

DEVELOPMENT OF A SCRATCH-BASED EDUCATIONAL GAME TO ENHANCE CREATIVE AND COMMUNICATION SKILLS THROUGH ENGLISH AND CODING INTEGRATION ALIGNED WITH SDGS

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Abstract

This study aimed to develop a Scratch-based educational game that supports English language learning and coding to enhance creative and communication skills in primary school students. The research employed the ADDIE development model through stages of analysis, design, development, implementation, and evaluation. Results demonstrated that the game was valid and practical for use in elementary classrooms. The game design featured comparative and superlative adjectives integrated into creative tasks using Scratch, which encouraged students' problem-solving and interactive communication. Because the game combined verbal and visual elements, students were more engaged and better understood linguistic concepts. The findings highlight the potential of combining digital technology and language learning in promoting SDG 4 on quality education. The game supports digital literacy and innovation in early education by merging science, technology, and language learning strategies.

Keywords: Coding, Communication, Creativity, English, SDG 4.

1. Introduction

In the digital era, coding has emerged as a crucial element of foundational literacy alongside reading and numeracy, especially for young learners [1]. Digital literacy encompasses not only the consumption but also the creation of content, enabling students to express ideas, solve problems, and participate meaningfully in a technology-driven society [2]. For elementary students, exposure to coding through block-based platforms like Scratch allows them to engage in creative thinking, design interactive content, and internalize computational logic at an early stage [3]. However, in Indonesia, coding education is not yet fully integrated into the primary curriculum, posing challenges in preparing children for the demands of future digital competency [4]. Moreover, the use of games in education has gained recognition for its ability to boost engagement, motivation, and learning outcomes [5, 6].

Simultaneously, the mastery of English (especially oral communication) remains a key priority in developing global competencies among students. Many reports regarding English education have been well-reported [7-12]. English functions not only as a linguistic skill but also as a medium for intercultural interaction and digital navigation [13]. Unfortunately, many primary school students in Indonesia experience difficulty in speaking due to limited practice and a lack of contextualized learning strategies [14, 15]. The concept of dual coding, which merges visual and verbal elements, offers a promising pathway for improving comprehension and communication, particularly when applied to game-based and code-based learning activities [16]. When students are allowed to express themselves through both programming logic and spoken English, they are more likely to grasp comparative and superlative structures in meaningful contexts [17].

This study aimed to design and validate a Scratch-based educational game that supports both coding and English learning by integrating comparative and superlative materials. The novelty of this study lies in the “code and speak” model, where students actively develop interactive games and articulate their ideas using structured English within a computational framework. This approach not only aligns with the goals of sustainable development goal 4 (SDG 4) on quality education [18], but also merges scientific and technological competencies with language instruction at the primary level. The study contributes to the growing field of educational technology by offering a model that fosters creativity, communication, and digital fluency simultaneously.

2. Literature Review

Figure 1 illustrates the dual coding process, which emphasizes the interaction between verbal and non-verbal systems in learning. Dual Coding Theory posits that learners process information through two distinct channels (verbal (logogens) and visual (imagens)) that function independently or synergistically to enhance understanding and recall [16]. In the context of coding and language learning, this theory provides a foundation for integrating imagery, symbols, and verbal explanation in classroom instruction. For primary school children, engaging in design activities using visual programming such as Scratch enables them to connect abstract concepts with concrete representations. This alignment strengthens their cognitive flexibility, enhances their problem-solving ability, and supports the development of both creative and communicative competencies [3].

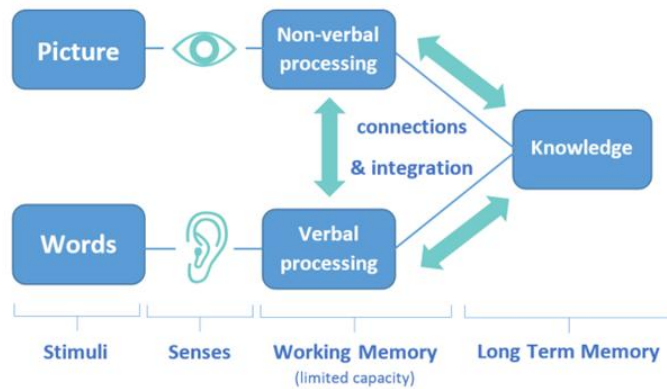


Fig. 1. Dual coding learning process.

Many reports presented studies utilizing Scratch for coding education [3, 19-21]. The evidence demonstrates the versatility of Scratch in improving computational thinking, motivation in STEM, and performance in programming [4, 5, 19]. Furthermore, Scratch has been effectively used in hybrid learning environments and in enhancing emotional creativity among students [5, 22]. These findings indicate that game-based learning using Scratch is not only engaging but also impactful in shaping students' attitudes toward problem-solving and digital creativity. However, few studies have explored its potential in fostering spoken English proficiency, particularly in the domain of grammar concepts like comparative and superlative adjectives.

The integration of language instruction into coding platforms reflects a growing interdisciplinary trend. While most Scratch-based applications emphasize logic and algorithmic thinking, their potential to serve as linguistic practice tools remains underutilized. Combining Scratch with a code-and-speak model can help students verbalize their designs, explain gameplay mechanics, and communicate rules in English. This technique offers a contextualized approach to language acquisition and promotes language use for real communication purposes [17]. Moreover, such integration aligns with educational goals that call for the convergence of science, technology, and global competencies, as stated in SDG 4. By designing a learning model that unites coding and communication, educators can support a more holistic development of learners' digital and linguistic capacities.

