Determining Factors and Strategies for Enhancing Student Focus in Unplugged Coding Learning: A Systematic Literature Review

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Abstract
The integration of unplugged coding in elementary schools offers a solution to the lack of devices in implementing the coding curriculum, but its effectiveness depends on student focus and engagement. This study aims to analyze the factors influencing student focus and strategies for maintaining concentration during such learning. The method used is a Systematic Literature Review (SLR) of articles from 2020–2025 on Google Scholar using keywords related to unplugged coding, focus, attention, and elementary school. Articles were selected based on inclusion criteria and then analyzed using content analysis and narrative synthesis techniques. The analysis of 7 articles revealed that student focus is influenced by kinesthetic stimulation, structured collaboration, and a game-based context. The use of manipulatives and gamification enhances attention as well as mastery of algorithms and debugging. With a balanced instructional design, unplugged coding effectively maintains student focus in alignment with their neurocognitive development.
Keywords: *Unplugged Coding, Student Focus, Computational Thinking, Primary Education*

Abstrak
Integrasi *unplugged coding* di sekolah dasar menjadi solusi atas keterbatasan perangkat dalam implementasi kurikulum *coding*, namun efektivitasnya bergantung pada fokus dan keterlibatan siswa. Penelitian ini bertujuan menganalisis faktor yang memengaruhi fokus siswa serta strategi untuk menjaga konsentrasi dalam pembelajaran tersebut. Metode yang digunakan adalah *Systematic Literature Review* (SLR) terhadap artikel tahun 2020–2025 dari Google *Scholar* dengan kata kunci terkait *unplugged coding*, fokus, atensi, dan sekolah dasar. Artikel diseleksi berdasarkan kriteria inklusi, lalu dianalisis menggunakan teknik analisis konten dan sintesis naratif. Hasil analisis 7 artikel menunjukkan bahwa fokus siswa dipengaruhi oleh stimulasi kinestetik, kolaborasi terstruktur, dan konteks permainan. Penggunaan alat manipulatif dan gamifikasi meningkatkan perhatian serta penguasaan algoritma dan *debugging*. Dengan desain instruksional yang seimbang, *unplugged coding* efektif menjaga fokus siswa sesuai perkembangan neurokognitifnya.
Kata kunci: *Unplugged Coding, Fokus Siswa, Berpikir Komputasional, Pembelajaran*

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INTRODUCTION

Education in the digital age requires the integration of computational thinking skills from an early age, which are now being incorporated into elementary school curricula. Computational thinking is not just about programming, but rather the ability to solve problems logically, systematically, and efficiently (Wing, 2006). However, infrastructure barriers such as limited computer devices and internet access are often major obstacles in teaching programming in various educational institutions, especially in developing countries. As a solution to these obstacles, the unplugged coding method has emerged as an effective alternative approach. Unplugged coding is a method of teaching computer science concepts through physical activities, card games, or puzzles without using any digital devices at all (Bell & Lodi, 2019). This method emphasizes understanding the logic and basic structure of programming through physical activities and games, making it easier for students to understand coding concepts intuitively and enjoyably (Coding Bee Academy, 2024). The advantage of this method lies in its ability to simplify abstract concepts such as algorithms, looping, and conditionals into real interactions that are easy for students to understand.

Although unplugged coding offers flexibility, the success of this learning method greatly depends on the psychological factors of students, especially the aspect of focus or attention. Learning focus is an important aspect that supports the success of the learning process, where focus is defined as concentrating the mind on the object of learning while ignoring other distractions (Slameto, 2020). Good concentration and learning focus can increase students' motivation and absorption of the material being taught (Aviana & Hidayah, 2015). Basically, each individual's level of learning focus differs from one another, and so does a student. The dimensions of individual differences in learning focus are influenced by intelligence, logical thinking skills, creativity, cognitive style, personality, values, attitudes, and interests (Ada, 2020). Students who have good learning focus will find it easier to understand the subject matter and achieve optimal results. However, in today's digital age, students' attention is often divided by numerous technological distractions, so learning methods that can effectively improve students' focus and concentration are needed.

