEN-LD) continue to face significant challenges in mastering basic whole numbers from 0 to 10. These challenges stem from cognitive limitations such as weak memory retention, short attention spans, and difficulties in comprehending abstract number concepts (Azmi & Hassan, 2021). As a result, pupils struggle to achieve adequate mastery of foundational mathematical skills, which are essential for the development of higher-order thinking skills.

Furthermore, traditional teaching methods, which remain dominant in special education classrooms, are less effective due to their abstract, linear, and non-interactive nature. Teaching aids used are often not tailored to pupils' cognitive levels and learning styles, causing them to lose focus and reducing their motivation to learn (Kamaruddin et al., 2020; Roslan et al., 2021). Although textbooks play an important role as content guides for teachers and as primary reading sources for pupils, existing designs and illustrations remain limited in supporting the specific learning needs of SEN pupils (Qhairunnisa Aziz, 2021).

In the context of innovative pedagogy, gamification has been shown to enhance motivation, interest, and student engagement in mainstream Mathematics learning (Zainal et al., 2022; Rahim & Ariffin, 2023). However, research on the effectiveness of gamification specifically tailored to SEN-LD pupils remains limited and has not been systematically developed, particularly for the topic of whole numbers 0–10 (Salleh & Mokhtar, 2024). Moreover, the readiness of special education teachers to implement gamification is still underdeveloped, especially in terms of managing student behaviour and selecting appropriate game elements (Prademic Press, 2024). This indicates a research gap that calls for the development of a systematically designed gamification module for Mathematics, anchored to the textbook as the main instructional resource.

Therefore, there is a pressing need to develop a Mathematics gamification module for SEN-LD pupils, specifically targeting the mastery of whole numbers from 0 to 10. This module should be constructed based on the Design and Development Research (DDR) approach, which emphasizes the phases of needs analysis, design and development, and evaluation. By doing so, the gamification module produced is expected not only to improve pupils' achievement in mastering basic number concepts but also to support active engagement and enhance their motivation in learning Mathematics.

Research Objectives

The general objective of this study is to identify the effectiveness of using the Year One mathematics textbook in assisting the mastery of numeracy skills for students with special educational needs in Malaysia. Meanwhile, the specific objectives of this study are to examine:

1. To identify the level of mastery of whole number concepts (0 to 10) among Special Educational Needs – Learning Disabilities (SEN-LD) pupils before and after the implementation of the gamification module developed through the Design and Development Research (DDR) approach.
2. To determine the differences in learning achievement between the experimental group, which received instruction using the DDR-based gamification module, and the control group, which received conventional instruction in the topic of whole numbers (0–10).

Research Questions

Based on the research objectives, this study aims to answer the following research questions:

1. What is the level of mastery of whole number concepts (0 to 10) among SEN-LD pupils before and after the implementation of the gamification module developed through the DDR approach?
2. Is there a significant difference in learning achievement between the experimental group that uses the gamification module and the control group that follows conventional instruction in the topic of whole numbers (0–10)?

RESULTS AND DISCUSSION

Research Design

This study employed a quantitative research design to objectively analyze data and address the research questions. Specifically, the study adopted a quasi-experimental non-equivalent control group design with pre-test and post-test measures, which is commonly used in quantitative research (Chua, 2022). Two groups of SEN-LD pupils were involved: the experimental group and the control group, matched according to their existing academic performance in Mathematics, particularly in the topic of whole numbers (0–10).

The experimental design was integrated within the Design and Development Research (DDR) framework, where the gamification module "Misi Doraemon Mencari Kuih Dorayaki" was first developed through the stages of needs analysis, design, and development. Once developed, the quasi-experimental approach was used in the implementation and evaluation phases of DDR to measure the module's effectiveness.

Accordingly, the main purpose of this design was to evaluate the effect of the gamification module on pupils' learning achievement in the topic of whole numbers by comparing the pre-test and post-test scores of the experimental and control groups. The experimental group received instruction using the DDR-based gamification module, while the control group received conventional instruction using the Year One KSSRPK Mathematics textbook.

Study Group

The study group consisted of Year 1 pupils enrolled in the Special Education Integration Program (PPKI) at a primary school in the Southwest District of Penang. This study was conducted after the gamification module "Doraemon's Mission to Find Dorayaki" had been developed through the needs analysis and design and development phases within the Design and Development Research (DDR) framework. As a continuation, this pilot study was carried out to evaluate the effectiveness of the module during the DDR evaluation phase.

A purposive sampling method was employed to ensure that the selected pupils were suitable in terms of cognitive and social functioning as well as their basic mastery of numbers 0 to 10. Selection was based on academic records, teacher observations, and confirmation of basic number concept mastery by the Mathematics special education teacher. A total of 12 SEN-LD pupils were identified and matched into two balanced groups, as shown below :

Table 1. Year 1 PPKI Pupils in Mathematics

Group	Number of Pupils	Teaching Method
Experimental Group	6 pupils	Gamification Module "Doraemon's Mission to Find Dorayaki" (DDR-based)
Control Group	6 pupils	Conventional Approach (Year 1 KSSRPK Mathematics Textbook)

Details of the study groups:

Experimental Group – consisted of 6 pupils who participated in lessons using the gamification module "Doraemon's Mission to Find Dorayaki". This module incorporated gamification elements such as missions, rewards, avatars, and game-based activities, all designed during the DDR design and development phase.