3. Method

We used in this study ADDIE, comprising analysis, design, development, implementation, and evaluation stages. Detailed information regarding this method is explained elsewhere [23]. This model was selected for its flexibility and suitability in educational product development. Each phase guided the creation and validation of the Scratch-based game to ensure alignment with learning objectives. Expert validators evaluated components, including lesson plans, teaching media, and assessment tools, to determine feasibility and effectiveness in enhancing creative and communication skills. We conducted the research at the following schools in Indonesia: SDN Sidotopo I, SDN Manukan Kulon I, and SDN Pacarkeling V.

4. Results and Discussion

Figure 2 presents the initial sketch of the game design developed through the design stage of the ADDIE model. This prototype incorporated comparative and superlative materials in English, integrated within a Scratch interface tailored to primary school learners. The game's visual and interactive elements were deliberately aligned with the Dual Coding Theory to enhance multimodal learning. During the design validation, experts from language education, educational technology, and instructional design provided feedback on layout clarity, syntax integration, and narrative quality, ensuring the game was pedagogically sound and technically functional [24, 25].

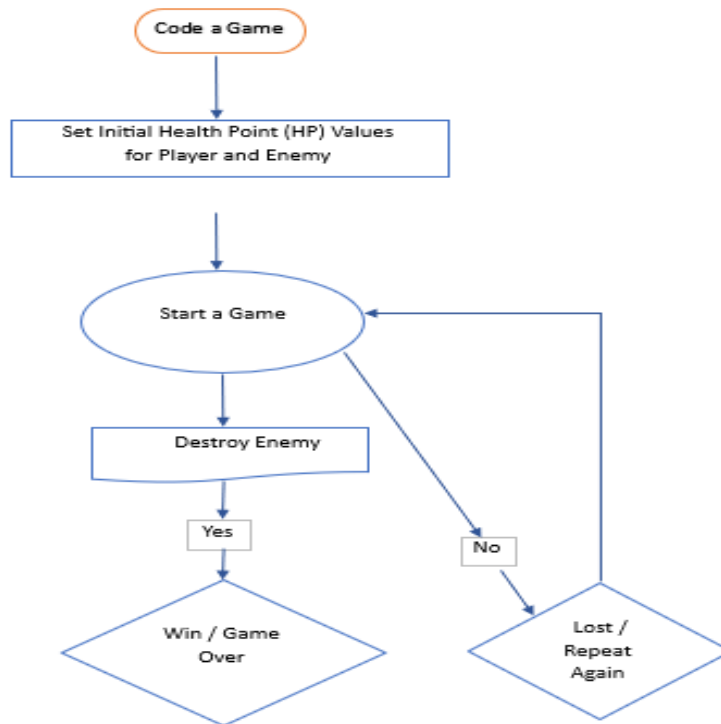


Fig. 2. Game sketch for Indonesian Bayraktar TB II.

Figure 3 shows the storyline and learning scenario of the Scratch-based game featuring the Indonesian Bayraktar TB II drone. The storyline, while metaphorical, is rooted in national identity and civic responsibility, embedding social values into gameplay. More importantly, the missions were structured to embed English grammar concepts within game logic-e.g.; using comparatives when describing drone speed or altitude compared to enemies. Students were prompted to use spoken English to narrate their design, thereby enhancing communication skills [17]. Creativity was stimulated through personalized game challenges, which encouraged students to modify code blocks and visualize different scenarios.



Fig. 3. Indonesian Bayraktar TB II game scenario.

We validated results by expert validators across five components: game mechanics, construct validity, creative skill, speaking skill, and student questionnaire. Most components scored above 3.25, indicating "very valid" status. Creative skill scored 3.15, categorized as "valid," suggesting minor revisions were required. These results suggest that the game met high standards for instructional material in terms of both form and function.

The results showed the implementation trials across three schools representing North, East, and West Surabaya. Trials were conducted with fifth graders using pre- and post-test measures in both experimental and control classes. All schools showed statistically significant improvements ($p < 0.05$) in the experimental group, especially in students' ability to articulate comparison in English and demonstrate originality in coding patterns [14, 26].

We also did a students' questionnaire regarding the practicality of the learning model. 89% of students expressed strong enthusiasm, describing the game as "fun," "easy to follow," and "helpful" for both English and Scratch. This response reflects the model's effectiveness in supporting differentiated instruction and active learning in digital environments [27].

Overall, the code-and-speak model aligns well with science and technology learning goals by embedding computational logic and communication simultaneously. The integration of SDG 4 is visible in its focus on quality, inclusive, and engaging education through technological and linguistic competencies. The success of this game reflects a broader potential to transform English learning through gamified digital platforms rooted in local narratives and global pedagogical strategies. This adds new information regarding SDGs, as reported elsewhere [28-33].

5. Conclusions

This study successfully developed a Scratch-based game integrating English grammar and coding to enhance creative and communication skills among primary school students. The game, validated by experts and tested in three schools, proved to be both effective and practical. Its dual focus on technology and language supports SDG 4 by promoting digital literacy and linguistic competence. The "code

and speak" model encourages active learning, creativity, and verbal expression, demonstrating its potential as an innovative approach in elementary education.

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