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Exploring Children's Attention Capacities During Unplugged Coding Activities in Early Childhood Education

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Abstract

Attention is a fundamental cognitive ability that plays a crucial role in early childhood learning success. This study aims to explore the manifestation of attention abilities in children aged 4-5 years during unplugged coding activities using building blocks. The study employed a descriptive qualitative approach with semi-structured interviews with one classroom teacher who directly observed the learning process. Data were analyzed using a grounded theory approach through open coding, axial coding, and selective coding stages. Results revealed four main findings: (1) unplugged coding activities elicited sustained attention in children; (2) differences in selective attention quality existed between children who built higher versus lower structures; (3) structured instruction more effectively directed goal-directed attention; and (4) adequate availability of learning media was a critical factor for children's attention quality. This research provides practical implications for early childhood educators that unplugged coding can serve as an effective learning alternative to train attention abilities.

Keywords: children's attention, unplugged coding, early childhood education, concentration skills, building blocks

INTRODUCTION

sensitive to environmental context, task design, and instructional media. Emerging research highlights that young children with attentional difficulties require structured, meaningful, and hands-on interventions to foster sustained cognitive focus.

Concurrently, the pervasive infiltration of digital screens into early childhood contexts has raised significant concerns regarding shortened attention spans and reduced self-regulation. In response, educational frameworks increasingly advocate for unplugged coding—the teaching of computational thinking and logic through tangible, screen-free physical manipulatives. By engaging children in algorithm-like sequencing, pattern building, and spatial problem-solving using concrete objects like building blocks, unplugged coding bridges early computer science concepts with age-appropriate physical play.

While recent studies in early childhood education have documented the benefits of unplugged coding for problem-solving, critical thinking, and spatial reasoning, few empirical investigations explicitly examine attention as a foundational executive function. To address this gap, this study examines how sustained, selective, and goal-directed attention capacities manifest during block-based unplugged coding activities in a preschool setting.

RESEARCH METHODS

This study employed a qualitative descriptive case study design to gain an in-depth understanding of children's attentional behaviors in a naturalistic educational context.

Participants and Context

The study was conducted at the State Special Primary School (SLBN) Ogan Ilir. The primary research participants consisted of:

- The primary classroom teacher specializing in early childhood special education ($N = 1$).
- A 5-year-old Grade 1 student formally diagnosed with Down syndrome ($N = 1$).

Data Collection Techniques

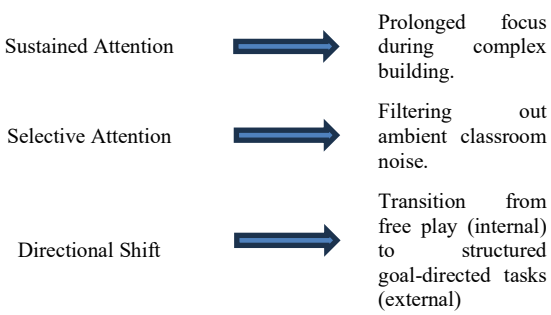
Data were gathered through three integrated techniques:

1. **Semi-Structured Key-Informant Interview:** An in-depth interview was conducted with the classroom teacher, guided by a protocol covering attentional persistence, response to environmental noise, task-switching behaviors, and social interaction during block coding tasks.
2. **Observational Records & Documentation:** Field notes documenting classroom layout, block availability, and children's task completion dynamics were reviewed to corroborate interview accounts.

Data Analysis and Rigor

Data were analyzed using thematic analysis comprising data familiarization, initial code generation, category search, theme refinement, and narrative synthesis. Trustworthiness was established through source triangulation and member checking.

RESULT AND DISCUSSION



ATTENTION MANIFESTATION FRAMEWORK

Elicitation of Sustained Attention Through Tangible Coding

The findings demonstrate that block-based unplugged coding fosters high levels of sustained attention (on-task persistence). When tasked with building elevated structures following algorithmic sequences, children exhibited prolonged focus, actively monitoring structural balance and adjusting placement to prevent collapse.

"Children attempting to build higher structures appeared completely absorbed in their task, showing minimal regard for surrounding activity. Their attention was entirely focused on balancing the blocks and ensuring structural stability." — Key Informant Interview

This state of cognitive absorption aligns with Csikszentmihalyi's flow theory and Diamond's executive function framework, wherein optimal challenge levels paired with immediate physical feedback induce sustained attentional states.

Selective Attention and Environmental Distraction Filtering

Selective attention—the ability to filter out irrelevant auditory and visual stimuli—was prominently observed during complex building tasks. Children engaged in higher-level spatial balancing maintained task focus despite background classroom noise.

This confirms Posner and Petersen's attention model, suggesting that high task involvement strengthens top-down attentional control, enabling young children to suppress ambient environmental interference.

Shift Between Internally and Externally Directed Attention

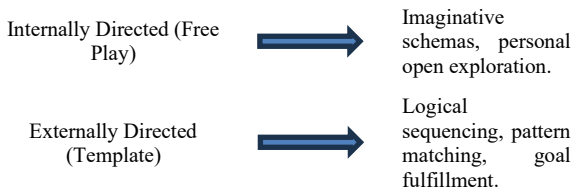
The study identified a distinct qualitative shift in attention based on task structure:

• Free Play (Internally Directed): During unstructured building, children

drew upon personal memories and imaginative schemas (e.g., constructing hotels, zoos, or homes).

• Structured Coding (Externally Directed): When provided with explicit sequence templates or pattern targets, children shifted toward goal-directed, externally focused attention, prioritizing accuracy, directionality, and logical order.

ATTENTIONAL DIRECTIONALITY MODES



Both attentional modes offer valuable educational benefits: unstructured play nurtures creative expression, whereas structured unplugged coding builds goal-directed executive control.

Inclusivity and Social Attention

Unplugged coding demonstrated strong inclusive potential. Children who typically exhibited hyperactive or inattentive behaviors during conventional sedentary instruction demonstrated high task engagement and sustained focus during tactile block coding. Furthermore, the activity fostered social attention, as children spontaneously assisted peers in correcting sequencing errors.

Environmental Factors: Media Availability and Teacher Scaffolding

Resource availability emerged as a critical mediating factor. Insufficient quantities of building blocks led to conflict, frustration, and attentional breakdown. Effective teacher scaffolding—offering subtle guidance while allowing children to solve structural problems independently—proved essential for maintaining task focus.

Conclusion

This study demonstrates that unplugged block-based coding is an effective, screen-free pedagogical approach for cultivating sustained and selective attention in early childhood education. Structured coding tasks effectively direct cognitive focus toward goal-driven problem solving while accommodating diverse learning profiles. To maximize attentional benefits, early childhood institutions must ensure adequate physical manipulatives and apply balanced teacher scaffolding that blends open creative play with structured computational challenges.

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