Control Group – consisted of 6 pupils who received lessons through the conventional approach using the Year 1 KSSRPK Mathematics textbook, without the integration of gamification elements.

The matched grouping ensured that both groups had relatively similar initial achievement levels. This was crucial to provide a fair comparison of the effectiveness of the gamification intervention. Therefore, the quasi-experimental design applied during the DDR evaluation phase enabled the researcher to assess not only the cognitive achievement outcomes but also the active engagement of SEN-LD pupils in learning the topic of whole numbers (0 to 10).

Research Instruments

This study employed three main instruments that were developed and applied in alignment with the phases of Design and Development Research (DDR), namely needs analysis, design and development, and evaluation:

1. **Mathematics Achievement Test (Numbers 0–10)**

This test was constructed based on the Standard Curriculum and Assessment Document (DSKP) for Mathematics and the Year One KSSRPK Mathematics textbook. It consists of subjective questions designed to measure mastery of whole numbers (0–10). The test was administered during the evaluation phase of DDR to assess pupils' performance before (pre-test) and after (post-test) the implementation of the gamification module.

2. **Gamification Module "Mission Doraemon Finds Dorayaki"**

The module was systematically developed in the design and development phase of DDR, incorporating gamification elements such as missions, avatars, rewards, game maps, and interactive tasks. It served as the main intervention for the experimental group, aiming to help SEN-LD pupils understand and master whole numbers from 0 to 10 in an engaging and meaningful way.

3. **Observation Checklist**

This instrument was created during the needs analysis and evaluation phases of DDR to assess pupils' engagement, interaction, focus, and responses throughout the teaching and learning sessions. Teachers or observers used this checklist particularly during gamification activities to gather qualitative data that complemented the achievement test results.

Overall, the integration of these three instruments enabled the researcher to comprehensively evaluate the effectiveness of the gamification module across cognitive aspects (achievement), affective aspects (motivation and engagement), and the overall quality of the module developed through the DDR approach.

Research Procedure

The intervention was conducted over a period of two weeks, involving four teaching sessions of 30–40 minutes each. The procedure was structured according to the **Design and Development Research (DDR)** phases,

particularly the *evaluation phase*, which tests the effectiveness of the developed module. Table 1.2 outlines the experimental procedure :

Table 2. Research Procedure Between Two Groups (Quasi-Experimental Design)

STEP	EXPERIMENTAL GROUP	CONTROL GROUP
Pre-test	Mathematics achievement test (Numbers 0–10)	Mathematics achievement test (Numbers 0–10)
Intervention	Gamification Module: *Mission Doraemon Finds Dorayaki*	Conventional teaching using the textbook
Post-test	Re-test on whole numbers (0–10)	Re-test on whole numbers (0–10)
Observation	Engagement checklist during gamification activities	General observation during conventional teaching

Through this design, the experimental group engaged in lessons using the gamification module developed in the DDR design and development phase, while the control group continued with conventional instruction based on the KSSRPK Mathematics textbook. Both groups were assessed using pre-tests and post-tests, in line with the evaluation phase of DDR, to determine the module's impact on pupils' mastery and engagement.

Data Analysis

Data collected were analyzed using quantitative statistical techniques, aligned with the evaluation phase of DDR, which emphasizes the systematic assessment of product effectiveness:

1. **Descriptive Statistics**

Means and standard deviations were calculated for pre-test and post-test scores within each group to describe pupils' performance levels.

2. **Independent Samples t-test**

This test determined whether there were statistically significant differences between the post-test scores of the experimental and control groups, thereby evaluating the effect of the DDR-based gamification module compared to conventional methods.

3. **Paired Samples t-test**

This analysis assessed within-group differences by comparing pre-test and post-test scores, thus identifying the degree of improvement resulting from the intervention.

All analyses were conducted using statistical software such as SPSS or Microsoft Excel, with the significance level set at $p < .05$. This ensured rigorous evaluation of the effectiveness of the gamification module developed through the DDR approach in enhancing SEN-LD pupils' achievement in whole number concepts (0–10).

Conceptual Framework Based on the Design and Development Research (DDR) Approach

This study adopts the **Design and Development Research (DDR)** framework as the guiding methodology for developing, implementing, and evaluating the gamification module "*Mission Doraemon Finds Dorayaki*". DDR is selected because it provides a systematic structure for addressing educational challenges through the design of innovative instructional solutions.

