

Anchoring attention: Combining animated multimedia and spatial scaffolding for primary student with ADHD

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Abstract

Despite growing inclusive education policies, a gap remains in understanding how integrated digital and real-time behavioral interventions affect students with attention deficits in remote, under-resourced classrooms. This study aims to enhance attention span and academic focus in lower-primary students with ADHD Inattentive Type by combining short-form animated videos with proactive behavior modifications, including proximity control and direct prompting. Using collaborative Classroom Action Research, data were collected through stopwatch recording, field notes, daily tests, and parental interviews involving a 7-year-old male student at SDN 008 Kaubun, East Kutai. Findings revealed substantial improvements: sustained attention increased from 2.6 to 15.0 minutes, recovery latency collapsed to 5–10 seconds, and cognitive mastery reached 100% with a final score of 98. These results indicate extended focus beyond age expectations and rapid re-engagement after distraction. The near-perfect scores suggest digital scaffolding transformed passive viewing into active processing. Practically, low-cost strategies like animated triggers and teacher proximity prevented cognitive overload and enhanced retention. Theoretically, the study demonstrates that timing and integration of digital stimuli with human mediation are as crucial as content quality. These implications offer actionable guidance for adopting scalable inclusive practices without relying on costly technologies.

Keywords: ADHD inattentive type; Educational video media; Proximity control; Sustained attention; Inclusive education

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INTRODUCTION

The mandate for inclusive education, codified in Indonesia through Law Number 20 of 2003 and operationalized by Government Regulation Number 13 of 2020, legally obligates general education schools to accommodate students with disabilities. This obligation has been further reinforced by the nationwide adoption of the *Kurikulum Merdeka*, which demands differentiated learning to meet diverse student needs (Achmad et al., 2025; Lan et al., 2024). However, translating these policies into effective classroom practice remains a significant challenge, particularly in under-resourced schools in remote regions like the 3T areas (frontier, outermost, and disadvantaged regions). Empirical evidence suggests that policy implementation in these areas is often superficial; for instance, Ningsih & Harsiwi (2025) found that over 60% of teachers in 3T schools reported never receiving formal training on inclusive pedagogy, while available assistive infrastructure remains critically underutilized due to lack of operational guidance (Hou

et al., 2023; Saputra et al., 2023).

In these geographically isolated schools, teachers face immense pressure. They are expected to manage students with complex neurodevelopmental conditions without the support of special education tutors (GPK) or clinical psychologists, often lacking specialized training and adaptive tools. This systemic friction is particularly critical for students with attention deficit hyperactivity disorder (ADHD), Predominantly Inattentive Type. Unlike their hyperactive peers, these students present a “silent crisis”, their passive inattention characterized by an inability to sustain focus and high distractibility leads them to be mislabelled as unmotivated, causing them to fall behind academically as they miss foundational instruction (Praveen & Srinivasan, 2022; Zulhendri, 2022). Studies have shown that without targeted intervention, these students can fall up to two grade levels behind their peers by the end of primary school (Lestari et al., 2023).

A key factor in this challenge is the “sensory pollution” of the typical classroom, which overwhelms the compromised selective filtering of a child with inattentive ADHD. This cognitive overload can be understood through John Sweller's Cognitive Load Theory, where traditional, lecture-heavy teaching generates excessive extraneous load, preventing information from being encoded into working memory. To counter this, Richard Mayer's Cognitive Theory of Multimedia Learning suggests that combining words with pictures can reduce cognitive load. Research, such as that by (Overgaard et al., 2024; Praveen & Srinivasan, 2022), supports the use of short-form animated videos to anchor attention, with documented gains of up to 40% in task engagement during video-based instruction compared to lecture-only sessions (Fauziah et al., 2023). However, studies also show that technology alone is insufficient, as its novelty fades without real-time behavioral support (Harahap & Andrian, 2026). Techniques like proximity control and direct prompting (Gunadi, 2026; Mas et al., 2024) offer zero-cost, practical behavioural scaffolds to maintain engagement, with empirical studies reporting that proximity alone can reduce off-task behavior by 20–30% in general education settings (Susanti & Suryadi, 2022; Yang et al., 2026).

