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"Microcirculation Instant Feedback" Gamification Intervention Classroom Implementation Problem for ADHD Students

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Abstract. The proportion of children with ADHD in school classrooms continues to rise, and there is a serious mismatch between the traditional teaching methods and procedures and the attentional characteristics of students with ADHD. This paper discusses the adaptability of a classroom intervention based on the concept of gamification for children with Attention Deficit Hyperactivity Disorder (ADHD) and its sustainability in actual classrooms. The study shows that gamificational interventions can effectively enhance the attention and classroom engagement of children with ADHD through point reward mechanisms, immediate feedback, and tiered incentives. However, practical applications still face difficulties in design, implementation, and evaluation, such as the balance between task difficulty and time, teachers' emotional management, and home-school cooperation. Therefore, it is recommended to develop a simple and easy-to-use gamificational teaching toolkit and establish a lightweight "student-teacher-parent" collaborative assessment cycle to ensure the dynamic adaptability and long-term effectiveness of the interventions, so as to improve the learning outcomes and classroom experiences of children with ADHD.

Keywords: Gamificational Intervention, ADHD, Classroom Microcycles, Immediate Rewards, Home-School Collaboration

1. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by difficulty in concentration, hyperactivity, and impulse control, with a high prevalence rate of 5% to 7% among school-age children [1].

Over the past two decades, the prevalence of ADHD among school-aged children has remained consistently high at 5%-9% worldwide [2]. The core symptoms of ADHD, including significantly age-inappropriate inattention, weak impulse control, and hyperactivity, not only directly undermine academic performance in subjects such as reading and math, but also dramatically increase the risk of grade repetition, suspension, and peer rejection [3]. Under the background of first-line clinical guidelines that progressively prioritize educational-behavioral interventions, DuPaul & Weygandt's systematic review suggests that reliance on central stimulants alone, while providing short-term symptomatic relief, does not address the difficulties of classroom transition, long-term side effects,

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and decreased parental compliance. Teacher and parent concerns about pharmacologic interventions are continuing to rise [4].

It has been shown that gamificational interventions can effectively motivate students and enhance attentional control by incorporating game elements such as task mechanics, reward feedback, and interactive participation into the learning process [5,6]. At the same time, it is found that gamification elements can enhance intrinsic motivation, and teachers should prioritize the use of platforms that support points and leaderboards in the design of courses [7,8]. Therefore, exploring the design of classroom interventions based on the concept of gamification to provide fun and operational instructional support for children with ADHD is of great practical and theoretical importance.

Meanwhile, evidence-based research, such as the Classroom Ecology Framework proposed by Arthur-Kelly et al., offers new ways for teacher-led, low-cost interventions that emphasize the creation of predictable and supportive learning environments for students with ADHD through pre-designed physical environments, clear classroom rules, and immediate positive feedback. The framework emphasizes the creation of a predictable and supportive learning ecology for students with ADHD through pre-designed physical environments, clear classroom rules, and immediate positive feedback from teachers [9].

However, the difficulty is still evident in real classrooms. Although the "brief instruction -- gesture prompt -- immediate positive feedback" has been validated by several studies [10]. Plantin Ewe points out that most of the current studies' conclusions are mostly based on single questionnaires or short-term observations and lack longitudinal tracking of the sustainability of the intervention [11]. In addition, teachers' self-reported lack of expertise in ADHD was a common obstacle. Nearly half of the 25 teachers interviewed still viewed ADHD as a discipline problem rather than a learning disability. Colberg's interviews further revealed that teachers struggled with the lack of time to read and translate lengthy manuals into daily micro-interventions [12]. Therefore, the most pressing task for current research is no longer to validate which strategies work, but to compress proven micro-strategies into minimalist processes and ensure that they are adhered to day in and day out in real classrooms through lightweight tools such as teacher emotion management, synchronized feedback at home and school, and visual progress bars.

2. Characteristics of the ADHD students and teaching and learning challenges

This section discusses challenges that ADHD students face in the classroom, which are categorized into three characteristics: attentional, behavioral, and academic-social characteristics. Understanding these characteristics is crucial for educators to develop targeted and effective teaching strategies that can address the unique needs of ADHD students and enhance their learning experiences. Each subsection provides a detailed overview of the specific challenges and their implications for classroom management.

