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Gamified Interactive Quiz Innovation Fosters Behavioral Student Attention In Inclusive Schools

Inovasi Kuis Interaktif Tergamifikasi Menumbuhkan Perhatian Siswa Berperilaku Khusus Di Sekolah Inklusif

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Abstract

General Background Inclusive education strives to provide all learners equal access to meaningful academic opportunities within regular classroom settings. **Specific Background** Traditional teacher-centered instruction frequently fails to sustain the attention of students with behavioral disorders, causing classroom disruptions and diminished academic participation. **Knowledge Gap** Although digital tools offer motivational benefits, empirical evidence regarding the application of gamified platforms specifically tailored to accommodate the neuropsychological traits of special educational needs students in Indonesian inclusive elementary classrooms remains limited. **Aims** This study investigates how a gamification-based interactive quiz innovation accommodates learning needs, channels excess energy, and stimulates intrinsic motivation among fifth-grade students with behavioral disorders at Muara Wahau Elementary School. **Results** Utilizing a qualitative case study and classroom action research design, findings demonstrate that gamified interactive quizzes successfully shifted average learning interest from 42 percent to 88 percent across two cycles. Specifically, rule-based features minimized impulsive interruptions, visual dynamics sustained hyperactive focus, redirected digital competition reduced aggressive interpersonal tension, and instant reward systems stimulated inattentive students to participate actively. **Novelty** This research distinctly maps specific digital game mechanics directly to the remediation of distinct disruptive behavioral profiles within a regular educational setting. **Implications** Inclusive educators must integrate cooperative gamified platforms into regular instruction to seamlessly unite the learning needs of students with behavioral disorders and their regular peers into a supportive educational ecosystem.

Highlights

- ♦ Wayground digital tools successfully shift academic participation averages from 42 percent to 88 percent across action cycles.
- ♦ Rule-based game mechanics directly minimize impulsive interruptions and redirect aggressive tension into structured competition.
- ♦ Cooperative digital play seamlessly unites regular peers with special needs children within a supportive ecosystem.

Keywords

Gamification; Interactive Quizzes; Learning Interest; Behavioral Disorders; Inclusive Education

INTRODUCTION

The aim of inclusive education in elementary school is to provide all students, including those with special educational needs, with equal access to real learning opportunities. Inclusive classroom teachers are expected to develop learning environments that are sensitive to the wide range of cognitive, behavioral and emotional attributes of students. Students with behavioral disorders need special help in teaching. Students in this category generally have difficulties with attention, impulsive behavior and sustained engagement in classroom learning activities. These problems often affect their academic performance and their social involvement in school. Research has found that positive and supportive teacher-student relationships are one of the strongest predictors of decreased disruptive behavior and increased classroom engagement for students with emotional and behavioral disorders (Sabol & Pianta, 2012; Cook et al., 2018). Moreover, students with behavioral disorders need a teaching approach that provides structured support, immediate reinforcement, and meaningful interaction to maintain their attention to learning activities (Dardiri & Hermawan, 2024). Therefore, inclusive education must not only guarantee the access to the classroom but also guarantee the use of teaching strategies sensitive to the unique characteristics of the students' learning.

However, teacher centered instruction and traditional learning media still dominate classroom practices in many inclusive elementary schools. Initial observations at SD Negeri 007 Muara Wahau showed there was a student with behavioral disorders who had low learning interest, was easily distracted, often displayed disruptive behavior, and had difficulty concentrating during the learning process. The generally static and unidirectional conventional instructional methods did not seem to be able to offer enough stimulation to maintain the student's engagement. Consequently, students were less involved in learning, classroom discipline became more challenging and students' academic performance suffered. Zentall (2020) proposed that students with behavioral disorders need learning environments that offer continuous stimulation, immediate feedback, and a variety of activities to sustain attention and motivation. The disparity between the characteristics of students with behavioral disorders and the instructional approaches typically used in inclusive classrooms indicates a clear pedagogical gap. Teachers have tried to implement differentiated instruction, but there are few examples of interactive learning media that meet the neuropsychological needs of these students. As a result, students often do not receive sufficient opportunities to engage in learning activities that promote lasting engagement and intrinsic motivation.

