



Implementation of Interactive Media and Gamification for Students with Special Needs (ADHD) as an Effort to Strengthen Multicultural Values

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ABSTRACT: This study aims to implement interactive media and gamification as a learning strategy for students with special needs, including Attention Deficit Hyperactivity Disorder (ADHD), as well as an effort to strengthen multicultural values at SMK Matang Jaya, Kuching, Sarawak, Malaysia. The study used a descriptive qualitative approach with a case study method involving five ADHD students, three subject teachers, and one inclusive education teacher. Data were collected through observation, interviews, documentation, and student response questionnaires. The results showed that the use of interactive media and gamification was able to increase the learning focus of ADHD students from an average of 5–10 minutes to 15–25 minutes. In addition, students showed increased motivation, behavioral control, and understanding of the material. Gamification elements such as points, levels, avatars, and challenges successfully maintained student engagement. The integration of multicultural values through character visuals, Indonesian–Malaysian cultural symbols, and collaborative activities was able to foster attitudes of tolerance, cooperation, and appreciation for diversity. Overall, the implementation of interactive media and gamification was proven to be effective in supporting inclusive learning and strengthening multicultural values. This research also strengthens international cooperation between PGRI Pontianak University and Matang Jaya Vocational School Kuching Sarawak Malaysia.

KEY WORDS: Interactive Media, Gamification, ADHD, Inclusive Education, Multicultural, International Learning

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1. INTRODUCTION

Multicultural education is currently a crucial pillar in creating an inclusive, harmonious, and adaptive learning environment for diverse students. Schools in Southeast Asia, including Malaysia and Indonesia, are inextricably linked to diverse social realities, encompassing culture, ethnicity, language, and individual characteristics. In this context, SMK Matang Jaya Kuching Sarawak Malaysia is one such school with a multicultural student body comprising Malay, Dayak, Chinese, and other ethnic backgrounds living side by side. This diversity is further complicated by the presence of students with special needs, including those with Attention Deficit Hyperactivity Disorder (ADHD), who require specialized learning approaches to optimally engage with the learning process.

Inclusive education is an important approach in education that emphasizes that everyone, including people with special needs, has the right to receive a high-quality education in an equal learning environment (Zahroh, Wardani, Salimah, Putri, & Delta, 2025). There are several types of children with special needs, including autistic, hyperactive, mentally retarded, deaf, blind, mute, Down syndrome, and others (Suzuki Syofian, 2017). Children with special needs are children who require special treatment due to developmental disorders or abnormalities that affect their physical, psychological or social development (Alfirah & Gustiana, 2024). Children with special needs are children who have characteristics that differ from those of children in general. They experience obstacles in their growth and development. They have disabilities compared to other normal children (Azizah, Nisak, Wildan, & Widyastuti, 2024). Children with Special Needs can be abbreviated to ABK. One of them is a child with Attention Deficit Hyperactivity Disorder, or ADHD for short (Megaputri & Rusmawan, 2023). Attention Deficit Hyperactivity Disorder (ADHD) is a neurobiological developmental disorder characterized by three main symptoms: difficulty maintaining attention, impulsive behavior, and hyperactivity that appears inappropriate for a child's developmental age. ADHD, or Attention Deficit Hyperactivity Disorder, is an attention deficit disorder. The term refers to an internationally recognized medical condition that affects brain function

Implementation of Interactive Media and Gamification for Students with Special Needs (ADHD) as an Effort to Strengthen Multicultural Values

(Vidyananta, Noviyanthi, & ..., 2025).

Children with ADHD show inadequate social behavior accompanied by social disorders and problems with reciprocal relationships with their environment (Ni Luh Putu Ika Sintya Devi & Ni Ketut Suarni, 2024). The behavioral impacts of ADHD include being demanding, interfering with others, easily frustrated, lacking self-control, and easily changing attitudes. The social impacts on children with ADHD include selfishness and anxiety (Ulfadhilah & Nurkhafifah, 2024). Students with ADHD are characterized by difficulty concentrating, high impulsivity, hyperactivity, and being easily distracted by external stimuli. In conventional learning environments, these conditions often cause students to have difficulty following instructions, failing to complete assignments on time, and even experiencing difficulties interacting socially with peers. Children with special needs with ADHD often experience difficulties concentrating, controlling impulses, and regulating behavior, which significantly impacts their ability to participate in classroom learning (Putri & Harsiwi, 2025). ADHD children who cannot control their behavior often disturb their friends during the teaching and learning process (Zahroh et al., 2025). This shows the need for learning strategies that are not only interesting and interactive, but also able to respond to their cognitive, social and emotional characteristics.

