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Learning Coding Through Scratch Edugames for Elementary School Children

Setyaningsih*[1], Fina Fakhriyah[2], Nur Fajrie [3]

[1,2,3] *Universitas Muria Kudus, Indonesia*
e-mail: [1]salsabilpriza@gmail.com, [2,3]nur.fajrie@umk.ac.id,

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ABSTRACT. This study aims to examine the effectiveness of using Scratch Edugame in enhancing coding skills among elementary school students. The research employs a qualitative approach, utilizing direct observations and questionnaires to gather data on students' engagement and understanding during coding lessons. The findings reveal that students demonstrated a high level of engagement and enthusiasm, actively exploring various command blocks in Scratch and collaborating with peers. Furthermore, students were able to solve basic coding problems independently, showcasing their problem-solving skills. The study concludes that Scratch, as an interactive and game-based learning tool, not only helps in teaching basic coding concepts but also fosters creativity, critical thinking, and collaboration among students. The use of Scratch in coding education contributes to a positive learning environment, enhancing students' motivation and confidence in technology-related subjects. This research highlights the potential of Edugame platforms like Scratch in elementary education, suggesting further exploration of its long-term impact on student learning.

Keywords: *Coding; Edugame; Elementary School*

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INTRODUCTION

In the midst of rapid technological advancement, the demand for fundamental digital skills such as coding has become increasingly essential, particularly for younger generations who will face complex challenges in the digital era (Alviana Metasari & Nur Amalia, 2024). Coding is no longer viewed solely as a technical skill for computer scientists, but as a foundational literacy that supports logical reasoning, creativity, and problem-solving abilities. As a result, introducing coding education at the elementary school level is considered a strategic step to prepare students for future academic and professional demands.

One educational platform that has gained significant attention in introducing coding to children is Scratch. Scratch is a game-based learning application specifically designed to help children understand basic programming concepts through visual block-based coding (Nisa et al., 2025). By eliminating complex syntax, Scratch allows elementary school students to focus on computational thinking processes such as sequencing, loops, and conditionals. This approach aligns well with children's cognitive development stages, making coding more accessible and enjoyable.

Within the context of elementary education, learning coding through edugames such as Scratch is expected to provide benefits beyond technical proficiency. Several studies indicate that Scratch-based learning can enhance students' logical thinking, creativity, and problem-solving skills while simultaneously increasing motivation and engagement (Stoustrup et al., 2023). The playful and interactive nature of Scratch encourages students to experiment, make mistakes, and learn through exploration, which is crucial for meaningful learning experiences.

Globally, the integration of technology into education, particularly coding education, has received growing attention from researchers and policymakers (Rahman et al., 2022). Many countries have begun incorporating computational thinking and coding into their primary school curricula. However, despite this growing interest, there remains a need to explore instructional approaches that are both enjoyable and developmentally appropriate for young learners, especially through game-based learning environments (Perkins, M & Roe, J, 2024)

In this regard, Scratch stands out as a promising instructional tool due to its intuitive interface, interactive features, and game-oriented design. Scratch allows students to create stories, animations, and games, enabling them to actively construct knowledge rather than passively receive information. Consequently, the use of Scratch edugames in elementary schools is important to examine in order to understand how children experience learning and how these experiences influence their cognitive and affective development.

Previous research has predominantly focused on the technical aspects of Scratch implementation, such as students' ability to operate the software or complete programming tasks successfully (Marudut et al., 2020). While these studies provide valuable insights, they often overlook non-technical dimensions of learning, including creativity, collaboration, communication, and critical thinking. Recent studies emphasize that these non-technical skills are equally important outcomes of coding education at the elementary level (Li, 2023)

Moreover, much of the existing literature examines Scratch-based learning in countries with well-established educational infrastructures. Research exploring the implementation of Scratch in developing countries, including Indonesia, remains limited. This gap highlights the importance of conducting context-sensitive studies that consider local social, cultural, and educational conditions (Marmoah et al., 2022). Understanding how Scratch is adapted and received in Indonesian elementary schools is essential for ensuring its effectiveness and sustainability.