One of the teaching innovations that has the potential to address this challenge is the use of interactive quiz media based on gamification principles. Gamification refers to the application of game elements (points, badges, levels, leaderboards, challenges, and instant rewards) in non-game educational contexts with the aim of increasing students' engagement and motivation (Mahbubi, 2025; Zea Ulhaque, 2023). These components make it possible for interactive learning platforms such as Quizizz and Wordwall to create fun and competitive learning activities and provide instant feedback on performance. Gamification has a very great potential to increase the students' learning motivation by making the learning fun and encouraging the active participation during the learning process (Rahmah & Tirtoni, 2025). There are several possible advantages of gamified learning environments for students with behavioral disorders. Immediate feedback mechanism promotes desirable learning behaviors. Short-term rewards and challenges are useful for maintaining attention and avoiding boredom. Moreover, the interactive quiz provides a competitive yet supportive environment that can motivate students to be more involved and interested in learning. These features make the gamification approach particularly appropriate to deal with the motivation and attention problems that students with behavioral disorders usually present in inclusive classrooms.

Previous studies have shown the positive effects of gamification on students' motivation and engagement. However, empirical evidence regarding the use of gamification for students with behavioral disorders in Indonesian inclusive elementary schools is still limited. Most of the existing studies have focused on general student populations without taking into account the unique learning characteristics of students with special educational needs. Thus, it is necessary to conduct classroom research on the effectiveness of gamified interactive quiz media in increasing the learning interest of students with behavioral disorders in real inclusive classrooms. Based on these considerations, the purpose of this classroom action research is to improve the learning interest of one student with behavioral disorders at SD Negeri 007 Muara Wahau through the use of interactive quiz media based on gamification. It is expected that the results of this study will provide practical evidence regarding effective pedagogical strategies in inclusive elementary education, and provide teachers with an innovative alternative to promote active participation and motivation to learn in students with behavioral disorders.

METHOD

The design used in this research is Classroom Action Research (CAR) is an effort to improve students' interest in learning with behavioral disorders by using media Interactive Quiz Based Gamification. The research used the Kemmis and McTaggart spiral model which has four repetitive stages, namely planning, acting, observing and reflecting. The cyclical design allowed the researcher to systematically evaluate each intervention and modify the next instructional practices based on the results of reflection until the predetermined criteria for success were reached. This research was conducted in the second semester of the academic year 2025/2026 at SD Negeri 007 Muara Wahau, an inclusive elementary school in East Kutai Regency, Indonesia. The intervention involved all 30 fifth graders to promote an inclusive classroom environment. However, four male students identified as having behavioral disorders and who exhibited characteristics of impulsivity, hyperactivity, emotional dysregulation and inattention were observed in detail. To protect the privacy of participants, all students were referred to by initials only (FA, MA, MF, and RP).

The intervention was the integration of gamification-based interactive quiz media such as Quizizz, Wordwall, and Wayground into classroom learning. Game mechanics including points, leaderboards, badges, time limits and instant feedback were integrated into the learning activities to encourage active participation and keep students engaged during the learning

process. In each action cycle, the researcher prepared lesson plans and interactive quizzes, carried out the learning activities, monitored students' behavioral and learning responses, and conducted reflective evaluations to improve the next cycle. Data were collected using several instruments to achieve methodological triangulation. Students' learning interest was measured using a Likert-scale questionnaire and reflective learning journals completed by all participants. Classroom observations were carried out by using structured observation sheets to record student engagement, participation and self-regulation during the gamified learning activities. Additionally, qualitative evidence of changes in classroom behaviour and learning engagement during the intervention was gathered through field notes and semi-structured interviews with the classroom teacher and the four focal students. The quantitative data were analyzed descriptively by calculating individual and class percentages of learning interest in the research cycles to see the improvements after each intervention. Qualitative data from classroom observation, interviews and field notes were analyzed using the interactive model of data reduction, data display and conclusion drawing. The findings were made more credible by data triangulation, by expert validation of the research instruments, and by establishing inter-rater reliability between the researcher and a collaborating teacher during classroom observations.