The conceptual framework of this study is structured around the three main phases of DDR:

1. **Needs Analysis Phase**
   a. Identified the challenges faced by SEN-LD pupils in mastering whole numbers (0–10), particularly their difficulties with abstract concepts, attention span, and motivation.
   b. Gathered input from teachers and reviewed the Year 1 KSSRPK Mathematics textbook to determine the suitability of its content as a foundation for developing the gamification module.
   c. Established the pedagogical necessity of integrating gamification elements such as missions, avatars, rewards, and interactive tasks to enhance engagement and comprehension.
2. **Design and Development Phase**
   a. Based on the findings of the needs analysis, the gamification module "*Mission Doraemon Finds Dorayaki*" was constructed by embedding game-based elements aligned with the cognitive and learning needs of SEN-LD pupils.
   b. The design emphasized accessibility, interactivity, and curriculum alignment, ensuring that tasks supported the learning objectives of whole numbers (0–10).
   c. The module was validated through expert review in curriculum studies and educational technology to ensure accuracy, usability, and relevance for special education contexts.
3. **Evaluation Phase**
   a. A quasi-experimental design with pre-tests and post-tests was conducted to measure the effectiveness of the gamification module.
   b. The experimental group received instruction using the DDR-developed gamification module, while the control group followed conventional textbook-based teaching.
   c. Data were analyzed using descriptive statistics, independent samples t-test, and paired samples t-test to evaluate improvements in mastery and engagement.
   d. Observational checklists were also used to capture pupils' responses, motivation, and participation during lessons.

Integration of DDR with Research Objectives

   a. The *needs analysis* addressed **Research Question 1** by establishing the baseline of pupils' mastery of whole numbers (0–10).
   b. The *design and development* phase produced the gamification module as the intervention tool.

c. The *evaluation* phase addressed **Research Question 2** by comparing learning outcomes between the experimental and control groups, thus validating the module's effectiveness.

Through this framework, DDR not only guided the systematic development of the gamification module but also ensured that the product was rigorously evaluated for its educational impact on SEN-LD pupils.

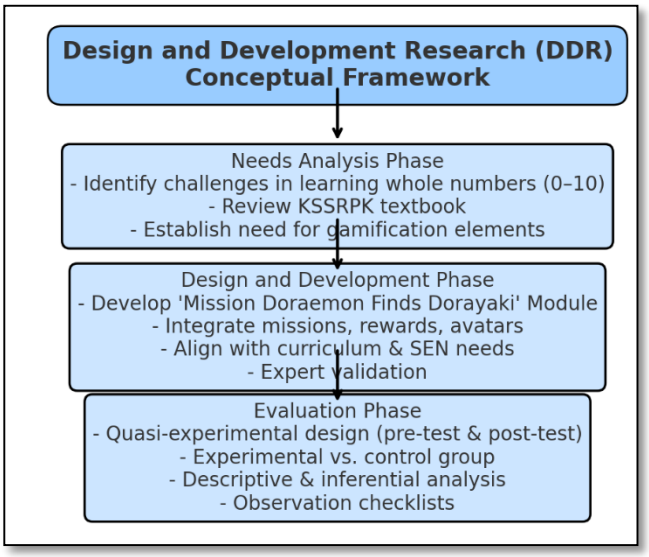

Figure 1. Conceptual Framework of DDR

The figure illustrates the Conceptual Framework of Design and Development Research (DDR), which consists of three main phases: Needs Analysis, Design and Development, and Evaluation.

1. **Needs Analysis Phase:** In this phase, the researcher identifies the challenges faced by SEN-LD pupils in learning whole numbers (0–10). The KSSRPK Year 1 Mathematics textbook is reviewed to determine content suitability and the need for integrating gamification elements to enhance learning engagement and understanding.
2. **Design and Development Phase**: Based on the needs analysis, the gamification module entitled *"Mission Doraemon Finds Dorayaki"* is developed. The module incorporates gamification elements such as missions, rewards, avatars, and game maps. It is aligned with the KSSRPK Mathematics curriculum and the specific learning needs of SEN-LD pupils. Expert validation is conducted to ensure content accuracy and usability.
3. **Evaluation Phase**: The developed module is tested using a quasi-experimental design involving pre-test and post-test procedures. Two groups are involved: the experimental group (taught using the gamification module) and the control group (taught using conventional methods with the KSSRPK textbook). Data is analyzed using both descriptive and inferential statistics, including independent and paired t-tests. Observation checklists are also employed to measure pupils' engagement during the teaching and learning process.

Overall, the figure presents the logical flow of DDR in this study, beginning with needs analysis, followed by the design and development of the gamification module, and concluding with its evaluation to determine effectiveness.

Data Analysis

The data collected in this study were analyzed using the following statistical methods:

1. **Descriptive Statistics:** Mean and standard deviation were calculated for the pre-test and post-test scores of each group to provide an overview of pupils' performance levels.
2. **Independent Samples t-test**: This test was conducted to determine whether there were significant differences in the post-test scores between the experimental group (using the DDR-based gamification module) and the control group (using conventional instruction).
3. **Paired Samples t-test**: This analysis was employed to identify changes in performance within each group by comparing their pre-test and post-test scores.