The challenge that arises in unplugged coding learning is that this method does not use digital media, which usually attracts students' visual and auditory attention (Coding Bee Academy, 2024). Therefore, this study is important to analyze the factors that influence students' focus in unplugged coding learning and identify strategies used to maintain students' focus in these activities. The issues raised in this study are whether students' focus can be maintained during unplugged coding learning and what steps are considered effective in maintaining student focus. Although this method is considered effective because it frees students from digital technology distractions that often divert their attention (Dontre, 2020), the reality in the field shows that maintaining student focus remains a major challenge, given the variation in student abilities and the role of teachers in facilitating engaging and interactive learning (Wahono et al., 2025).

Several recent studies show that unplugged coding significantly improves elementary school students' computational thinking (CT) skills, particularly in the areas of algorithms, abstraction, evaluation, decomposition, and generalization (Dag et al., 2023). Other studies have also found that unplugged coding activities are very beneficial for developing computational thinking in elementary school children, while also improving self-efficacy and social skills (Berg et al., 2025). Computational thinking learning through programming in K-12 effectively improves students' problem-solving and logic skills, but age-appropriate materials and methods need to be developed to optimize results (Lye & Koh, 2014). According to previous research, screenless learning environments can reduce cognitive fatigue, but on the other hand, unstructured physical activities in

unplugged learning risk breaking students' concentration if not managed properly (Brackmann et al., 2017).

Based on these previous studies, it can be concluded that unplugged coding is an effective method for improving elementary school students' computational thinking (CT) abilities, problem-solving skills, and self-efficacy through a screenless learning environment that reduces cognitive fatigue. However, to maximize these benefits and mitigate the risk of distraction from physical activities, it is necessary to develop age-appropriate materials and implement structured instructional design to maintain students' concentration and focus.

To date, literature on unplugged coding learning has focused more on computational skills, problem solving, collaboration, cognitive learning outcomes, and creativity development. There is still a research gap regarding how student focus is maintained during the learning process. Students' inability to focus is often caused by uninteresting instructional design or overly complex instructions in unplugged activities. Therefore, this study was conducted using the Systematic Literature Review (SLR) method to synthesize various findings from previous studies. The main focus of this review is to analyze the factors that influence student focus and identify the most effective pedagogical strategies in maintaining student attention during unplugged coding activities. The results of this study are expected to contribute theoretically to the development of a more inclusive and effective CT learning design.

In an effort to achieve these objectives, this study will systematically synthesize relevant literature to answer several key research questions. By identifying trends and findings from various previous studies, this article focuses on three research questions conducted by following the Systematic Literature Review protocol to ensure objectivity in answering the following research questions: 1) What factors significantly affect students' focus and attention levels during unplugged coding activities? 2) What instructional strategies or learning design elements are most effective in minimizing student distractions in unplugged methods? and 3) How does the level of student focus correlate with the effectiveness of computational thinking concept mastery based on the results of the existing literature review? Through the answers to these questions, it is hoped that this research can become a comprehensive reference for education practitioners in optimizing the delivery of unplugged coding material at the elementary school level.

METHOD

This study uses the Systematic Literature Review (SLR) method. SLR is a literature review method that identifies, assesses, and interprets all findings on a research topic to answer predetermined research questions (Kitchenham & Charters, 2007). The stages of this study consist of identifying research questions, literature search strategies, selection criteria, and data extraction.

As mentioned in the introduction regarding the identification of research questions, the next step was to conduct a literature search in December 2025 on several articles indexed in Sinta 1-6 through the Google Scholar academic database. The publication period of the articles analyzed was limited to the years 2020 to 2025 to ensure the relevance and currency of the data. The keywords used in the search were arranged using Boolean operators (AND, OR), including: 1) ("unplugged coding" OR "unplugged computational thinking"), 2) AND ("student focus" OR "student attention" OR "student engagement"), 3) AND ("elementary school").