RESULT AND DISCUSSION

The classroom action research was carried out from January to April 2026 at SD Negeri 007 Muara Wahau, East Kutai Regency, East Kalimantan, Indonesia. The intervention was conducted in an inclusive classroom with 30 fifth grade students, during Mathematics lessons, targeting four male students (FA, MA, MF, and RP) diagnosed with behavioral disorders who showed low interest in learning and difficulty in sustaining attention in classroom activities. This study used the four stages of the model of Classroom Action Research of Kemmis and McTaggart, namely planning, acting, observing, and reflecting. This study integrated gamification-based interactive quiz media (Wayground) in Mathematics learning to improve students' interest in learning. Baseline data were gathered prior to the intervention and the changes in the students' learning interest were monitored across the two action cycles.

Pre-Cycle

Before the intervention, a baseline observation was conducted in January 2026 to find out the initial level of learning interest of four fifth-grade students with behavioral disorders (FA, MA, MF, and RP). This observation focused on four indicators of learning interest, for example enjoyment, attention, interest and active involvement during mathematics lessons. The result showed that the learning interest of the students was low to very low with an average percentage of 42%. The results showed that the traditional teacher-centered instructional approach could not sustain students' engagement and attention in classroom learning. The preliminary observation also revealed different behavioural patterns among the four students. During the lecture-based instruction, FA was often bored and interrupted the teacher. MA seldom finished learning tasks on time and was easily distracted by activities in the surrounding classroom. MF seemed restless often, fiddling with objects on the desk and sometimes got frustrated when there were learning difficulties. Meanwhile, RP was often day-dreaming in the latter part of the lesson, and did not always do the work set. These behaviors always interfered with their participation in Mathematics learning.

From these baseline findings, the researcher concluded that a more engaging instructional strategy was needed to increase students' learning interest and to decrease disruptive classroom behaviors. Therefore the intervention used was a gamified interactive quiz platform (Wayground). The platform incorporates game elements such as points, leaderboards, badges, instant feedback, and visual challenges, which were anticipated to capture students' attention, foster active participation, and contribute to a more enjoyable learning experience.

Student	Initial Learning Interest (Attention > 10 Minutes)	Observed Disruptive Behaviors During Mathematics Lessons	Planned Wayground Intervention
FA	Low (easily distracted)	Frequently interrupted the teacher (>5 times) and disturbed classmates by playing with their stationery.	Buzzer/Fast Response feature to channel impulsive responses into structured participation.
MA	Very Low (restless)	Frequently walked around the classroom and engaged in off-topic conversations.	Movement Mission feature, allowing the student to participate while standing in a designated learning area during the quiz.
MF	Low (easily frustrated)	Displayed aggressive behaviors, such as hitting or threatening peers when unable to answer correctly or after losing.	Cooperative Badges (Teamwork) feature to promote empathy, collaboration, and emotional regulation.
RP	Very Low (passive)	Frequently daydreamed and made excuses or avoided tasks when questioned by the teacher.	Avatar Customization and Instant Rewards features to increase intrinsic motivation and sustain attention during learning.

Table 1. Baseline Observation of Learning Interest and Behavioral Characteristics of Students with Behavioral Disorders

As shown in Table 1, all the four students had low interest in learning and displayed various disruptive behaviors during Mathematics lessons. While each student exhibited distinct behavioral characteristics, they all exhibited similar challenges with staying focused, engaged, and completing learning tasks. These results indicate that traditional approaches to instruction were not sufficient to meet the different learning needs of students with behavioral disorders. The implementation of the Wayground gamification-based interactive quiz was therefore considered as an appropriate instructional intervention because the game elements were specifically designed to enhance students' attention, motivation,

and active engagement, while at the same time reducing disruptive classroom behaviors. The baseline data was used as a reference to evaluate the improvement of students' learning interest in the subsequent cycles of the action research.

Cycle I

Cycle I was held from February to March 2026, during Mathematics lessons, on the theme of measuring angles. The intervention was conducted using the Wayground gamification-based interactive quiz platform with the purpose to increase the learning interest of four students with behavioral disorders namely FA, MA, MF and RP. The Cycle I implementation is four stages of classroom action research, they are planning, acting, observing and reflecting. This action was intended to give students stronger visual stimuli, immediate feedback, structured competition, and learning rewards, which were anticipated to help keep students' attention and decrease disruptive behavior during Mathematics instruction. During the planning stage, the researcher looked over the fifth grade Math content on measuring angles and made it into an interactive quiz on Wayground. The learning material was short questions with clear illustrations, contrasting colors and simple instructions. The questions were designed to assess students' ability to identify types of angles, estimate measures of angles, and calculate angles using appropriate procedures. To reduce the cognitive load of students and help them stay focused during the activity, short and visually supported questions were used.