All statistical analyses were carried out using software such as SPSS or Microsoft Excel. The significance level was set at $p < .05$ to determine the effectiveness of the gamification module on pupils' learning outcomes. In line with the **Design and Development Research (DDR)** approach, this analysis phase represents the evaluation stage, where the developed gamification module is tested for its impact on SEN-LD pupils' mastery of whole number concepts. The findings from these statistical analyses serve to validate the effectiveness of the module and provide evidence-based insights into its contribution toward improving mathematics learning.

Descriptive Statistics

Descriptive statistical analysis was conducted to obtain the mean and standard deviation (SD) for the pre-test and post-test scores of both the experimental and control groups. The results of this analysis provide an initial quantitative overview of pupils' achievement levels in the topic of whole numbers (0–10) before and after the intervention. According to Chua (2022), descriptive analysis is essential in quantitative research as it lays the foundation for understanding data patterns and preliminary changes in scores, which subsequently support the inferential analyses to be carried out.

In the context of **Design and Development Research (DDR)**, descriptive statistics form part of the evaluation phase. They provide baseline insights into pupils' mastery of whole number concepts and help researchers to assess whether the gamification module—developed through DDR—shows potential effectiveness before deeper inferential tests are conducted. Table 1.3 below illustrates the Mean and Standard Deviation of Pre-test and Post-test Scores for both the Experimental and Control Groups:

Table 3. Mean and Standard Deviation of Pretest and Posttest Scores for the Experimental and Control Groups

Group	N	Test	Mean (M)	Standard Deviation (Sd)
Experimental	6	Pretest	38.33	4.50
		Pretest	78.67	5.16
Control	6	Posttest	39.00	5.01
		posttest	52.50	6.23

Table 1.3 presents a comparison of the mean scores (M) and standard deviations (SD) for the pretest and posttest results obtained by both the experimental and control groups. The analysis indicates that the experimental group recorded a more substantial increase in scores compared to the control group after the intervention. Specifically, the experimental group, which participated in teaching sessions using the gamified module "Doraemon's Mission to Find Dorayaki", demonstrated an improvement in mean scores from 38.33 (SD = 4.50) in the pretest to 78.67 (SD = 5.16) in the posttest. This increase of 40.34 points highlights the positive impact of gamification on students' achievement, particularly in mastering whole numbers from 0 to 10. The low and stable standard deviation within this group also reflects that the improvement was consistent across the participating students.

In contrast, the control group, which received conventional teaching based on the KSSRPK textbook, showed a smaller increase in mean scores—from 39.00 (SD = 5.01) to 52.50 (SD = 6.23). Although there was an improvement of 13.50 points, this increase was substantially lower than that of the experimental group and may be attributed to repeated exposure to the same content rather than the effect of a more interactive teaching approach.

These findings align with Chua (2022), who emphasizes that descriptive statistical analysis serves as an essential initial step in identifying patterns and directions of change in data before generalizations are made through inferential analysis. Within the context of this study and under the Design and Development Research (DDR) framework, the descriptive data provide preliminary evidence that a gamified approach can more effectively enhance the mastery of foundational concepts in the Mathematics subtopic of whole numbers 0–10, compared to conventional methods. This is particularly relevant for students with special learning needs (MBPK-MP), supporting the iterative process of DDR by informing the design and refinement of educational interventions.

Independent Samples T-Test

In this study, the researcher employed the Independent Samples T-Test to determine whether there was a significant difference in student achievement between the experimental and control groups. Two forms of t-tests were selected: the paired samples t-test and the independent samples t-test. This test is essential for evaluating the effect of the gamified module intervention on the achievement of Year One students with special educational needs for learning difficulties (MBPK-MP) in the topic of whole numbers 0–10.

According to Chua (2022), the use of the t-test in quantitative research is appropriate when comparing two statistically different data groups, especially when the sample size is small and the data are interval or ratio-scaled. The t-test can confirm whether the difference observed in mean scores is statistically significant or merely occurred by chance. Table 1.4 is presented as follows:

Paired Samples t-Test

The paired samples t-test was used to measure the change in scores within the same group before and after the intervention. The test results are as follows:

Table 4. Comparison of Pretest and Posttest Scores in the Experimental and Control Groups

Group	Pretest Mean	Posttest Mean	T-Value	Sig. (P)
Experimental	38.33	78.67	-14.72	0.000*
Control	39.00	52.50	-5.42	0.002*
**** Significant at p < .05***				

Based on Table 1.4, the findings from the paired samples t-test indicate that the experimental group demonstrated a statistically significant increase in posttest scores compared to pretest scores ($t = -14.72$, $p = 0.000$). This result suggests that the implementation of the gamified module *"Doraemon's Mission to Find Dorayaki"* had a strong positive impact on student achievement, particularly in the topic of whole numbers 0–10. The substantial increase in scores reflects the effectiveness of the module in helping MBPK-MP students develop a deeper understanding of foundational mathematical concepts.