Therefore, this study aims to explore the implementation of coding learning through Scratch edugames in the Indonesian elementary school context. The primary objective is to describe how Scratch influences students' learning experiences, focusing on emotional engagement, social interaction, and cognitive development. By adopting a qualitative approach, this study seeks to capture students' perceptions and lived experiences during the learning process.

Additionally, this research seeks to examine changes in students' thinking patterns, including their approaches to problem-solving, collaboration with peers, and emotional responses such as enjoyment, frustration, or satisfaction while using Scratch (Pedroso et al., 2023). Data will be collected through classroom observations, interviews with teachers, and discussions with parents to provide a comprehensive understanding of Scratch's impact on learning.

The findings of this study are expected to contribute significantly to the development of technology-based learning methodologies in Indonesia. Furthermore, the results may offer valuable insights for educators and policymakers regarding the importance of integrating edugames like Scratch into elementary education. By leveraging engaging and educational technologies, elementary schools can create more effective and meaningful learning environments that equip students with essential skills for the digital age.

METHOD

This study employs a qualitative descriptive research design to explore the implementation of Scratch-based edugames in elementary coding instruction. Qualitative research is grounded in an inductive paradigm that emphasizes understanding social phenomena through systematic observation and participant perspectives (Sugiyono, 2019). Recent methodological scholars affirm that qualitative inquiry is particularly suitable for capturing complex learning processes, contextual classroom interactions, and meaning-making experiences that cannot be adequately represented through numerical data (Creswell & Poth, 2021). By focusing on naturally occurring instructional settings, this approach enables an in-depth exploration of how digital learning tools are integrated into real classroom practices.

The qualitative approach adopted in this study is naturalistic in nature, as the research was conducted in an authentic educational environment without manipulation of learning conditions. Naturalistic inquiry allows researchers to examine educational phenomena as they unfold organically, preserving the integrity of social interactions and learning dynamics (Lincoln & Guba, 2019). In this context, the study seeks to provide a detailed description of how Scratch edugames are utilized in elementary coding lessons and how they influence students' creativity, problem-solving abilities, and collaborative skills. This aligns with contemporary educational research that highlights the importance of contextualized and learner-centered methodologies when examining technology-enhanced learning (Braun & Clarke, 2021).

The primary objective of this study is to describe and analyze the phenomenon of coding instruction using Scratch edugames, particularly in relation to the development of students' logical and creative thinking skills. The research focuses on students' interactions with the Scratch platform, including how they design programs, solve coding challenges, and collaborate with peers. In addition, the study examines the role of teachers in planning, implementing, and evaluating Scratch-based learning activities. Understanding both student and teacher perspectives is essential, as prior studies emphasize that effective technology integration depends not only on digital tools but also on pedagogical design and instructional decision-making (Koehler et al., 2019).

The research subjects consist of information and communication technology (ICT) teachers and fourth- and fifth-grade students at an urban elementary school. The object of the study is the implementation of Scratch edugames in coding instruction and their impact on students' creativity, problem-solving skills, and peer collaboration. The research site was selected purposively because the school has actively integrated digital technology into its curriculum and regularly uses Scratch as an interactive and engaging learning medium. Purposeful site selection is commonly recommended in qualitative research to ensure information-rich cases that can illuminate the research focus in depth (Creswell & Poth, 2018).

Data were collected through in-depth interviews, classroom observations, and document analysis, which are widely recognized as core techniques in qualitative educational research (Merriam & Tisdell, 2016). Interviews were conducted with teachers involved in Scratch-based instruction and with selected students chosen purposively to gain rich insights into their learning experiences. Observations focused on student engagement, interaction patterns, and collaborative dynamics during Scratch activities. Documentation included lesson plans, field notes, photographs, and students' digital projects. Data analysis followed the interactive model proposed by Miles, (Miles et al., 2014) consisting of data reduction, data display, and conclusion drawing. To ensure trustworthiness, data credibility was enhanced through source triangulation (teachers and students) and method triangulation (interviews, observations, and documentation), thereby strengthening the validity and reliability of the research findings.