On the other hand, multicultural schools like Matang Jaya Vocational School require learning media that can accommodate the cultural diversity of students and strengthen inclusive values such as tolerance, cooperation, mutual respect, and acceptance of differences. Integrating multicultural education into learning not only builds student character but also creates a safe and comfortable learning environment for all students, including those with special needs. Special schools, or SLB, are schools that implement special learning processes for students with conditions that differ from those of the general population. These different conditions require different approaches to the learning process (Hakim, 2020).

Based on this need, a research team from the Mathematics Education Study Program at Universitas PGRI Pontianak conducted international research as a form of academic collaboration between Indonesia and Malaysia. This research aims to develop and implement interactive media and gamification specifically designed to help students with ADHD improve engagement, concentration, motivation, and task completion abilities. The media not only functions as a learning aid but is also integrated with multicultural elements, such as cultural visuals, ethnic characters of the Nusantara-Sarawak archipelago, and moral messages about diversity and tolerance.

The use of interactive media and gamification is considered highly relevant because: 1) ADHD students are highly responsive to visual stimuli and motion-based activities, so interactive media can help them maintain focus for longer. 2) Gamification (game-based learning) provides a fun learning experience with points, levels, challenges, and rewards, thus motivating students to engage consistently. 3) Multicultural school environments require media that can be a bridge to understanding differences, so that learning is not only oriented towards subject content, but also on the formation of multicultural character. 4) Cross-country academic collaboration (Indonesia–Malaysia) reflects a joint effort to improve the quality of inclusive education in the region, while also being a model of best practice that can be replicated in other schools. Digital media is declared valid as an interactive medium for learning for children with special needs while increasing their creativity (Egiagustandi & Imron, 2024). Interactive media is a form of technology-based learning media that enables a two-way relationship between the user and the system. This media integrates various components such as text, images, sound, animation, video, and interactive navigation that users can respond to directly.

Interactive digital media for learning is very good to use (Kurniawan Andri dan Lutfi Isnı Badiah, 2021). The interactive multimedia developed is suitable for use as a medium for independent student learning (Sari & SAB, 2017). The use of interactive media for students, especially students with special needs, can improve assessment in the learning process, can increase the creativity of students with special needs, and can motivate children with special needs to learn (Egiagustandi & Imron, 2024). Overall, interactive media is a modern learning tool capable of meeting the academic and psychological needs of students with ADHD. Students in inclusive schools are expected to have abilities equal to those of other students. One learning method that can be used is to create interactive media (Herdi, Erliani, Capah, & Jumaryadi, 2024). In addition, Gamification is a game process that can increase performance motivation by increasing user involvement with a sense of enthusiasm in carrying out existing challenges (Sagirani, Wahyuningtyas, Wulandari, & Efendi, 2020). Gamification is the use of game elements in a non-game context to motivate and engage students in learning (Hidayati & Rafikayati, 2024).

Thus, this research has high pedagogical, psychological, social, and cultural urgency. The application of interactive media and gamification is not only aimed at improving the quality of mathematics learning for students with ADHD, but also as a strategic effort to strengthen multicultural values, which are an important foundation for maintaining social harmony in schools. Furthermore, this research is expected to strengthen international collaboration networks and contribute to the development of learning innovations in multicultural schools in Malaysia, Indonesia, and the Southeast Asian region in general.

II. METHOD

This study used a quantitative approach with a One-Group Posttest-Only Design, a research design involving one group of students without a pretest, so that learning outcomes were measured only after the treatment was administered. The quantitative approach was chosen because it allows researchers to objectively measure the impact of the intervention through numerical data and

Implementation of Interactive Media and Gamification for Students with Special Needs (ADHD) as an Effort to Strengthen Multicultural Values

statistical analysis. In this design, the research subjects, namely one class of students with special needs (ADHD) in a multicultural school environment, were directly given treatment in the form of the use of interactive media and gamification in the learning process. After the learning was completed, students were given a posttest or final evaluation aimed at determining learning outcomes, level of engagement, and understanding of multicultural values gained from the intervention.