The researcher also adapted the quiz rules to the characteristics of the students in the inclusive classroom. The response time for each question was about 45-60 seconds. This relatively long time was intended to avoid placing RP in a position of anxiety or delay in question processing. At the same time the timer was still visible to encourage MA answer the questions more efficiently. The quiz had points, badges, a leaderboard, visual effects and instant feedback to keep students motivated. Small physical rewards in the form of classroom stars were also prepared and given at the end of the session based on students' participation, effort and achievement. The organization of learning groups considered behavioral characteristics of focal students. Because MF tended to become frustrated and respond aggressively, she was placed in a group with calm, cooperative peers. This setup was to provide peer modelling and to assist MF to regulate his emotions in competitive contexts. In one classroom, FA was given the role of "Quiz Bell Captain," who rang the bell at the beginning of each question. This role was set up to turn his interrupting the teacher into a structured, positive classroom activity. When MA found it difficult to sit, he had a designated space where he could complete the quiz while standing. The researcher prepared several instruments to collect the data, namely; student activity observation sheet, student learning interest observation sheet, field notes, and a simplified student reflection journal. The observation tools are "attention," "active participation," "emotional responses," "completion of tasks," and "decreases in disruptive behavior." The reflection journal was used to allow students to share their feelings after taking the interactive quiz with simple sentences and emoticons. In addition, a collaborating teacher was an observer to objectively record students' behavior during the intervention. Cycle I implementation consisted of an opening activity, main learning activity and closing activity. The opening activity lasted about 10 minutes. The teacher started the lesson by greeting the students, checking on their preparedness and giving an apperception related to angles on everyday objects. "Look at the hands of a clock, the corner of a book, a door opening and the shape of a roof," the teacher said, demonstrating. The students were then informed that the Mathematics lesson would be conducted through an interactive quiz on Wayground.

Prior to the quiz, the teacher explained the rules of participation, the scoring system, badges, and the function of the leaderboard. The teacher stressed that points were given for correct answers, orderly participation, effort, cooperation and respectful behavior. These rules were instigated so that the students would not see the activity as an individual competition. FA was assigned the role of Quiz Bell Captain, and MA was told he could move to the designated standing area if he was having trouble staying in his seat. The main activity took around 45 minutes. The teacher first gave a brief but meaningful explanation of the basic concepts of angles. The explanation concentrated on the identification of acute, right, obtuse and straight angles and the use of a protractor to measure angles. The teacher shunned long lectures and used direct demonstrations supported by visual examples. Students then logged into Wayground on any of the digital devices available, and began answering the interactive questions. FA immediately showed interest in the visual display and his assigned responsibility during the quiz. He looked at the screen and seemed eager to start each question. But he still occasionally yelled out answers before being told to answer. The teacher told him to act responsibly in his role and wait for the right signal. The structured responsibility decreased the number of times participants interrupted each other compared to the pre-cycle condition.

MA showed improvement in initiation of task and speed of responding. The visible timer made him answer questions more quickly than he did on written assignments. He still moved his legs and shifted his body frequently, but no longer did he walk aimlessly around the classroom. When he began to fidget he would rise and stand in the designated area, then return and take the quiz. This accommodation allowed him to burn off physical energy without disrupting the learning activity. MF was very enthusiastic about the digital quiz. His motor activity was directed to pressing the screen and selecting answers. He was engaged during most of the session and did not strike any of his fellow students. However, he was still frustrated when he gave a wrong answer or when another student got a better score. Once, after seeing a wrong answer, he hit the table. The teacher immediately gave him verbal reinforcement, reminding him that the badges also rewarded effort and teamwork. RP had initially difficulty maintaining attention. He was distracted by the avatar-selection menu for the first three questions, and he daydreamed briefly. He then started to follow the questions more and to participate more regularly after getting direct guidance from the teacher. His attention increased when the leaderboard came up and when he got immediate positive feedback. But his involvement in the second half of the lesson was less consistent than the others. The closing activity had a duration of approximately 15 minutes. The teacher went over the Mathematics concepts that were covered in the quiz and asked students to talk about questions that they found difficult. Badges and classroom stars were then announced for participation, effort and achievement. Students completed a simplified reflection journal with emoticons to indicate whether they felt happy, interested, confused, or challenged. The teacher finished the lesson by stressing the importance of waiting for turns, working together with classmates and responding calmly to both correct and incorrect answers.