Meanwhile, the control group also showed a significant improvement between pretest and posttest scores ($t = -5.42$, $p = 0.002$). However, the magnitude of improvement was much smaller than that of the experimental group. This suggests that conventional teaching approaches based on the KSSRPK textbook have a more limited effect on student achievement, potentially due to the lack of motivational elements, interactive engagement, and self-directed practice that are typically embedded in gamified approaches.

Furthermore, these findings are consistent with Rahim et al. (2021), who reported that gamification-based teaching approaches can enhance motivation and academic achievement among students with special educational needs for learning difficulties, especially when students are exposed to game elements such as rewards, challenges, and missions. These elements not only increase student engagement in learning activities but also support the understanding and retention of fundamental mathematical concepts for students with special learning needs.

In the context of the Design and Development Research (DDR) framework, the significant improvement in the experimental group provides empirical evidence that the gamified module is an effective intervention. The DDR approach emphasizes iterative design, development, and evaluation, and these results support the module's efficacy in enhancing learning outcomes for MBPK-MP students. This evidence underscores the potential of gamification as a

more effective alternative to traditional textbook-oriented teaching methods in Mathematics for students with learning difficulties.

Independent Samples t-Test

The researcher also selected the Independent Samples t-Test to evaluate whether there was a significant difference between two different groups, namely the experimental and control groups, in their posttest scores.

Table 5. Comparison of Posttest Scores Between the Experimental and Control Groups

Group	Posttest Mean	Standard Deviation (Sd)	T-Value	Sig. (P)
Experimental	78.67	5.16	9.12	0.000*
Control	52.50	6.23		
**** Significant at p < .05***				

Based on Table 1.5, the data analysis comparing posttest scores between the experimental and control groups indicates a statistically significant difference between the two groups ($t = 9.12$, $p = 0.000$), with the experimental group achieving substantially higher scores than the control group. These results provide evidence that the use of the gamified module had a positive impact on learning and understanding of basic mathematical concepts among MBPK-MP students.

Furthermore, these findings are consistent with Lee & Hassan (2020), who reported that gamification approaches significantly enhance student achievement by stimulating both cognitive and positive emotional engagement through enjoyable and interactive activities. Additionally, Nordin and Omar (2023) highlighted that gamification elements such as rewards, avatars, and missions can improve student focus and understanding in special education classrooms, particularly in mastering foundational skills.

CONCLUSION AND RECOMMENDATION

Based on the results of both t-tests, the findings indicate that the intervention using the gamified module *"Doraemon's Mission to Find Dorayaki"* had a significant and positive effect on the achievement of MBPK-MP students in the topic of whole numbers 0–10. This demonstrates the effectiveness of the gamification approach in enhancing the understanding of basic mathematical concepts compared to conventional teaching methods.

According to Chua (2022), when data show statistically significant differences through inferential tests, it provides confidence that the observed effects are not due to chance but are the result of a systematic and well-planned intervention. In the context of the Design and Development Research (DDR) framework, these findings validate the iterative design and evaluation process, showing that the gamified module effectively meets the learning needs identified during the needs analysis phase. The empirical evidence supports the module's potential as an alternative instructional approach, reinforcing the value of DDR in developing educational interventions that are both evidence-based and tailored to the needs of special education students.

Implications of the Study

Textbooks serve as primary reading materials that provide quality guidance, support, and reference for teachers during teaching and learning, both inside and outside the classroom. Research on textbooks has demonstrated positive implications for teaching practice. However, ongoing evaluation of the suitability of textbook design and illustrations by teachers remains necessary to continuously improve the quality of education through the use of high-quality learning materials.

Jennifer (2020) highlights that although students' academic performance varies according to their individual achievement levels, only a few teachers actively adapt instructional techniques in their teaching. Most teachers continue to rely on traditional methods, such as rote memorization and worksheets, without ensuring that students fully understand topics as suggested in the textbooks. Therefore, teachers must possess strong pedagogical skills to ensure that classroom learning is delivered effectively, particularly for students with learning difficulties, in order to maximize both teacher and student capabilities when using mathematics textbooks.

This study presents several key implications in the context of teaching and learning for students with special educational needs in the learning difficulties category (MBPK-MP), particularly in mastering foundational mathematical concepts. The findings demonstrate that the intervention using the gamified module "Doraemon's Mission to Find Dorayaki" had a positive and significant effect on student achievement in the topic of whole numbers 0–10.

Firstly, the improvement in posttest scores among students in the experimental group indicates that gamification strategies are effective in reinforcing conceptual understanding. The intervention supports the learning needs of MBPK-MP students, who tend to respond well to visual, structured, and activity-based approaches. This aligns with Rahim et al. (2021), who emphasized that integrating game elements into teaching can enhance attention and

engagement among special education students, thereby improving academic outcomes.