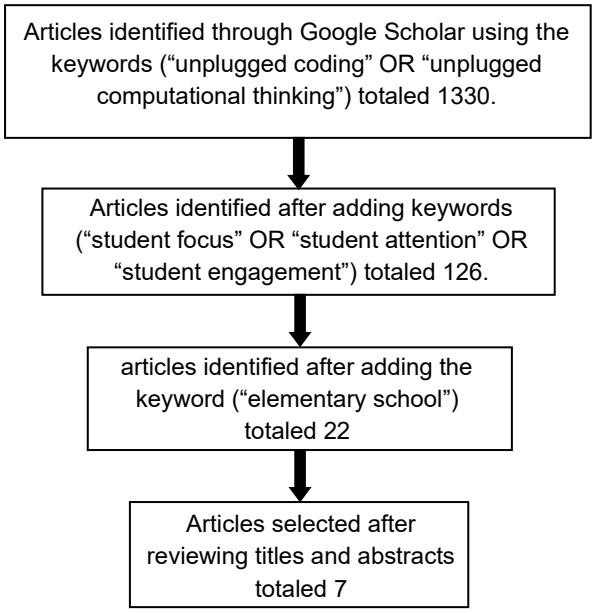
To ensure that the literature reviewed is relevant to the research objectives, the following inclusion and exclusion criteria were established:

Table 1. Inclusion and exclusion criteria

Criteria	Inclusion (Accepted)	Exclusion (Rejected)
Time Range	Articles published in the last 5 years (2020–2025)	Articles published before 2020
Document Type	Scientific journal articles or conference papers that have undergone peer review.	Books, theses, dissertations, editorials, or popular articles.
Language	Indonesian and English.	Languages other than Indonesian and English.
Study Focus	Discusses unplugged coding learning and student focus/attention aspects.	Discusses software-based (plugged) coding without mentioning unplugged methods.
Subject	Students at the elementary education level.	Middle school students or university students.

The article selection process in this study was conducted systematically following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol. The first stage was identification, in which all literature that appeared from the search results using keywords in the database was collected and recorded comprehensively. Next, a screening stage was conducted to eliminate duplicate articles and conduct a preliminary review of the titles and abstracts; articles that were not relevant to the topic of focus for students in unplugged coding learning were immediately excluded at this stage.

Image 1. Article Selection Flow with the PRISMA protocol



After the screening process, the next stage is eligibility testing, where researchers review the full text of the remaining articles to ensure that each document meets all of the previously established inclusion and exclusion criteria. The final stage is inclusion, which is determining the final list of articles that are of high quality and relevant for in-depth analysis. The entire selection process is documented to ensure transparency and replicability in determining the literature that forms the basis of the research database.

The data collected from the seven selected articles were analyzed using content analysis and narrative synthesis techniques to systematically summarize key findings. The analysis process began with the extraction of structured data into summary tables based on the following parameters: author name, year of publication, teaching method, measurement instrument, and main findings regarding factors influencing student focus. Next, thematic coding was performed to group the data into three main categories to answer the research questions: determinants of focus, strategies for mitigating distractions, and the correlation between focus and mastery of computational thinking concepts. All findings from various research methodologies were synthesized descriptively to map the psychological and pedagogical dynamics occurring during the unplugged coding learning process. Finally, the results were interpreted to examine current research trends and identify research gaps regarding how student focus is maintained during the activity.

RESULTS AND DISCUSSION

Results

Based on the results of a search of academic databases, seven articles were selected that met all inclusion criteria, consisting of national and international studies published in the last five years. These articles cover a variety of research methodologies, ranging from quantitative experiments to qualitative case studies, which collectively provide a comprehensive picture of the dynamics of student focus when learning computational thinking without digital devices. The extracted data focused on identifying key variables that affect student concentration, the effectiveness of the learning media used, and the psychological impact of kinesthetic activities on their learning resilience.