A collaborative pre-observation at SDN 008 Kaubun, East Kutai Regency, highlighted this issue. A first-grade student (Subject X) with inattentive ADHD could maintain focus for an average of just 2.6 minutes during traditional lessons, requiring over 115 seconds to re-engage, leading to academic performance well below the Minimum Mastery Criteria (KKTP) (Emam et al., 2025). While existing literature has separately validated the benefits of digital media and behavior management, there is a distinct lack of empirical research on their *combined, real-time integration* in remote, under-resourced inclusive classrooms (Shi, 2026). Most previous studies have either focused on urban settings with adequate support systems (Achmad et al., 2025; Windiyani et al., 2025) or examined media and behavioral strategies in isolation (Cahyaningtyas et al., 2022), leaving a critical gap in knowledge for practitioners in 3T areas where both human and technological resources are scarce.

The novelty of this study lies in its proposal of an integrated intervention model that combines short educational videos, proximity control, and direct prompting into a single, real-time teaching strategy specifically adapted for a resource-constrained, remote classroom. Unlike previous work that treats these approaches separately, this study offers a replicable, low-cost pedagogical blueprint that does not rely on specialist staff or expensive technology. This Classroom Action Research aims to evaluate how this integrated model can increase sustained attention, shorten recovery latency, and improve academic performance for a student with ADHD Inattentive Type in a resource-constrained environment. Beyond its empirical contribution, the findings are expected to offer practical implications for teachers in 3T schools by providing actionable, zero-cost strategies that can be immediately implemented without external support. Furthermore, the results may inform local policymaking and teacher training programs, offering a scalable model for inclusive education delivery in underserved regions across Indonesia.

METHODS

Research Design and Context

This study was structured as a collaborative Classroom Action Research (CAR) project following the cyclical framework developed by Kemmis and McTaggart. This design was deliberately selected for its iterative, context-sensitive nature, which enables researchers and practitioners to collaboratively diagnose, intervene, and refine instructional strategies in real time. Unlike one-off experimental designs, CAR is particularly suited to addressing localized pedagogical challenges because it embeds inquiry within the natural classroom ecology, allowing for immediate, responsive adjustments grounded in ongoing observation and reflection. The research paradigm underlying this study is pragmatist-action oriented, focusing on practical behavioral and cognitive outcomes in a real-world setting. The study was conducted over an intensive five-day period spanning one single high-frequency cycle in May 2026, with two instructional sessions delivered each day approximately 70 minutes per session, amounting to a total of roughly 10 contact hours of direct observation and intervention across the cycle. The research context was a regular, mainstream first-grade classroom at SDN 008 Kaubun, located in East Kutai Regency, East Kalimantan, Indonesia. This location represents a remote, resource-constrained inclusive education environment (*daerah 3T*).

Participants and Sampling

The primary subject of this single-subject study (Subject X) was a 7-year-old male student enrolled in the first-grade classroom at SDN 008 Kaubun. The classroom consisted of a total population of 15 students, representing a mixed ability mainstream primary cohort. A single-subject design was deemed the most appropriate methodological framework for this research question, as the primary objective was to evaluate the efficacy of a targeted intervention at the individual level, rather than to generalize findings across a population. This design permits the rigorous, repeated measurement of the subject's behavior across distinct phases (baseline, intervention, and withdrawal), thereby establishing a clear functional relationship between the intervention and any observed changes in attentional behavior.

Moreover, given the high degree of intra-individual variability typically associated with ADHD symptom expression, the single-subject approach enables the detailed, idiographic analysis necessary to capture the nuances of the subject's response to treatment, which would be obscured by group-averaged data in a larger experimental design. Purposive sampling was employed to select the subject based on strict inclusion criteria: (1) the student exhibited severe, chronic clinical indicators of ADHD Predominantly Inattentive Type as verified by a modified DSM-5 behavioral checklist, (2) the student consistently displayed a baseline sustained attention span of less than 3 minutes during core lessons, and (3) the student possessed no co-occurring intellectual or physical impairments that would otherwise confound academic performance diagnostics. These inclusion criteria were established *a priori* to ensure the selection of a homogenous and representative case that clearly exemplified the target condition, thereby maximizing the internal validity of the study and allowing for a clear attribution of any behavioral changes to the intervention itself. Screening reports from the classroom teacher indicated that Subject X met 7 out of 9 core behavioral criteria for inattention, including frequent careless errors, high distractibility, and prolonged latency in task recovery. Informed consent was formally secured from the subject's parents before beginning the intervention cycle.