The researcher's execution was the instructional activities and the collaborating teacher's execution was the observation. The observation was on students' learning interest, attention span, active participation, emotional regulation and disruptive behavior in the Wayground quiz. The observer noted positive behavioral changes and challenges that lingered in Cycle I. Results showed that all four participants demonstrated improved attention and participation compared to the pre-cycle condition. FA was well visually attended to and waited eagerly for each question, although he did interrupt the teacher once or twice as he was impatient to see the scores. MA was still focused on the quiz and not walking around the classroom too much but his legs were still moving and he was moving around positionally. MF did the quiz enthusiastically and did not hit his classmates but did hit the desk once when he got a wrong answer. RP got involved after the first 3 questions but still had brief moments of day dreaming during the lesson.

Observation Indicator	FA (Impulsive)	MA (Hyperactive)	MF (Aggressive)	RP (Inattentive)
Focus on the quiz and learning interest	Watched the screen enthusiastically and waited for each question to appear.	Focused on the quiz, although his legs continued to move and he frequently changed his sitting position.	Occasionally looked at classmates' scores but continued answering the questions.	Daydreamed during the first three questions but began participating in the subsequent questions.
Reduction in disruptive behavior	Still interrupted the teacher one or two times because he was impatient to see the score.	Did not walk far from his seat and only moved around the designated learning area.	Did not hit any classmates but struck the desk once after giving an incorrect answer.	Did not make excuses about completing the task because the Wayground scoring system provided transparent evidence of participation.

Table 2. Observation Results of Students' Learning Interest and Behavior in Cycle I

The results in Table 2 indicate that the gamification based interactive quiz led to positive initial change in the learning behavior of the four students. The visual display, timer, points, badges, and immediate feedback increase their willingness to attend the lesson and participate in the learning activities. The intervention also reduced a number of disruptive behaviors, although the improvement was not yet consistent across all students. At the beginning and end of the lesson, FA was still displaying impulsive verbal responses, MF was still struggling with frustration management and RP's attention was still unstable. Based on the quantitative observation results, the average percentage of learning interest increased from 42% in the pre-cycle to 65% in the Cycle I. This increase of 23 percentage points indicated that the use of Wayground had a positive impact on students' enjoyment, attention, interest and active participation. The Cycle I score was classified as high category for the pre-determined interval of 61%–80%. But some behavioral indicators were still not consistent enough, so Cycle II needed more improvement. The researcher and the observer carried out the reflection together after Cycle I was complete. The reflection results indicated that the Wayground gamified interactive quiz could increase the initial interest of the students in Mathematics. The biggest improvement was seen in the first 20 minutes of the quiz, where students were very thrilled with the visual questions, scores, timer, badges and leaderboard. The interactive format proved to be more successful than the traditional lectures in attracting their attention and motivating them to be actively involved in the lesson. FA had the structured responsibility of being the Quiz Bell Captain. His interruptions of the teacher were reduced because he was given a specific role in the activity. But he still needed support to wait his turn and control verbal impulsivity. The timer gave a clear visual limit that helped MA to complete tasks faster. He also walked less around the classroom, because he was allowed to participate while standing in a designated area. This finding showed that controlled physical accommodation could be used to help maintain his engagement without disrupting other students.