RESULT AND DISCUSSION

Result

This study portrays a dynamic and highly engaging classroom atmosphere during students' participation in coding lessons using Scratch. Throughout the learning process, students demonstrated strong enthusiasm and curiosity, actively experimenting with various command blocks to create moving animations and simple interactive games. Rather than being passive recipients of instruction, students took an exploratory role, testing ideas, making revisions, and learning from immediate visual feedback provided by the Scratch platform.

Social interaction played a significant role in shaping the learning experience. Students frequently engaged in peer discussions, exchanged ideas, and offered assistance to one another when encountering difficulties. This collaborative problem-solving process fostered a positive social learning environment, indicating a noticeable improvement in students' teamwork and communication skills. The classroom setting thus evolved into a community of learners where knowledge was constructed collectively rather than individually.

Students' emotional responses further reflected the effectiveness of this approach. When they successfully completed an animation or game, their facial expressions revealed a strong sense of pride, achievement, and satisfaction. These affective outcomes are consistent with the questionnaire results, which show that the majority of students perceived Scratch-based learning as enjoyable, accessible, and not overly difficult. Importantly, students reported feeling more confident and willing to experiment, even when the possibility of making mistakes existed.

Overall, the integration of Scratch in the learning process successfully created a supportive and enjoyable learning environment. It enhanced students' intrinsic motivation, encouraged a growth mindset toward problem-solving, and strengthened both their social skills and self-confidence in learning technology. These findings suggest that Scratch is not only an effective tool for introducing coding concepts but also a powerful medium for promoting meaningful, student-centered learning experiences in the classroom

The observational findings were strongly supported by questionnaire results, which revealed that the majority of students perceived Scratch-based coding lessons as enjoyable, accessible, and not overly difficult. Many students reported feeling more confident in trying new tasks, even when there was a possibility of making mistakes. This shift in mindset suggests that Scratch helps reduce anxiety toward learning technology and encourages a growth-oriented approach to problem-solving.

Student Engagement in Learning

Student engagement during Scratch-based coding lessons was significantly higher than that observed in conventional instructional settings. Based on classroom observations, most students actively interacted with the learning materials by experimenting with different programming blocks, engaging in discussions with peers, and demonstrating curiosity toward the features available in Scratch. This level of engagement reflects a learner-centered environment in which students take an active role in constructing their own knowledge.

As expressed by the fourth-grade teacher (BN), the use of Scratch captured students' attention more effectively than traditional teaching methods. The teacher noted that students were more focused and directly involved in each stage of the learning process, in contrast to the relatively passive participation often seen in conventional lessons. According to the teacher, Scratch-based learning made coding concepts easier for students to understand, as abstract ideas were presented in a visual and interactive format.

This perspective was further reinforced by the school principal (AD), who emphasized the school's commitment to creating an enjoyable and interactive learning environment. The principal highlighted that the implementation of Scratch-based edugames significantly increased students' engagement and motivation. Students not only showed greater enthusiasm but also demonstrated a clearer understanding of basic coding concepts, suggesting that game-based learning effectively supports conceptual comprehension.

Overall, teachers observed that Scratch-based coding instruction resulted in higher levels of focus, participation, and motivation compared to previous conventional learning experiences. The use of Scratch edugames successfully attracted students' attention, created a fun and interactive classroom atmosphere, and significantly enhanced their motivation to learn. Beyond its entertainment value, this game-based approach proved effective in helping students grasp fundamental coding concepts while simultaneously strengthening their social skills, confidence, and positive attitudes toward technology-based learning.

Enthusiasm and Problem-Solving Skills

Students demonstrated remarkable enthusiasm when they successfully created animated projects using Scratch. This enthusiasm was evident not only in their excitement during the learning process but also in their persistence in experimenting with various features of the platform. As expressed by BN, a fourth-grade classroom teacher, "*Observing students successfully create moving animations and correct their mistakes with minimal guidance indicates that they are beginning to master basic coding skills and develop independent problem-solving abilities.*" This statement highlights the emergence of students' foundational computational thinking skills, particularly in understanding cause-and-effect relationships within coding sequences.