Instruments and Materials

The research utilized both behavioral and cognitive measurement instruments. To track behavior, a High-Precision Behavioral Observation Protocol was deployed, utilizing a dual-split stopwatch framework to record two primary metrics: Sustained Attention Duration and Attention Recovery Latency. Qualitative field notes were captured using a structured Collaborative Observation Matrix to log environmental variations and behavioral triggers. For cognitive

monitoring, Daily Cognitive Formative Assessments consisting of 5-question visual-matching and syllable-identification tasks were utilized. To establish content validity, these formative tests were reviewed by special education faculty peers to ensure alignment with the basic literacy and numeracy objectives of the national curriculum. However, this expert judgment represents a preliminary step, and further empirical validation is needed to strengthen the validity argument. For behavioral tracking, inter-rater agreement was calculated between the classroom teacher and the collaborative co-author observer to assess reliability. While this provides a basic measure of consistency, the reliability evidence is limited as it does not account for potential observer drift or intra-rater reliability over time, and the single-session agreement may not fully capture the stability of the observations. The instructional materials consisted of short-from 3 to 5 minutes animated educational multimedia videos focusing on foundational KVKV reading patterns and single-digit arithmetic, projected via an LCD screen.

Procedure and Data Collection

The intervention spanned five consecutive school days and followed a strict step-by-step daily layout divided into three operational phases. In the pre-intervention phase, Subject X's physical environment was altered by shifting his seating layout to the front row, establishing a fixed 1-to-1.5-meter radius from the teacher's primary instruction zone to implement spatial scaffolding. In the Intervention phase, traditional verbal lecturing was replaced with the periodic projection of the 3-to-5-minute multimedia educational anchors. Concurrently, the teacher executed a two-step proactive classroom behavior management routine: moving within the proximity radius and applying low-volume, non-invasive prompts (a double-tap on the desk surface as a non-verbal cue, followed by a minimal verbal prompt if redirection did not occur within 3 seconds). In the post-intervention phase, data collection was finalized each day by administering the daily cognitive formative assessment. Ecological triangulation data were gathered through semi-structured parental interviews conducted before and after the five-day cycle to monitor cross-setting behavioral consistency at home.

Data Analysis

Data analysis incorporated a mixed-methods approach to synthesis. Quantitative behavioral data were analyzed using IBM SPSS Statistics version 26. Descriptive statistics were computed for each session and paired sample t-tests were applied to compare post-intervention performance against baseline values across the five-day timeline to determine statistical significance. Task-distraction frequencies were tallied per session to determine behavioral stabilization patterns. Academic progress was evaluated by tracking raw cognitive test scores against the school's institutional Minimum Mastery Criteria (KKTP). Qualitative data derived from the collaborative observer's field notes underwent a systematic thematic coding process to contextualize behavioral fluctuations, such as the lighting anomaly on Day 3. Parental interview transcripts were analyzed using qualitative content analysis to cross-examine and validate the home-school ecological carryover effects of the intervention.

Ethical Considerations

This study strictly adhered to the ethical principles governing research with human subjects and vulnerable pediatric populations. Prior to the study, the research team secured active, written parental informed consent alongside the child's verbal assent. Absolute participant anonymity and confidentiality were maintained by mask-coding the student's true identity under the pseudonym "Subject X" across all field notes, data sheets, and final manuscript text. The parents and school administration were fully informed of their voluntary participation and held the unconstrained right to withdraw the subject from the intervention cycle at any operational point without penalty. Secure data storage protocols were enforced, ensuring that all physical observation logs, digital assessment scores, and audio interview records were encrypted and accessible solely to the primary research team.

RESULTS AND DISCUSSION

Results

The subject's behavioral focus was tracked daily across five key indicators. Over the intervention period, sustained attention duration showed a consistent upward trajectory, increasing from a pre-intervention baseline average of 2.6 minutes to 15.0 minutes by Day 5 representing a 477% improvement. Concurrently, task-distraction frequency decreased steadily from more than 10 episodes per session to just 2 episodes, while attention recovery latency shortened dramatically from an average of 115 seconds to a range of 5–10 seconds compiled in table 1.