2.1. Attentional characteristics

Students with ADHD are most likely to be exposed to symptoms in classroom situations where they are asked to sit still, remain quiet, and stay focused. Studies point to a highly fluctuating attention span, difficulty in focusing on learning objectives for sustained periods of time, and hypersensitivity to small movements in the classroom. When teachers rapidly switch instructions or ask students to jump from one task to another, their executive functioning load increases steeply, as evidenced by longer elapsed time and higher error rates, which in turn exacerbates academic frustration [11].

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2.2. Behavioral characteristics

The structured demands of the classroom, such as lining up, waiting to speak, and sitting for long periods of time, often act as a pressure valve for hyperactive and impulsive behavior. Scenes of students bouncing around in their seats, getting up without permission, or interjecting loudly without raising their hands are frequent. These behaviors are not intentionally provocative, but are direct results of neurodevelopmental traits. When teachers respond with criticism, punishment, or lengthy instructions, students are more likely to be triggered into antagonism and emotional outbursts, creating a vicious cycle of "negative teacher response - escalation of student externalized behavior - reinforcement of negative teacher response" [11].

2.3. Academic and social characteristics

Teachers generally report significantly lower levels of emotional closeness and significantly higher levels of conflict with students with ADHD compared to their non-ADHD counterparts. This rejection is also felt and sensed by the students themselves, leading to lower self-esteem and higher levels of isolation [11]. Low-quality student-teacher relationships not only directly predict academic failure but also further strengthen social difficulties through peer rejection, leading to simultaneous setbacks in achievement, relationships, and self-concept for children with ADHD.

3. The role of gamification interventions and group adaptation

3.1. Mechanism

At the classroom level, the point-reward mechanism serves as an engine for gamificational interventions. Li Wenbo found that if the learning task was divided into a number of quantifiable mini-goals and immediate points were set, children with ADHD maintained the goals for a significantly longer period of time, and the number of classroom rule violations was significantly reduced [1]. Chen further demonstrated that, in the elementary school language classroom, if the teacher sets a reading task in the form of a challenge in which students earn badges and points for completing each reading passage, students were able to maintain a high level of attention during a 20-minute reading class [13]. Sun emphasized that the effectiveness of points and rewards depends on whether the difficulty of the task is matched to the child's stage of cognitive development: if the task is too difficult, the points will not be able to offset the frustration, and if the task is too easy, rewards will lose their motivational value. Points and reward systems can truly amplify the effects of attentional reinforcement only when the task gradient is consistent with the child's current level of executive functioning [14].

3.2. Technology

The technological dimension centers on using "instant feedback" and "hierarchical incentives" in the classroom teaching process. In Anderson et al.'s study, teachers used interactive software with a leveled progress bar, where students immediately saw an increase in experience value and unlocked the next level for each exercise they completed, showing a significant decrease in the number of times children with ADHD left the classroom, and a significant increase in time spent on focusing [15].

Pope et al., on the other hand, introduced a real-time task completion tracking system in a math classroom: individual and group completion progress bars were displayed in real time on the left

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side of the screen, and a visual reward animation popped up on the right side. Data showed that this real-time visual feedback effectively reduced task avoidance in children with ADHD, resulting in higher levels of engagement during the 30-minute task cycle. The immediacy and visualization of the technology compensated for ADHD children's natural weaknesses in delayed gratification and self-monitoring [16].

3.3. Context

In order for a gamificational intervention to be effective, the classroom must create an atmosphere that satisfies the three elements of self-determination. According to Deci and Ryan, autonomy, competence, and connectedness are the three main pillars of intrinsic motivation [17]. In the point task, teachers allow children with ADHD to choose the order of the challenges within a certain range, which satisfies "autonomy". The difficulty of the task is dynamically adjusted to remain slightly above the current level, which ensures a sense of "competence". At the same time, the teacher's immediate verbal praise and peer praise mechanism together provide a sense of "connectedness". When these three psychological needs are satisfied simultaneously, children no longer see the learning task as an external compulsion, but are actively engaged. This contextual design effectively alleviated the negative cycle of emotional detachment brought about by the teacher and allowed the gamificational intervention to form a closed loop of support at the motivational, behavioral, and emotional levels.