This observation was further reinforced by AD, the school principal, who noted that the learning activities fostered not only high levels of student engagement but also meaningful collaboration among learners. According to AD, "*Students not only show extraordinary enthusiasm, but they also improve their collaboration and teamwork skills by helping one another and exchanging project ideas*." This collaborative atmosphere encouraged students to communicate their ideas, negotiate solutions, and collectively refine their projects, thereby enhancing both their social and cognitive development.

The sense of achievement gained from successfully completing animations played a significant role in motivating students to continue exploring and experimenting with Scratch. This feeling of accomplishment increased their confidence and willingness to take learning risks, such as trying new commands, combining different blocks, and modifying existing code structures. As a result, students became more active learners who were eager to expand their understanding beyond initial instructions.

Furthermore, students demonstrated the ability to identify and correct simple errors in their programs through basic debugging processes with minimal teacher intervention. This indicates that they were not merely following instructions mechanically, but were beginning to understand the logic behind their code. Such experiences are crucial in developing independent learning habits and problem-solving skills, which are essential competencies in technology-based education.

In addition to cognitive gains, positive social interactions were also observed throughout the learning activities. Students frequently assisted their peers, shared creative ideas, and provided constructive feedback on each other's projects. These interactions reflect a noticeable improvement in collaborative skills, including teamwork, mutual respect, and effective communication. Overall, the implementation of Scratch-based learning not only enhanced students' basic coding abilities but also contributed to the development of independent problem-solving skills and positive social collaboration, both of which are vital for preparing students to engage with future digital learning environments.

Positive Response to Learning

Students demonstrated a remarkably strong positive response to learning coding through Scratch-based edugames. The majority of students reported that this learning approach was enjoyable, engaging, and easy to understand. The game based and visual nature of Scratch allowed students to interact with coding concepts in a way that felt familiar and playful, reducing the perception of coding as a difficult or intimidating subject. This positive experience was clearly articulated by BN, a fourth grade classroom teacher, who stated:

> *"I enjoy learning Scratch because I can create my own games, and learning coding does not feel difficult since it is like playing"*

In addition to enjoyment and comprehension, several students expressed an increased willingness to experiment and take risks during the learning process, even when they anticipated making mistakes. This was highlighted by NS, a fourth grade student, who remarked:

> *"I feel more confident to try, even if I make mistakes."*

Such responses indicate a significant improvement in students' self-confidence and learning autonomy in the context of technology education. The Scratch edugame environment appears to foster a psychologically safe learning space where errors are perceived as a natural part of the learning process rather than as failures. These findings suggest that Scratch not only simplifies abstract coding concepts through visual programming and interactive gameplay, but also provides essential emotional support that helps students overcome fear of failure a common barrier in learning technology. Consequently, Scratch-based learning contributes holistically to both cognitive development and affective growth, particularly in building confidence, resilience, and a positive attitude toward coding among elementary school students.

Building Motivation and Self-Confidence

Scratch has been shown to significantly enhance students' intrinsic motivation in the learning process, as well as their self-confidence when facing technological learning challenges. By providing an accessible and engaging platform, Scratch enables students to explore coding concepts without feeling overwhelmed, thereby fostering a sense of autonomy and enjoyment in learning. This finding was supported by BN, a fourth-grade classroom teacher, who stated:

> *"Scratch helps students feel more comfortable and enthusiastic about learning coding, while simultaneously improving their technical and social skills, such as communication and collaboration."*

The game-based and interactive nature of Scratch creates a learning atmosphere that is both enjoyable and meaningful. Students are encouraged to experiment, make mistakes, and refine their ideas, which helps reduce anxiety related to technology-based learning. As a result, learners demonstrate greater persistence and curiosity, key components of intrinsic motivation that are essential for sustainable learning engagement.