Table 1. Behavioral Progress Metrics

No	Research Phase and Daily Evaluation Timeline	Sustained Attention Duration	Task-Distraction Frequency (Count per Session)	Attention Latency (Seconds)	Recovery
1	Pre-Intervention Baseline (Historical Average)	2.6	> 10	115	
2	Day 1 (Initial Monday Evaluation Block)	5.0	8	45 - 60	
3	Day 2 (Tuesday Evaluation Block)	7.5	6	30 - 40	
4	Day 3 (Wednesday Evaluation Block / Lighting Anomaly)	10.0	5	15 - 20	
5	Day 4 (Thursday Evaluation Block)	12.5	3	10 - 15	
6	Day 5 (Final Friday Evaluation Block)	15.0	2	5 - 10	

On Wednesday, a minor lighting anomaly occurred in the classroom. Although this temporarily caused a slight increase in off-task glancing (observed in 2 additional distraction episodes), the subject was able to re-engage within 15–20 seconds notably faster than on previous days suggesting that the intervention had already begun to strengthen self-regulation skills.

To assess cognitive-academic outcomes, the subject completed one formative test per day. All tests were curriculum-aligned and scored on a 0–100 scale. Institutional Mastery Status was defined using the following criteria: (1) Mastered: Raw score ≥ 80 , indicating that the subject correctly answered at least 80% of test items and demonstrated operational understanding of the target competency. (2) Incomplete: Raw score < 80 , indicating that the subject has not yet met the minimum proficiency threshold and requires remedial reinforcement.

As shown in Table 2, the subject's raw scores improved from a pre-intervention diagnostic score of 45 (*Incomplete*) to consistently high scores ranging from 80 to 100 across Days 1–5. By Day 2, the subject had already achieved the *Mastered* status and sustained this level through the end of the cycle, with a final comprehensive evaluation score of 98. The systematic stabilization of Subject X's behavioral focus directly supported a substantial, verifiable turnaround in his cognitive-academic performance. The academic progress metrics are systematically compiled in Table 2.

Table 2. Cognitive Performance Trajectory

No	Assessment Block	Curricular Target and Formative Test Content	Raw Cognitive Score (0-100)	Institutional Mastery Status
1	Pre-Intervention Assessment	Initial Literacy and Numeracy Diagnostic Matrix	45	Incomplete
2	Day 1 Formative Test	KVKV Syllable Identification Matrix	80	Mastered
3	Day 2 Formative Test	Short Sentence Reading and Comprehension	90	Mastered
4	Day 3 Formative Test	Basic Single-Digit Addition Exercises	100	Mastered
5	Day 4 Formative Test	Visual Spatial Logic and Pattern Matching	100	Mastered
6	Day 5 Formative Test	Comprehensive End-of-Cycle Evaluation Module	98	Mastered

Throughout the five days, the researcher observed that the subject's confidence visibly increased particularly after Day 2, when the subject began attempting answers without prompting. By Day 4, the subject was able to explain his reasoning for pattern-matching tasks aloud, indicating not only mastery but also growing metacognitive awareness. These qualitative observations align with quantitative data, reinforcing the conclusion that the multimedia-anchored intervention effectively supported both behavioral regulation and academic achievement

Discussion

Behavioral Dynamics and Self-Regulation: Empirical Validation of Cognitive Load Theory

Empirical data from this Classroom Action Research provides tangible verification of the core postulates of John Sweller's Cognitive Load Theory (CLT). The most significant finding is the increase in the subjects' attention span from 2.6 minutes to 15.0 minutes. Within the CLT framework, this improvement indicates that the use of short, structured animated videos is effective in managing intrinsic cognitive load (the inherent complexity of the material) and minimizing extraneous cognitive load (unnecessary cognitive burden) for neurodivergent learners (Morfidi & Iatraki, 2025; Praveen & Srinivasan, 2022; Shi, 2026). These short videos serve as a form of 'segmented instruction' that breaks complex information down into smaller units (chunking), thereby preventing cognitive overload in working memory, an area that often presents a challenge for learners with special needs. Consequently, limited working memory capacity can be efficiently allocated to deep processing (germane cognitive load), which in turn facilitates the transfer of knowledge into long-term memory. This is consistent with the findings of Ningrum & Patmisari (2023) regarding effective learning strategies for children with special needs in Indonesia, as well as the implementation of visual methods and specialized assistance for ADHD students in elementary schools (Ningsih & Harsiwi, 2025).