Secondly, the implementation of the gamified module promotes transformation in special education teachers' pedagogical strategies, particularly in designing learning experiences that are more engaging and meaningful. The study signals to teachers that conventional, textbook-centered teaching alone may be insufficient to meet the needs of MBPK-MP students, who benefit from repetition, concrete activities, and continuous encouragement.

Thirdly, the gamified module, designed with missions, avatars, maps, and a reward system, contributes to the development of innovative teaching aids in special education. It offers an alternative to existing instructional resources, which are often generic and not responsive to the learning needs of students with special educational needs in the learning difficulties category. Active student engagement during gamified activities also demonstrates the potential of this strategy to enhance intrinsic motivation and positive attitudes toward Mathematics, which are crucial for the development of early numeracy literacy.

From the perspective of the Design and Development Research (DDR) framework, these implications highlight the value of iterative design, development, and evaluation in producing instructional interventions that are empirically validated and tailored to learners' needs. The gamified module serves as a model of how DDR can be applied to create meaningful, effective, and adaptable teaching materials that improve both student outcomes and teacher practices.

Therefore, this study also has the potential to enhance teacher motivation in implementing KPM-produced mathematics textbooks for students with learning difficulties, ensuring more effective and engaging classroom learning experiences in the future.

Based on the limitations and findings of this study, several recommendations are proposed for future research. First, this study involved a small sample size and was limited to a single school. Therefore, future research is recommended to include a larger sample and multiple locations or states, in order to produce more comprehensive findings that can be generalized to a broader population of MBPK-MP students.

Additionally, the duration of the intervention in this study was short, spanning only two weeks. Future studies should consider implementing longer intervention periods to evaluate the effectiveness of gamification longitudinally, including its impact on knowledge retention, problem-solving skills, and social development of students. Furthermore, future research could involve teachers and parents as sources for data triangulation, particularly in assessing changes in students' learning behaviors, motivation, and self-efficacy. Involving multiple stakeholders would provide a more holistic understanding of the intervention's effectiveness. Moreover, since this study focused only on the topic of whole numbers 0–10, subsequent studies could expand the scope to other mathematical topics, such as addition, subtraction, and patterns, as well as other subjects like Malay Language or Science, to examine the effectiveness of gamification strategies across different learning domains.

Finally, future research could integrate digital technology elements, such as mobile applications or interactive learning platforms, to enhance the effectiveness and accessibility of gamified strategies. This aligns with the demands of 21st-century education, which emphasize the use of technology as a facilitative tool in teaching and learning, particularly in special education contexts that require flexible and adaptive approaches. From the perspective of the Design and Development Research (DDR) framework, these recommendations highlight the importance of iterative cycles of design, development, implementation, and evaluation. By expanding the sample, extending intervention duration, incorporating multiple stakeholders, and integrating digital technologies, future DDR studies can further refine and validate gamified instructional interventions to meet the evolving needs of MBPK-MP students effectively.

Overall, the evaluation of the Mathematics gamified module titled "Doraemon's Mission to Find Dorayaki" for the topic of whole numbers 0–10 highlights the importance of design elements that are engaging, user-friendly, and aligned with the needs of students with special educational needs in the learning difficulties category (MBPK-MP). Based on the analysis of overall mean scores, the findings indicate that the suitability of the gamified module is generally good. However, there remains room for improvement, particularly in terms of visualization, activity flow, and the effectiveness of visual aids in conveying numerical concepts more explicitly and meaningfully.

Meanwhile, the overall mean scores reflect special education teachers' perceptions of the module's effectiveness in supporting student learning. High scores indicate that the gamification elements and visual presentation are appealing and accessible to students, while lower scores highlight areas for refinement, such as aligning the difficulty level of activities with students' cognitive abilities and their capacity to maintain focus throughout the tasks. This suggests that although the module design has successfully met some of the learning needs, further attention is needed to adapt content and activities to the individual abilities of students.

Therefore, the involvement of special education teachers in providing feedback and recommendations is crucial for enhancing the design and content of the gamified module to make it more inclusive and effective. Moreover, curriculum developers and educational policymakers are encouraged to conduct periodic evaluations and research to improve gamification-based modules, guided by empirical evidence and students' actual needs.

From the perspective of the Design and Development Research (DDR) framework, this study demonstrates the value of iterative cycles of design, development, and evaluation. Continuous feedback and refinement ensure that the module is systematically enhanced to maximize its impact on cognitive development and meaningful learning. Gamified modules like this have the potential to be designed with greater effectiveness, thereby supporting the foundational number concepts and overall mathematical learning for Year One MBPK-MP students in the KSSRPK curriculum.

FUTHER STUDY

This research still has delays, so it is necessary to conduct further research related to the topic A Gamification-Based Learning Module for Enhancing Mastery of whole Numbers 0–10 Among Students with Special Educational Needs in order to improve this research and add insight for readers.