This perspective was further reinforced by AD, the school principal, who emphasized the broader impact of Scratch-based learning on the school environment:

> *"Scratch-based learning creates a positive and open learning environment, encouraging students to actively participate and increasing their confidence in facing learning challenges."*

From an institutional standpoint, Scratch not only supports individual student growth but also contributes to the development of a more inclusive and supportive learning culture. Students feel valued as active participants in the learning process, rather than passive recipients of information. This sense of appreciation strengthens their self-efficacy and willingness to take intellectual risks.

Moreover, edugame-based learning through platforms such as Scratch is effective not only in developing essential technical skills, including basic programming and logical thinking, but also in nurturing students' social competencies. Collaborative project-based activities in Scratch promote communication, teamwork, and problem-solving skills, which are crucial for students' holistic development at the elementary level.

Overall, the use of Scratch motivates students to engage fully in the learning process, integrating cognitive, emotional, and social dimensions of learning. Such engagement is particularly important in elementary education, where positive learning experiences play a foundational role in shaping students' attitudes toward technology and lifelong learning.

Building Creativity and Social Skills

The importance of game-based learning is clearly reflected in the use of Scratch as an educational medium, where students are able to experience the benefits of technology in an engaging, enjoyable, and non-burdensome manner. By integrating learning with play, Scratch creates a learning environment that reduces anxiety, increases motivation, and encourages active participation. This approach allows students to perceive technology not merely as a complex or intimidating tool, but as a creative platform that supports exploration and self-expression. As explained by BN, a fourth-grade classroom teacher:

> *"Learning using Scratch does not only teach coding skills, but also enhances students' creativity, critical thinking, and social skills through collaboration and group discussions."*

Coding instruction delivered through Scratch-based edugames goes beyond introducing fundamental programming concepts such as sequencing, loops, and logical structures. It also equips students with essential twenty-first-century skills that are highly relevant to their daily lives. Through designing games, solving problems, and debugging programs, students are encouraged to think critically, experiment with ideas, and develop creative solutions. These processes foster higher-order thinking skills, as students must analyze challenges, evaluate outcomes, and refine their work independently or collaboratively.

This perspective is further reinforced by AD, the school principal, who emphasized the broader educational value of game-based learning:

> *"Through game-based learning, students do not only learn about technology, but also acquire important skills such as teamwork, respect for differences, and the ability to share ideas, which are essential in today's globalized world."*

Moreover, interaction through group discussions and collaborative project work provides meaningful opportunities for students to develop social and communication skills. While working in teams, students learn how to negotiate roles, listen to diverse perspectives, and appreciate differing opinions. Such experiences cultivate mutual respect and empathy, which are critical components of effective collaboration. These social competencies are increasingly valued in modern educational and professional contexts, where the ability to work collaboratively and adapt to diverse environments is essential for addressing global challenges.

Overall, the integration of Scratch-based edugames demonstrates that learning coding can serve as a holistic educational experience. It not only enhances students' technological literacy but also supports the development of creativity, critical thinking, and social awareness. Consequently, game-based learning emerges as a powerful pedagogical approach that prepares students academically, socially, and emotionally to navigate the complexities of the digital and global era.

Discussion

Game based learning, particularly through the use of Scratch, has been widely recognized as an effective approach to creating an engaging, enjoyable, and low-pressure learning environment for students. By integrating elements of play with instructional content, Scratch helps reduce learning anxiety and fosters a sense of curiosity and enjoyment. Interactive and technology-based approaches have been shown to significantly enhance students' intrinsic motivation, enabling them to grasp abstract concepts more easily and meaningfully (Padthar et al., 2024). As a result, students are more willing to explore, experiment, and persist in learning tasks compared to those exposed to traditional teacher-centered methods.