MF was very interested in the digital media and was able to direct much of his motor activity into the operation of the quiz machine. The lack of hitting behavior was a significant improvement. But the individual leaderboard added emotional tension when it was FA's score that was higher than his. MF hit the desk and looked at FA threateningly in return. This event showed that competition based on high individuality might lead to frustration and conflict between individuals. The competitive structure therefore had to be changed to a focus on cooperation rather than individual ranking. RP had been making slow progress with individual attention but was still distracted during avatar selection and missed a number of early questions. In the second half of the lesson, his attention also faded as the competitive stimulation lessened. The results of the reflection showed that the technical preparation needed to be done before the lesson so that RP could get the quiz questions without being disturbed by the menu selection. These results have led to the planning of several follow-up actions for Cycle II. The quiz mode would transform from a solo competition to a team-based cooperative mode. Scores would be maintained as group scores so that students would be encouraged to work together rather than compete as individuals. This modification was aimed at alleviating the emotional burden of MF and enhancing positive interaction between MF and FA.

Secondly, RP's avatar and account settings would be configured before the lesson started. It was hoped that this pre-conditioning strategy would stop him being distracted in the opening stage and allow him to get involved from the first question. The teacher also provided a simple visual schedule of the sequence of activities so that RP could expect each part of the lesson. Thirdly, there will be a short self-assessment and behavioral commitment activity before the quiz. Students would be asked to pick simple statements such as, "I will wait for my turn," "I will respond calmly," and "I will help my group." This activity was created to reinforce self-regulation and to remind students of the expected behaviors prior to the game. In conclusion, Cycle I showed that the use of interactive quiz media with gamification can increase the interest of students with behavioral disorders in learning Mathematics lessons. With improved attention, faster task initiation, increased participation, and fewer disruptive behaviors, the average learning-interest score increased from 42% to 65%. However, emotional regulation, sustained attention and cooperative behavior were still not consistently developed, so the intervention continued to Cycle II with improvements based on the reflection results.

Cycle II

In Cycle II, the implementation of Mathematics learning on data management was carried out in the form of a Wayground interactive quiz based on gamification. Based on the reflection from Cycle I, the intervention was adapted to incorporate group points, a live leader board, instant rewards, visual worksheets, and cooperative competition. Students used

Wayground to work with tables, pictograms and bar charts and answer related questions. The FA became more orderly because inappropriate interruptions could decrease the score of his group and because the praise-and-ignore strategy increased appropriate participation. The data-management task was more independent for MA because the worksheet was presented in an attractive infographic format. MF paid full attention to digital media and correctly answered questions on diagrams, while RP showed a significant improvement in sustained attention because he was highly motivated to keep his group at the top of the leaderboard.

The results of the observation showed that the modification that was done in Cycle II could improve the learning interest and classroom behavior. The students showed improved attention, active participation, task completion, cooperation, and emotional regulation during the lesson. The average learning interest was 65% in Cycle I and increased to 88% in Cycle II which was described as very high. This finding shows that the application of group-based gamification, instant feedback, visual learning materials, and direct reward successfully increased the learning interest of students with behavioral disorders in Mathematics learning.

Observation Indicator	FA (Impulsive)	MA (Hyperactive/Slow Task Completion)	MF (Aggressive)	RP (Inattentive)
Focus and learning interest	Maintained attention to the quiz and waited more consistently for his turn.	Focused on the visual worksheet and completed the task within the allocated time.	Maintained full attention to the digital quiz and accurately interpreted diagrams.	Remained focused from the first question until the end of the lesson.
Active participation	Responded in an orderly manner because inappropriate interruptions affected the group score.	Participated in group discussion and completed the infographic-based worksheet independently.	Actively helped group members and answered diagram-related questions correctly.	Consistently followed the quiz and contributed answers to improve the group ranking.
Self-regulation	The frequency of interrupting the teacher decreased substantially through the praise-and-ignore strategy.	Remained in the designated learning area despite minor motor restlessness.	Did not display hitting, threatening, or desk-striking behavior when answers were incorrect.	Did not engage in prolonged daydreaming and required fewer reminders from the teacher.
Response to gamification	Motivated by group points and direct praise for orderly behavior.	Motivated by visual tasks, the timer, and immediate task-completion feedback.	Responded positively to cooperative badges and group-based scoring.	Highly motivated by the dynamic leaderboard and immediate rewards.