REFERENCES

Ali, A. A., & Tan, B. P. (2024). Pembangunan permainan papan untuk pengajaran dan pembelajaran kewarganegaraan digital [The development of a board game for teaching and learning digital citizenship]. JSSH Online, 8(4), 82–107

Azizi Jaafar (2015). Penilaian pelaksanaan kurikulum pendidikan islam sekolah menengah berasaskan model context-input-process-product (CIPP). Tesis Phd (tidak diterbitkan), Universiti Utara Malaysia.

Azizi Yahya. (1999). Keberkesanan perlaksanaan program kemahiran hidup di sekolah-sekolah menengah di Malaysia berdasarkan model penilaian konteks, input, proses dan produk. Tesis PhD (tidak diterbitkan), Universiti Pertanian Malaysia.

Azizi Yahaya. (2001). The using of model context, input, process and products (CIPP) in learning programs assessment. Paper presented at the International Conference on Challenges and Prospects in Teacher Education. July 16-17, 2001, University of Technology Malaysia.

Azizi Yahaya. (2007). Menguasai penyelidikan dalam pendidikan. Kuala Lumpur: PTS Publications & Distributors Sdn. Bhd.

Azizi Yahaya. (2009). Penggunaan Model KIPP dalam penilaian mata pelajaran Kemahiran Hidup di sekolah menengah di Malaysia. Jurnal Penyelidikan Pendidikan, 20(10), 73-78.

Anisah Abdul Razak (2009). Permasalahan dalam KOMSAS Bahasa Melayu. Dimuat turun daripada http://suhanis87.blogspot.com/2009/10/permasalahn-dalam-KOMSAS. html pada Februari 2014

Fuzirah Hashim, Bahiyah Abdul Hamid, Kesuma A. Bakar & Zarina Othman. (2018)11. Gambaran gender dalam buku teks Bahasa Inggeris. Malaysia Geografia OnlineTM Malaysian Journal of Society and Space, 14(4), 174-187. doi: https://doi.org/10.17576/geo-2018-1404-14

Fatima, S. (2024, October). Evaluating the Effectiveness of Gamified Learning in Special Education Classrooms. Prosiding konferensi Technology in Education, Karachi.

Georgakellos,D.A dan Marcis,A.M. (2009). Application of The Semantic Learning Approach In The Feasibility Studies Preparation Training Process. Information System Management, Vol 26(3) :231-240

Ghazali Yusri Abd Rahman. (2012). Penilaian kemahiran lisan dalam kurikulum bahasa arab di Universiti Teknologi Mara (UiTM). Tesis PhD (tidak diterbitkan), Universiti Kebangsaan Malaysia.

Iskandar Nursit. (Volume I, Nomor 1, Februari 2015, Issn: 2442–4668). Pembelajaran Matematika Menggunakan. Jurnal Pendidikan Matematika, Halaman 42–52.

Jamila K.A. Mohamed. (2012). Penerapan Kemahiran Literasi Bagi Murid Prasekolah Masalah Pendengaran di SKPK. Tesis Doktor Falsafah. Universiti Kebangsaan Malaysia : BangiKamus Dewan Edisi Keempat (2015). Kuala Lumpur : Dewan Bahasa Dan Pustaka.

Jamila Mohd, Ooi Guan Lee & Rie Kitade. (2017). Isu dalam penulisan dan penggunaan buku teks bahasa Jepun Kurikulum Bersepadu Sekolah Menengah tingkatan lima. Jurnal Bahasa dan Budaya Jepun, 6, 153-169.

Karamert, Ö., & Kuyumcu Vardar, A. (2021). The effect of gamification on young mathematics learners' achievements and attitudes. Journal of Educational Technology & Online Learning, 4(2), 96–114. https://doi.org/10.31681/jetol.904704

Kementerian Pendidikan Malaysia (2017). Semakan Dokumen Standard Kurikulum KSSRPK Asas 3M Masalah Pembelajaran. Putrajaya

Kementerian Pendidikan Malaysia (2010). KIA2M Untuk Kadar Literasi Dan PROTIM Untuk Kadar Numerasi. Putrajaya

Kementerian Pendidikan Malaysia (2018). Buku Dasar Pendidikan Kebangsaan. Edisi Ketiga. Putrajaya.

Kementerian Pendidikan Malaysia (2015). Kod Amalan Pendidikan Murid Berkeperluan Khas. Bahagian Pendidikan Khas, Putrajaya.

K.A Razhiyah (2016). Panduan Bagi Ibu Bapa Membesarkan Anak Istimewa. Pahang : PTS Profesional Publishing Sdn.Bhd.

Kementerian Pelajaran Malaysia (2015). Plan Pembangunan Pendidikan Malaysia. Kuala Lumpur.

Mohd. Najib Abdul Ghafar. (2006). Reka Bentuk Tinjauan Soal Selidik Pendidikan.Skudai : Penerbit Universiti Teknologi Malaysia

Mohd. Zuri Ghani, Aznan Che Ahmad (2014). Kaedah Dan Strategi Pengajaran Kanak-kanak Beerkeperluan Khas. Pulau Pinang : Penerbit Universiti Sains Malaysia.