The results of the selected literature represent current research trends from various geographical and methodological contexts. Overall, the seven articles show a shift in research focus from mere cognitive effectiveness to in-depth analysis of student learning behavior, particularly the aspects of student focus and active engagement. The majority of studies used experimental and case study approaches to test how physical media such as flow blocks, game cards, and art integration can reduce distractions that often arise in conventional learning. The data also shows that elementary school-aged children are the main focus of the research. This is because childhood is a very important time for them to learn self-management, practice patience, and hone their ability to think before acting, which are important skills for their future development. A detailed overview of the objectives, methods, and key findings of each piece of literature is presented in the following table:

Table 2. Summary of Selected Literature Synthesis

No.	Author(s) & Year	Article Title	Method	Findings Related to Students' Focus/Attention
1	Threekunpra pa & Yasri (2020)	Unplugged Coding Using Flowblocks for Promoting CT	Experimental	The use of physical tools (Flowblocks) increased students' attention span due to instant visual feedback.
2	Syamsiah et al. (2024)	*Pengaruh Edukasi* Unplugged Coding *Terhadap* CT *Anak SD*	Quasi-Experimental	Collaborative unplugged coding activities maintained student engagement longer than theory-based instruction.
3	Chen et al. (2023)	Fostering CT through	Mixed Methods	Gamification elements (challenges and rewards)

		Unplugged Gamified Tools		significantly reduced distractions during learning activities.
4	Dag et al. (2023)	The Effect of an Unplugged Coding Course on Primary School Students…	Experimental	A structured unplugged coding course improved computational thinking while consistent hands-on activities sustained students' attention.
5	Hartono et al. (2025)	*Efektivitas Pembelajaran* Plugged *dan* Unplugged (SLR)	Systematic Literature Review (SLR)	Unplugged methods were more effective in maintaining young learners' attention by minimizing screen-related eye fatigue.
6	Zhang et al. (2025)	Developing children's CT and executive functions	Experimental	Unplugged coding trained executive functions (inhibitory control), which were directly correlated with improved focus.
7	Anuar et al. (2020)	Art-Integration in CT as an Unplugged Approach	Case Study	Art-integrated unplugged coding activities (drawing and coloring) helped students remain calm and concentrate better.

Discussion

Analysis of the extracted literature reveals a consistent pattern regarding how unplugged coding methods play a role in managing student attention. The findings from these various studies not only confirm the effectiveness of non-computer methods, but also map the psychological and pedagogical dynamics that occur during the learning process. The following discussion will outline these findings thematically, grouped according to research questions (RQ) to provide an in-depth understanding of the determinants of focus, distraction mitigation strategies, and their long-term impact on students' computational thinking skills. Through this synthesis, it will become apparent how the interaction between activity design and student developmental characteristics shapes the quality of meaningful learning experiences.

Based on the analysis of the seven literature sources above, the discussion is grouped according to the Research Questions (RQ) that have been formulated:

1. Factors Affecting Student Focus (Answering RQ1)

   Findings from Zhang et al., (2025) and Threekunprapa & Yasri, (2020) show that student focus in unplugged coding is greatly influenced by kinesthetic and visual stimulation. Unlike passive screen-based learning, unplugged activities require physical movement (e.g., jumping on a grid or arranging cards). This diverse sensory involvement prevents boredom and keeps the central nervous system alert, thereby significantly increasing the duration of student focus.
2. Strategies for Minimizing Distractions (Answering RQ2)

   Chen et al., (2023) and Syamsiah et al., (2024) emphasize the importance of Gamification and Structured Collaboration. One of the biggest challenges in the unplugged method is the potential for noise when students work in groups. The literature shows that assigning clear roles (such as The Programmer, The Robot, and The Debugger) can divert students' social energy into focusing on the task.

Additionally, the use of small rewards at each level of the unplugged game has proven effective in keeping students' attention on the instructional path.