Several recent studies further confirm that students demonstrate higher levels of engagement and sustained attention in game-based learning environments than in conventional instructional settings. (Sahra et al., 2025) reported that game-based digital learning environments promote active participation and reduce passive learning behaviors, particularly among elementary school students. In the context of Scratch, learners are not merely recipients of information but active creators who design animations, stories, and games. This active involvement strengthens conceptual understanding and increases students' ownership of the learning process.

Beyond enhancing motivation and engagement, Scratch-based edugames play a crucial role in developing students' technical competencies, especially foundational programming and computational thinking skills. Through block-based coding, Scratch allows students to understand logical sequencing, conditional reasoning, and problem decomposition without the cognitive overload associated with text-based programming languages. Recent research highlights that early exposure to visual programming environments significantly supports the development of computational thinking and digital literacy skills essential for the 21st century (Zourmpakis et al., 2023).

In addition to technical skills, learning with Scratch provides substantial opportunities for students to develop creativity and critical thinking abilities. Active learning processes, such as problem-solving, experimentation, and iterative design, encourage students to analyze challenges from multiple perspectives and generate innovative solutions. Amini et al. (2019) emphasized that learning environments that prioritize exploration and hands-on activities are particularly effective in fostering higher-order thinking skills. Within Scratch-based activities, students are encouraged to test ideas, identify errors, and refine their projects, which naturally cultivates reflective and critical thinking.

Collaborative learning is another key dimension strengthened through the use of Scratch in the classroom. Group discussions, peer feedback, and collaborative project development allow students to exchange ideas and co-construct knowledge. According to Li and Bertrand (2026), collaborative digital learning environments enhance not only cognitive outcomes but also interpersonal communication skills. During Scratch-based activities, students learn to articulate their ideas clearly, listen to alternative viewpoints, and negotiate solutions collectively, reinforcing meaningful social interaction within the learning process.

The integration of game-based learning through Scratch also contributes to the development of essential social skills, such as communication, cooperation, and empathy. When students work together to design and debug projects, they must coordinate roles, manage

conflicts, and respect diverse perspectives. These social interactions align with socio-constructivist learning principles, which emphasize that knowledge is constructed through social engagement and shared experiences (Pedroso et al., 2023).

In the context of an increasingly globalized world, the cultivation of collaborative skills through Scratch-based learning is particularly relevant. Modern educational paradigms emphasize teamwork, adaptability, and cross-cultural communication as essential competencies for future success. Pedroso et al. (2023) highlighted that collaborative skills are among the most critical attributes for preparing students to face global challenges. Scratch-based edugames create authentic learning scenarios where students practice collective problem-solving and shared decision-making in a supportive environment.

Moreover, the flexibility of Scratch allows educators to integrate local and contextual content into game-based learning activities, making learning more meaningful and culturally responsive. By embedding familiar themes, stories, or social issues into Scratch projects, teachers can connect abstract coding concepts with students' real-life experiences. Recent studies suggest that contextualized digital learning enhances relevance and deepens conceptual understanding, particularly for younger learners (Rahmawati & Hidayat, 2024).

In conclusion, the use of Scratch as an edugame platform offers comprehensive educational benefits that extend beyond technical coding skills. It enhances motivation, creativity, critical thinking, collaboration, and social competence, all of which are essential for holistic student development. Supported by recent empirical findings, Scratch-based game learning emerges as a powerful pedagogical tool that aligns with contemporary educational demands and prepares students to thrive in both academic and real-world contexts.

CONCLUSION

Based on the findings of this study, the use of Scratch-based edugames in elementary school coding instruction has been proven to effectively enhance students' engagement, motivation, and self-confidence. Classroom observations indicate that students became more focused and actively involved in the learning process, while also demonstrating the ability to independently acquire basic programming and problem-solving skills. This game-based learning approach not only facilitates the development of technical competencies but also supports the growth of essential social skills, such as collaboration and communication among peers. Overall, the results highlight that technology-based learning methods can produce a significant positive impact on both student engagement and social development. Therefore, the integration of edugames such as Scratch shows strong potential for broader implementation in elementary education and may serve as a valuable foundation for future research examining its long-term effects on students' skill development across various domains.

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