Table 3. Observation Results of Students' Learning Interest and Behavior in Cycle II

The results in table 3 show that the changes in cycle II have successfully responded to the challenges found in the first cycle. The constantly changing leaderboard remained a source of motivation, but the scoring system based on cooperation reduced unhealthy individual competition. Understanding of the tasks was improved with visual worksheets and appropriate behavior in the classroom was reinforced with immediate feedback. The four students showed not only greater enjoyment and participation but also enhanced self-regulation and task persistence. Quantitative data indicated that the mean percentage of learning interest increased from 65% in Cycle I to 88% in Cycle II. This represented an increase of 23 percentage points on the pre-cycle score of 42%, and a total increase of 46 percentage points between the two cycles. The outcome of Cycle II was classified as very high based on the predetermined criteria for evaluation. The increase showed that the intervention had succeeded in enhancing students' enjoyment, attention, interest and active participation in Mathematics learning.

The results of the reflection showed that the implementation of Wayground in Cycle II was better than in Cycle I. The changes introduced in the instructions were effective to overcome the behavioral and learning difficulties mentioned above. The group-based scoring avoided the emotional conflict that could have resulted from individual competition, and the dynamic leaderboard kept students motivated. The group's success, students learned, depended not just on the right answers but on cooperation, discipline and control of emotions. The rules of scoring established a clear link between self-control and group success, resulting in a significant improvement in FA's behavior. He understood more that interrupting the teacher might have a negative effect on his peers. The praise-and-ignore strategy also worked to decrease reinforcement of minor attention-seeking behavior while increasing appropriate participation. As a result, FA was more organized without losing his enthusiasm for the quiz. MA was helped by the use of visual and infographic-based learning materials. The modified worksheet reduced written information and divided the tasks into manageable parts. With this change, he was able to start and complete tasks more efficiently. His progress suggested that the visual organization of learning content could help children who struggled to stay focused during traditional written tasks.

The outcome of the reflection indicated that the implementation of Wayground in Cycle II was more effective than Cycle I. The cooperative structure worked well for MF. The group-based leaderboard turned his focus from beating his classmates to contributing to the success of the group. He was able to accept mistakes, manage frustration and participate in peer discussion without aggressive behavior. This change showed that cooperative gamification was more suitable for his emotional and behavioral characteristics than direct individual competition. RP showed the greatest improvement in sustained attention. Technical preparation before the lesson made him not get distracted during avatar selection and the dynamic leaderboard and immediate rewards kept him focused until the end of the session. With less daydreaming and more responsiveness, the blend of visual stimulation, immediate feedback and meaningful competition was working to meet his attentional needs. The average learning-interest score was 88% which was above the predetermined success criterion and categorized as very high. All four students showed gains in observed indicators such as enjoyment, attention, interest, active participation, task completion, and behavioral self-regulation. Disruptive behaviors were also significantly less than pre-cycle and Cycle I conditions. Based on these results, the researcher and the collaborating teacher concluded that the action had reached the expected performance indicators. Therefore, the classroom action research was stopped at Cycle II. The application of Wayground gamification-based interactive quizzes was found to be effective in increasing the learning interest of students with behavioral disorders during Mathematics lessons in an inclusive elementary classroom.

Discussions

The results of this classroom action research show that the application of interactive quiz based on gamification of Wayground can effectively increase the learning interest of fifth grade students with behavioral disorders in an inclusive elementary classroom. The average score of learning-interest had gradually increased from 42% in the pre-cycle stage, to 65% in Cycle I, and 88% in Cycle II which indicated that the intervention was successful in meeting the pre-determined success criteria. The improvements were seen not only in quantitative scores but also in observable behavior change such as increased attention, increased participation, better emotional regulation and less disruptive behaviors during Mathematics learning. These findings indicate that the integration of gamification components in classroom instruction could help create a more engaging and inclusive learning atmosphere for students with varying behavioral profiles.

One important finding was that visual and interactive game elements were successful in attracting the attention of students, especially the students who had shown impulsive or inattentive behaviors in the past. The colorful interface, the animations, the immediate feedback, the countdown timer, the badges and the leaderboard made Mathematics lessons an enjoyable experience that kept students engaged throughout the lesson. Deterding et al. (2011) define gamification as the use of game design elements in non-game contexts in order to increase user engagement and motivation. Likewise, Hamari, Koivisto, and Sarsa (2014) found that gamification has positive effects on learner motivation, engagement and participation in general, when applied properly. These findings are consistent with the current study in which the interactive digital environment shifted students' attention from disruptive behaviors to meaningful learning activities.