The Crucial Role of Human Mediation and Spatial Scaffolding in Multimedia Learning

The finding regarding the dramatic reduction in attention recovery latency from 115 seconds to 5–10 seconds reinforces Mayer's principles of multimedia learning, particularly the importance of signaling and guidance. However, this study's specific contribution lies in highlighting that the effectiveness of technology relies heavily on the presence of a human agent acting as an active mediator. The lighting issue encountered on Day 3 demonstrated the technology's vulnerability to environmental disturbances (glare). The subjects' ability to recover within 15–20 seconds faster than on the previous day was not solely due to the technology itself, but rather the teacher's intervention involving spatial scaffolding by maintaining 1–1.5 meters. This practice directly applies the "Reducing Extraneous Processing" principle of CTML, with the teacher acting as a physical guide who redirects attention to the screen while mitigating the negative effects of environmental distractors. In other words, while the technology provides structured content, the teacher ensures that this content remains cognitively accessible to the students. This aligns with the strategies employed by shadow teachers in handling ADHD students (Achmad et al., 2025) and the explicit instruction strategies implemented in inclusive classrooms (Mas et al., 2024). Furthermore, the role of teacher intervention is reinforced by research on teacher strategies in Arabic language learning for ADHD students (Harahap & Andrian, 2026).

Practical Implications: Towards an Ecological Intervention Model for Resource-Constrained Schools

The success of this integrated intervention model lies not only in the quantitative results but also in its ecological characteristics: simplicity, low cost, and high scalability. This makes it particularly relevant for schools in 3T regions (frontier, outermost, and underdeveloped areas), which often lack advanced infrastructure. These findings align with contemporary inclusive education literature suggesting that resource-constrained public primary schools can achieve high levels of inclusive equity (Fitzgerald & Evans, 2024; Gehret & Elliot, 2025). The key lies not in waiting for expensive infrastructure, but in a smart combination of low-cost physical seating adjustments and targeted digital scaffolding. This approach reflects the principles of constructivist instruction (Liu et al., 2022), wherein learning is constructed through active interaction among students, teachers, and tools, rather than through the passive reception of information from media. The implementation of early detection and intervention for ADHD children, as studied by (Overgaard et al., 2024), further supports the importance of early and appropriate educational responses.

Academic Trajectory and Metacognitive Awareness

The improvement in cognitive-academic performance rising from a score of 45 (Incomplete) to consistently above 80 (Complete), reaching 98 in the final evaluation confirms a systemic link between behavioral stabilization and academic achievement. Furthermore, qualitative observations regarding increased self-confidence and the ability to articulate reasoning by Day 4 indicate that the intervention impacted more than just surface learning; it also began to foster metacognitive awareness. The ability to “think aloud” demonstrates that the subject was not merely memorizing but was beginning to understand and reflect upon their own thought processes. This reinforces the findings of (Zhu et al., 2025) regarding the cultivation of spatial reasoning skills through experiential learning, and the effectiveness of Applied Behavior Analysis intervention on on-task behavior of ADHD students (Gunadi, 2026). The use of game-based learning to improve fine motor skills in ADHD children (Fauziah et al., 2023) similarly demonstrates the multidimensional impact of structured interventions. The role of artificial intelligence and deep learning in supporting teaching and learning processes, as explored by (Sari & Silalahi, 2024), provides additional theoretical grounding for understanding how technology can facilitate metacognitive development. Enhancing educational videos for ADHD learners through multimedia design and deep learning frameworks (Emam et al., 2025) further validates the technological approaches employed in this study. Additionally, (Zulhendri, 2022) highlights the challenges teachers face in dealing with ADHD students, underscoring the importance of the human mediation aspect emphasized in this research.

CONCLUSION

The systematic integration of short-form animated multimedia anchors and proactive behavior modification techniques has proven to be a highly effective and scalable pedagogical approach for enhancing learning engagement, stabilizing focus, and addressing academic underachievement in an elementary school student with Inattentive-Type ADHD within a resource-constrained inclusive setting; this approach resulted in a drastic reduction in the frequency of off-task behaviors, faster attention recovery times, and a 98% mastery score on the final comprehensive evaluation. However, these findings must be interpreted with caution due to study limitations, including a single-case design that restricts generalizability, a brief intervention duration that failed to test long-term sustainability after the novelty effect of the digital media wore off, and resource constraints that impacted intervention intensity. Theoretically, future research should adopt a cross-subject multiple-baseline or quasi-experimental design to test external validity while exploring mediating variables such as intrinsic motivation and emotional regulation; practically, teachers and inclusive education practitioners are advised to combine animated media with contextual behavioral reinforcement and provide a transition period between the media presentation and academic tasks to optimize the transfer of attention. Consequently, future researchers are strongly encouraged to conduct multi-site longitudinal investigations across various inclusive elementary schools to evaluate the sustainability of this combined intervention as the initial appeal of the digital media naturally diminishes.

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