Mohd. Zuhir Abd. Rahman (2005). Penilaian Dalam Pembelajaran : Satu Kajian Buku Teks KBSM Bahasa Arab Komunikasi. Tesis Ijazah Sarjana Pendidikan. Universiti Malaya.

Mohd. Zuri Ghani. (2014). Pendidikan Kanak-Kanak Berkeperluan Khas. Tanjong Malim : Penerbit Universiti Pendidikan Sultan Idris.

Mohd. Zuri Ghani, Aznan Che Ahmad (2011). Kaedah Dan Strategi Pengajaran Kanak-kanak Beerkeperluan Khas. Pulau Pinang : Penerbit Universiti Sains Malaysia.

Mohd. Sharifudin Yusof (2015). Kertas Kerja Forum "Literasi Melestari Budaya" pada 9 September 2014. Majlis Astaka Minda, Dewan Bahasa Dan Pustaka

Mohd. Zuhir Abd. Rahman (2015). Penilaian Dalam Pembelajaran : Satu Kajian Buku Teks KBSM Bahasa Arab Komunikasi. Tesis Ijazah Sarjana Pendidikan. Universiti Malaya.

Mohd Nazri Abd. Rahman, Rosman Ishak, Juhara Ayob, Saedah Siraj, Norlidah Alias, Rohani Bdul Aziz, Ruslina Ibrahim (2014). Transformasi Bentuk Pentaksiran dan Penilaian Buku Teks: Aplikasi Interpretive Structural Modelling (ISM). Jurnal Kurikulum Dan Pengajaran Asia Pasifik, Bil. 2(2) : 16- 22.

Minoo Alemi dan Nikan Sadehvandi (2012). Textbook Evaluation : EFL Teacher's Perspectives On "Pacesetter Series". English Language Teaching, Vol.5 (7), 64-74

Nor Asiah Ismail (2011). Penguasaan Penulisan Karangan Bahasa Melayu Dari Perspektif Komunikatif. Pahang : IPGM Kampus Ampuan Afzan

Nur Atiqah Md. Sungif, Dayang Hartijah Abang Ahmad & Jayakaran Mukundan (2014). Evaluation of Malaysian Primary English Language Textbooks. Advances In Language And Literacy Studies, Vol. 5(5): 5-9.

Norazilawati Abdullah, Noraini Mohd. Noh, Mahizer Hamzah, Nik Azmah Nik Yusuf dan Rumaizah Omar (2017). Kesediaan Guru Sains dan Matematik Dalam Pelaksanaan Kurikulum Standard Sekolah Rendah. Jurnal Pendidikan Sains dan Matematik Malaysia, Vol.4(1), 81-96.

Qhairunnisa Aziz. (2015). Ilustrasi dalam buku teks bahasa Malaysia tahun dua sepanjang tahun 1974-1984. (Tesis Sarjana yang tidak diterbitkan). Pulau Pinang: Universiti Sains Malaysia.

Rahmita Yuliana Gazali. (Vol. 2, No. 3, September - Desember 2016). Pembelajaran Matematika Yang Bermakna. Math Didactic: Jurnal Pendidikan Matematika, Issn 2442-3041.

Rashidah Begum Gelamdin, Norlidah Alias dan Dorothy Dewitt (2015). Penerapan Pendidikan Bioteknologi Dalam Kalangan Guru Biologi Sekolah Menengah : Kajian Kebolehlaksanaan. Jurnal Kurikulum & Pengajaran Asia Pasifik, Bil.2(1) : 55-60.

Raja, S. A. P., & Nordin, M. N. (2024). Exploring the readiness of teachers in the use of mobile gamification to handle the disruptive behavior of students with learning disabilities. Special Education [SE], 2(1), e0019. https://doi.org/10.59055/se.v2i1.19

Salila Shahar (2018). Peranan Buku Teks Bahasa Melayu Di Beberapa Buah Sekolah Dalam Zon Keramat, Kuala Lumpur. Kertas Projek Sarjana Pendidikan. Universiti Malaya: Kuala Lumpur.

Stufflebeam, D.L. (1994). Standard For Evaluation of Educational Programs, Project and Material. In The Joint Committee On Standard For Educational Evaluation. American Evaluation Assosiation.

Thotapally Anjaneyulu (2014). A Critical Analysis Of The ELT Books In Andra Pradesh, India. An International Refered E-Journal Of Literacy Exploration, Vol.2 (2) : 816- 832

Yahya Ibrahim. (2017). Pembangunan Modal Insan: Isu dan Cabaran. Selangor : Penerbit Universiti Kebangsaan Malaysia.

Yasin, A. A., Masri, R., Adnan, M., & Mohamed, F. (2021). Development of STEM mathematical model based on values and morals in primary schools: A needs analysis. Jurnal Pendidikan Sains dan Matematik Malaysia,