The intervention also demonstrated that different gamification elements targeted different behavioral characteristics of the participants. Visual stimulation proved useful in maintaining FA's attention, while the countdown timer motivated MA to complete learning tasks more efficiently. In the meantime, digital interaction was a convenient outlet for MF's motor activity, decreasing his propensity to engage in disruptive behaviors during instruction. RP, who had previously experienced sustained periods of inattention, was engaged throughout the lesson, helped by the dynamic leaderboard and instant rewards that promoted continual participation. These findings align with the views of Hallahan, Kauffman, and Pullen (2019) that students with behavioral disorders flourish in instructional settings that are structured, motivating, and very engaging, with immediate reinforcement and clear behavioral expectations.

Another major finding is regarding the instructional modifications made in Cycle II. The transition from an individual to a cooperative group-based format of competition proved successful in reducing interpersonal conflict, while students felt motivated to participate. Students worked together as teams to improve group performance instead of competing against their peers individually. This cooperative structure permitted positive peer interaction, regulation of emotions and shared responsibility for learning outcomes. These findings are in line with Deci and Ryan's (2000) Self Determination Theory, which argues that motivation is promoted when learners simultaneously experience competence, relatedness, and autonomy. In the learning process, students had the opportunity to experience these psychological needs through the cooperative leaderboard and immediate feedback.

The increase in learning interest found in this study can also be interpreted by using the indicators proposed by Slameto (2015), namely enjoyment, attention, interest, and active involvement in learning. All four indicators showed significant improvement during the intervention. The students were more enthusiastic in Mathematics lessons, they could concentrate for longer periods of time, showed more interest in completing learning challenges, and actively participated in solving mathematical problems. The observation data also pointed to the decrease of impulsive behavior, off-task behavior, aggression and daydreams, indicating that the increased learning interest was accompanied by improvements in classroom behavior, but not only temporary excitement generated by digital media.

In conclusion, this study provides empirical evidence of the effectiveness of gamification-based interactive quiz media as an instructional strategy in inclusive Mathematics classrooms involving students with behavioral disorders. In addition to enhancing academic engagement, the intervention resulted in positive behavioral change through immediate feedback, structured reinforcement, cooperative learning, and visually stimulating instructional materials. In addition, the results expand on prior research on gamification by illustrating that the benefits of gamification are particularly significant when the instructional design is purposefully tailored to the behavioural traits and learning demands of students in inclusive education settings.

CONCLUSION

Based on the results of the classroom action research, it can be concluded that the implementation of interactive quiz-based gamification Wayground can effectively increase the learning interest of students with behavioral disorders in class V in an inclusive elementary school. The intervention led to a gradual increase in students' learning interest, from pre-cycle stage to Cycle II, with increased attention, active participation, task engagement and emotional regulation during the learning of Mathematics. Visuals, immediate feedback, points, badges and leaderboards were effective in directing students' disruptive behaviors towards productive academic tasks. In addition, the intervention led to positive outcomes for each focal student in relation to his/her behavioral profile such as decreased impulsive behavior, improved task perseverance, greater emotional regulation, and increased attention span during the learning process. The overall use of gamification helped create a more engaging, supportive, and inclusive classroom environment, allowing students with behavioral disorders to actively participate with their peers. It showed that Wayground is an effective instructional medium for enhancing learning interest in inclusive Mathematics classrooms. The teachers are encouraged to use the gamification-based interactive media as an alternate teaching approach to enhance students' interest in learning and positive classroom behavior in students with behavioral disorders while adapting the game elements to individual learning characteristics and behavioral needs. Future research should explore other gamification features (e.g., collaborative missions, adaptive rewards, or personalized

feedback systems) and examine the long-term effectiveness of combining gamification with behavioral intervention approaches (e.g., token economy or self-regulation strategies). Furthermore, further studies are needed with longer intervention periods, larger groups of participants, and experimental and single-subject research designs to find out whether the improvements in learning interest and behavioral regulation can be sustained beyond the initial novelty effect of digital gamification.

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