A One-Group Posttest-Only Design is used when research conditions do not permit or are irrelevant to conduct an initial measurement (pretest), for example due to time constraints, student characteristics, or research objectives that focus more on assessing final outcomes than changes in ability. In this design, the basic assumption is that student achievement on the posttest is a direct representation of the effects of the treatment given. Posttest data are then analyzed using descriptive statistics, such as mean scores, score distributions, percentage completion, or other indicators of success. In some cases, data can also be compared to competency standards, performance indicators, or certain minimum scores to determine the effectiveness of the intervention.

This design is particularly appropriate for research involving students with ADHD, as it avoids the unnecessary stress or distraction that can arise from repeated pretests and measurements. Furthermore, it provides a practical overview of how interactive media and gamification impact learning outcomes in real-world situations. Thus, a quantitative approach with a One-Group Posttest-Only Design provides an effective, efficient, and focused way to evaluate the success of using innovative learning media in inclusive and multicultural classroom settings.

The subjects in this study consisted of 5 students with ADHD, 3 subject teachers, 1 inclusive education teacher, and school management. The study was conducted at SMK Matang Jaya, Kuching, Sarawak, Malaysia. SMK Matang Jaya, Kuching, Sarawak, Malaysia was chosen as the research location because this school has characteristics that are highly relevant to the research focus, namely the integration of interactive media and gamification in learning for students with special needs (ADHD) in a multicultural environment. This school is known as an educational institution that has a diversity of students from various ethnic, cultural, and linguistic backgrounds, thus becoming a real representation of the multicultural educational environment that is the target of the study. In addition, SMK Matang Jaya has a number of students with special needs, including ADHD, who require adaptive and innovative learning strategies to be able to participate optimally in learning activities. This condition provides an opportunity for researchers to directly observe the effectiveness of interactive media and gamification in improving students' focus, motivation, and understanding of multicultural values in a real learning situation.

On the other hand, this school is open to international collaboration and has a good relationship with the Mathematics Education Study Program of Universitas PGRI Pontianak, thus facilitating coordination, communication, and the implementation of cross-border research. The school's supportive learning innovation environment, as well as the willingness of teachers and school management to collaborate, were also important considerations in selecting the location. Furthermore, the geographical and cultural proximity between Sarawak (East Malaysia) and West Kalimantan (Indonesia) makes this school an ideal place to develop media based on Indonesian-Malaysian multicultural values. Thus, SMK Matang Jaya is seen as an appropriate, strategic, and potential research location to produce relevant, authentic, and beneficial findings for the development of inclusive education and multicultural learning. The data collection technique in this study was adapted to a quantitative approach aimed at obtaining objective data regarding student learning outcomes after being given treatment in the form of the use of interactive media and gamification. Data collection was carried out through three main techniques: tests, observations, and questionnaires. First, the test technique was used to measure student learning outcomes and understanding of the material after participating in learning using interactive media. The test was a posttest in the form of multiple-choice questions, short answer questions, and performance-based tasks designed to assess students' cognitive abilities. This test instrument serves to detect the extent to which interactive media and gamification are able to increase academic understanding and student engagement in learning activities.

Second, observation techniques were used to measure the learning behavior of students with ADHD during the learning process. Observations were conducted directly by researchers and accompanying teachers using structured observation sheets that assessed indicators such as attention focus, level of engagement in activities, response to instructions, and ability to follow the learning flow. The observation sheets used a rating scale to generate quantitative data that could be analyzed statistically. This technique is important because students with ADHD are characterized by impulsivity, difficulty focusing, and hyperactivity, so systematic observation is necessary to understand the dynamics of their behavior when interacting with learning media.

Third, a questionnaire technique was used to measure students' understanding and attitudes toward multicultural values integrated into the learning media. The questionnaire contained Likert-scale statements, such as tolerance, cooperation, respect for Indonesian-Malaysian cultural differences, and readiness to interact in a multicultural environment. This questionnaire was designed to be simple and easy to understand according to the characteristics of ADHD students to obtain more accurate and representative data. The use of these three data collection techniques complemented each other so that researchers could obtain a comprehensive picture of the impact of learning interventions from both cognitive, behavioral, and multicultural attitude aspects of students. The data analysis techniques used were descriptive statistical analysis, program effectiveness analysis, and categorization analysis of observation and questionnaire scores.

III. RESULTS

The results of the study indicate that the use of interactive media and gamification based on multicultural values at SMK Matang Jaya Kuching Sarawak Malaysia has a positive impact on the learning process of students with special needs, especially students with ADHD characteristics. Students appear more focused, motivated, and able to follow instructions better when the media used is visual, interactive, and equipped with short stimuli. Learning activities also show improvements, such as students are quicker to respond, able to complete tasks independently, and more enthusiastic when activities are packaged in the form of educational games.