3. Correlation between Focus and Mastery of CT Concepts (Answering RQ3)

   There is a strong positive correlation between attention levels and problem-solving abilities. Findings presented by Dag et al., (2023) further reinforce the correlation between attention management and cognitive effectiveness in unplugged learning. In his study, Dag shows that structured unplugged coding courses are able to provide a more stable “focus space” for elementary school students. Through consistent manual activities, students not only learn algorithmic concepts, but also train their mental endurance to stay on one task until it is completed.

A synthesis of seven selected literature reveals that the phenomenon of student focus in unplugged coding is not singular, but rather the result of interactions between media design, classroom management, and students' neurocognitive development. The findings of Dag et al., (2023) and Threekunprapa & Yasri, (2020) collectively confirm that physical (manipulative) media act as “visual anchors” that bind students' attention and focus to the logic of algorithmic sequences. When students hold real objects, their cognitive load is distributed more evenly, thereby minimizing the mental fatigue that usually triggers distraction. This is supported by the perspective of Zhang et al., (2025), who see that this attention engagement indirectly trains children's executive functions, creating a positive cycle in which the more often students engage in unplugged activities, the stronger their ability to maintain concentration on complex tasks.

Furthermore, the integration of social and emotional aspects is a new dimension discovered in this discussion. Anuar et al., (2020) and Syamsiah et al., (2024) show that students' focus peaks when they feel relaxed but collectively challenged. The integration of art and peer collaboration changes students' perceptions of coding—from a rigid logical task to a meaningful play activity. However, as Chen et al., (2023) and Hartono et al., (2025) remind us, this effectiveness is highly dependent on the role of the teacher as a facilitator who is able to direct students' physical enthusiasm to remain in line with instructional objectives. Therefore, the success of unplugged learning does not lie solely in the absence of technology, but in its ability to create a learning ecosystem that respects students' limited attention spans while challenging their intellectual potential.

Overall, unplugged coding learning offers a more “attention-friendly” learning environment for students, especially at the elementary level. The best strategies for maintaining focus are to integrate physical activities, assign specific roles within the group, and ensure that the media used is visually appealing.

CONCLUSION

This study, through a Systematic Literature Review (SLR) approach to literature from the last five years, has successfully concluded several crucial points related to student focus in unplugged coding learning: 1) Determinants of Focus: Student focus in unplugged activities is greatly influenced by sensory and kinesthetic involvement. The use of physical props (manipulatives) acts as a visual anchor that helps students manage their cognitive load, so that their attention remains focused without experiencing screen fatigue. 2) Distraction Mitigation Strategies: The most effective strategies for minimizing distractions are the implementation of structured gamification designs and a clear division of roles in group work. The integration of game elements and instructions related to everyday contexts has been proven to transform students' social energy into productive focus, and 3) Impact on CT Skills: There is a positive correlation between students' attention span and their mastery of computational thinking concepts. Stable focus allows students to engage in more in-depth reflection and manual debugging, which ultimately strengthens their logical and algorithmic understanding beyond simply completing physical tasks.

Overall, this study concludes that unplugged coding learning has great potential in maintaining and improving student focus through a kinesthetic and collaborative approach. Based on a systematic review of the latest literature, it was found that the main factors affecting student attention are concrete media design and active sensory involvement. This method is effective in mitigating digital distractions that are often found in device-based learning. Overall, student focus is not only a supporting factor, but a crucial prerequisite for the successful internalization of computational thinking concepts. Based on these findings, educators are advised to be more creative in designing learning scenarios that combine storytelling elements and concrete instructions in order to maintain students' concentration throughout the learning session. Educational institutions are also expected to facilitate the development of a variety of physical teaching aids to prevent boredom and provide fresh visual stimulation for students. Meanwhile, for future researchers, there is ample room to conduct empirical studies on measuring students' flow state or total focus using more precise psychological instruments. In addition, further research is needed to compare the dynamics of attention between different age groups and social backgrounds of students in order to gain a more inclusive understanding of the long-term effectiveness of this unplugged coding method.

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