4. Difficulties and recommendations

4.1. Difficulties in design

Colberg noted that children with ADHD have a window of focus of only 15-20 minutes at a time, and that requiring the completion of 20-30 homogeneous exercises can quickly exhaust motivation when concepts have already been mastered [12]. Geng's classroom observations further validate this bottleneck: students A, D, and E exhibited escalating behaviors such as "leaving the room, shouting, and throwing objects" when teachers assigned tasks that were too long or too difficult at once. Together, both studies suggest that gamificational design must find a dynamic balance between difficulty and time -- using immediate rewards to maintain peak motivation and microcycle tasks to prevent cognitive overload [10].

4.2. Difficulties in implementation

Colberg's interviews show that teachers generally lack systematic training and rely on word-of-mouth from colleagues or self-explanation [12]. Geng's field observations found that when teachers lost control of themselves, raised their voices, or turned their backs on their students because they repeatedly left the room, the confrontational behaviors of the students escalated immediately. Studies suggest that the greatest barrier to implementation is not "not knowing the strategy" but rather the difficulty teachers have in staying calm and consistently implementing the strategy in high-stress situations [10]. It is recommended that "teacher emotion regulation" be included in gamificational intervention packages: time reminders, colleague support scripts, and visual calming cue cards to help teachers use non-confrontational strategies, such as low-pitched, short instructions and gestures, in high-stress situations.

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4.3. Difficulties in assessment

Colberg emphasizes that daily reassessment and home-school collaboration are the keys to sustained effectiveness, but in reality, teachers are often too short on time to make it a formality [12]. Geng's data also shows that the same set of strategies has significant variations in effect for different students: Student A responds well to "tap shoulder + gesture" while Student D ignores the same strategy completely [10]. For any gamification or behavioral intervention to be effective over time, it must be a "student-teacher-parent" collaborative effort: the teacher completes a daily 2-minute quick self-assessment form. Parents complete feedback on the three components of mood, homework completion, and sleep quality by the end of the day; the support team summarizes at the end of the week.

4.4. Recommendations

Based on the previous analysis of gamificational interventions for children with ADHD, this paper proposes the following recommendations to enhance the adaptability and sustainability of gamificational interventions in classrooms for children with ADHD. First, for teachers, it is recommended to develop a simple and easy-to-use gamificational teaching toolkit, which should contain task templates that divide the 15-20 minute window of focus into 3-5 micro-tasks, each with clear points and rewards rules to reduce the difficulty of design, and to provide instant feedback scripts with standardized short instructions and positive feedback statements templates. Second, it is recommended to establish a lightweight assessment cycle of "student-teacher-parent" collaboration: teachers should design a daily 3-minute "classroom observation shorthand" to record students' key behaviors and the effects of immediate feedback, and then summarize the results in a weekly newsletter. Parents should record their children's moods and homework completion before going to bed every day. The support team integrates teacher and parent data every Friday, quickly adjusting the difficulty of next week's tasks and rewards to ensure that the intervention program is dynamically adapted to the needs of the students. Through the above suggestions, the gamificational intervention can be transformed from a theoretical design into a sustainable, practical program in classrooms, and finally achieve the goal of improving the learning effect and classroom experience of children with ADHD.

5. Conclusion

This study discusses the use of gamificational interventions in classrooms for children with ADHD, highlighting their potential benefits and practical challenges. Findings suggest that gamificational inventions can significantly increase attention and engagement of students with ADHD through point reward mechanisms, immediate feedback, and tiered incentives. However, successful implementation of these interventions requires careful consideration of task design, teacher training, and ongoing assessment. The collaborative "student-teacher-parent" assessment cycle and the development of a gamificational toolkit suggested in this paper offer practical solutions to these challenges. Future research should focus on longitudinal studies to track the long-term effects of gamificational interventions and explore the influence of cultural and socioeconomic factors on their effectiveness.

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