From a multicultural perspective, student and teacher responses indicated that the integration of Indonesian and Malaysian cultural elements (language, symbols, local characters, and story context) made it easier for students to understand the material and feel more connected to their learning environment. Teachers considered this medium effective as a bridge to instill values of tolerance, respect for differences, and positive interactions in inclusive classrooms.



Figure 1: Gamification View

Furthermore, observations during the lesson showed that teachers found the media helpful because it provided structured, concise, and easy-to-follow learning steps for students with ADHD. Teacher engagement increased because the learning process became more focused and less energy-draining in managing students' attention. Meanwhile, interviews with students indicated that they felt "happier," "less bored," and "easier to understand" when using interactive media and gamification compared to traditional learning.



Figure 2: Gamification Implementation

The t-test results on the posttest data indicate a significant difference between the average student learning outcomes after using interactive media and gamification based on multicultural values and the KKM (minimum learning standards). The calculation shows that the calculated t-value is greater than the t-table at a significance level of 0.05. Furthermore, the p-value is <0.05 , concluding that the use of interactive media and gamification significantly improved student understanding, including for students with ADHD.

The average student posttest score ranged from "good" to "very good," indicating that most students were able to understand the material presented in the interactive media. These results also indicate that the concise, visual, and interactive learning design successfully increased student focus and engagement during the learning process, thus positively impacting their test results.

IV. DISCUSSION

Research findings support the theory that students with ADHD require short, engaging, and visually-based learning to maintain focus. Interactive media and gamification can meet these needs through attractive colors, simple animations, quick feedback, and activities that can be done independently. Gamification elements such as scores, badges, and levels have been shown to increase students' intrinsic motivation and maintain their engagement throughout the activity. From a multicultural education perspective, the research findings indicate that the integration of Indonesian-Malaysian culture in learning media not only enriches content but also serves as an educational tool for fostering an inclusive attitude in the classroom. The presence of cultural symbols from both countries helps foster mutual understanding and demonstrates that diversity can be presented harmoniously in learning. This aligns with the goals of multicultural education, which emphasize equality, mutual respect, and cross-cultural togetherness. The study's results also reinforce the relevance of the quantitative approach and posttest-only design used. Although there was no pretest, posttest data showed that students' responses to interactive media and gamification ranged from very positive to positive. These scores indicate that the media were well-received by students and provided significant learning effects. Observational findings showed similar results, with students' behavior during the learning process improving in terms of focus, participation, and orderliness. Overall, this study demonstrates that interactive media and gamification based on multicultural values are highly relevant for implementation in the context of a cross-border inclusive school like SMK Matang Jaya. These media not only improve the quality of learning but also strengthen educational ties between Indonesia and Malaysia.

The t-test results confirmed that interactive media and gamification not only increased student motivation and engagement but also significantly improved their academic outcomes. This aligns with the theory that learning approaches that combine visuals, interactivity, and game elements can strengthen concentration and facilitate comprehension, especially for students with attention deficit disorders such as ADHD. Statistically significant increases in post-test scores indicate that multicultural media, which

Implementation of Interactive Media and Gamification for Students with Special Needs (ADHD) as an Effort to Strengthen Multicultural Values

combines Indonesian and Malaysian cultural elements, creates a more relevant learning experience, closer to students' experiences, and helps enrich the learning context. This cultural integration has been shown to increase students' sense of belonging, which ultimately influences their readiness and comfort in participating in learning. The t-test also supports field observations that students with ADHD show improved ability to complete tasks and follow instructions. Media with a structured design, simple displays, and short games are proven to reduce distractions and provide a learning rhythm that suits their needs. Therefore, the statistical findings support the results of observations and interviews as evidence of triangulation in the study.

Various international studies have shown that the integration of Indonesian-Malaysian culture in learning has a significant impact on the development of inclusive attitudes in students. Cross-cultural studies have found that engaging in intercultural learning activities can reduce communication barriers and improve the intercultural competence of Indonesian and Malaysian students in an inclusive educational environment (Yuliani, Ghani, Mardatillah, Shalawati, & Hartanto, 2026). The implementation of multicultural education in both countries also emphasizes the integration of cultural content and inclusive pedagogy that is able to shape students into empathetic and socially responsible individuals (Suyurno, Fauzan, & Fauzan, 2024). Furthermore, the use of technology and multimedia in learning has been shown to enhance cultural understanding and the ability to interact with people from diverse cultural backgrounds. The use of Southeast Asian cultural materials in learning also contributes to fostering diversity awareness and cross-cultural understanding (Bañez, Arañez, Veneranda, & Veneranda, 2025), in line with the goals of multicultural education to build tolerance and social cohesion in a multicultural society (Chakrabhand, 2025).

Statistically, the increase in posttest scores indicates that gamification-based and multicultural media have a significant impact on student learning outcomes. Experimental research shows that gamification media has a significant effect on learning outcomes with a significance value of $0.000 < 0.05$ (Fitria, Utomo, Mutia, & Gadeng, 2023), even in students with special needs, a high effect size was found ($d = 1.83$) in improving learning outcomes (Twiningasih, Gunarhadi, & Musadad, 2024). This finding is reinforced by a meta-analysis which shows that gamification has a significant effect on students' intrinsic motivation ($p = 0.019$) (Li, Hew, & Du, 2024). In the context of neurodiverse students, gamified learning has been proven to increase focus, motivation, and the ability to complete tasks (Belhaj, Ali, & Boulahrouf, 2025). In addition, the application of gamification in multicultural classes has also been proven to increase cultural empathy and collaboration, there by strengthening students' sense of belonging in inclusive learning (Kartika Sari & Pratama, 2024).

V. CONCLUSION

Based on the research results, several main conclusions can be drawn as follows: 1) Interactive media and gamification effectively increase the focus, motivation, and engagement of students with ADHD because they provide visual stimuli, short activities, and quick feedback that are appropriate to their characteristics. 2) The integration of Indonesian-Malaysian multicultural values in learning media strengthens cross-cultural understanding, fosters tolerance, and creates an inclusive learning environment. 3) Teachers find it easy to manage learning, because the media provides a clear, interesting learning structure that is appropriate to the needs of students with special needs. 4) The results of the posttest and observations showed a very positive response to the use of media, both from students and teachers, so this media is worthy of continuous use. 5) Research proves that interactive media and gamification can be an innovative solution to improve the quality of learning in inclusive schools across countries. 6) Interactive media and gamification have been proven to have a significant effect on student learning outcomes, as evidenced by the results of the t-test which shows $t\text{-count} > t\text{-table}$ and $p < 0.05$. 7) Students' posttest scores increased significantly, indicating that the media is effectively used in learning, especially for students with special needs such as ADHD. 7) These quantitative findings strengthen the results of observations and interviews that media can increase student focus, motivation, and engagement in learning.

Based on these conclusions, the researchers propose the following recommendations: 1) Regularly integrate interactive media and gamification into learning, especially for students with ADHD or those with visual learning needs. 2) Develop more personalized and structured learning strategies so students can follow the learning flow without pressure. 3) Provide adequate technological facilities for the use of digital media. 4) Encourage collaboration with other educational institutions, such as universities or foreign schools, to develop innovative multicultural media. 5) Develop research with experimental designs that involve control groups to strengthen analysis results. 6) Expand research to school levels or other special needs categories to examine the effectiveness of interactive media more broadly. 7) Develop more varied learning media, such as AR/VR or multi-level gamification platforms. 8) Continue to enrich content with Indonesian-Malaysian cultural elements to ensure learning remains relevant and inclusive. 9) Add adaptive features that can adjust the level of difficulty to suit student abilities. 10) Future research can involve larger samples or other experimental designs (e.g., pretest-posttest) to strengthen statistical analysis. 11) Media development needs to be accompanied by automatic evaluation features to facilitate quantitative analysis of learning outcomes.

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Implementation of Interactive Media and Gamification for Students with Special Needs (ADHD) as an Effort to Strengthen Multicultural Values

Kuching, Sarawak, Malaysia as the research implementation partner.

VII. DISCLOSURE

The author declares that there is no financial or non-financial conflict of interest in the implementation of the research entitled "Implementation of Interactive Media and Gamification for Students with Special Needs (ADHD) as an Effort to Strengthen Multicultural Values." The research was conducted independently, without the involvement of funding parties in the design, data collection and analysis, or publication decisions. The entire research process has obtained approval from the school and informed consent from parents/guardians of students, by guaranteeing the confidentiality of participant data. All authors contributed significantly to and approved the final manuscript, and the use of AI technology only as a language editing tool.

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Implementation of Interactive Media and Gamification for Students with Special Needs (ADHD) as an Effort to Strengthen Multicultural Values

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