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Development of Digital Learning Media on the Icons of the Nusantara Capital City to Enhance Critical Literacy of Fifth-Grade Elementary Students

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ABSTRACT: This study aims to develop digital learning media featuring the Icons of the Nusantara Capital City (IKN) to enhance the critical literacy skills of fifth-grade elementary school students through an ADDIE-based Research and Development (R&D) model. Validation by content experts and media experts indicated that the developed product met the "Highly Valid" category, with an average score of 90%, encompassing content relevance, informational accuracy, visual design quality, and interactive navigation. The practicality of the media was also rated as "Highly Practical," achieving an average score of 89% based on teacher and student responses, which highlighted the media's ease of use, attractiveness, efficiency, and ability to support active learning engagement. The effectiveness of the media was demonstrated by a significant improvement in students' critical literacy scores, increasing from a pretest mean of 60.32 to a posttest mean of 83.75, with an N-gain value of 0.70 (high category). The Paired Sample t-test yielded a significance value of 0.000, while the effect size (Cohen's d = 1.87) was classified as very high. These findings confirm that the IKN digital learning media effectively enhances students' visual interpretation, analytical, and evaluative skills, and serves as a relevant instructional tool for fostering critical literacy in elementary education.

KEYWORDS: digital learning media; critical literacy; IKN icons; elementary education; ADDIE R&D

I. INTRODUCTION

The rapid advancement of information technology in the twenty-first century has significantly influenced various sectors of human life, including primary education. Digital transformation compels educational institutions to continuously enhance the quality of learning processes in order to produce learners who possess higher-order thinking skills, strong literacy competencies, and the ability to process information critically. Within this context, the integration of digital media has become an essential strategy for improving learning effectiveness, as it enables more interactive, multimodal learning experiences that align with the characteristics of twenty-first-century learners (Mahrunnisya, 2023).

The Merdeka Curriculum emphasizes student-centered learning and provides broad opportunities for the development of critical reasoning competencies. Learning activities are no longer oriented solely toward conceptual understanding, but also toward the development of analytical skills through the use of instructional media that actively engage students in the learning process. Digital technology plays a strategic role in supporting this approach, as it allows learning materials to be presented in visual, dynamic, and contextualized forms, thereby facilitating deeper conceptual understanding (Prayogi et al., 2025). Moreover, the integration of digital media in classroom learning offers students opportunities to develop critical literacy skills through the exploration of visual data and symbolic interpretation that cannot be fully achieved through conventional learning media (Liu et al., 2024).

Various studies indicate that the level of critical literacy among Indonesian students remains relatively low. Critical literacy refers to the ability to analyze, evaluate, and interpret information across multiple forms of representation, including texts, images, and visual symbols. This competence has not yet developed optimally among elementary school students, as reflected in their tendency to comprehend information literally without engaging in deeper analysis of context or underlying meaning (Yusmar & Fadilah, 2023). Similar findings suggest that students often experience difficulties in reading and interpreting visual symbols, resulting in less effective learning processes when symbolic representations are involved (Vanhees et al., 2025). This condition is further reinforced by the limited use of digital learning media that are capable of enriching students' visual understanding and analytical skills (Rizqiani et al., 2024).

In the context of national development, the establishment of the Nusantara Capital City (IKN) introduces new demands for the education sector, particularly in familiarizing students with national symbols that embody philosophical, historical, and identity-

related values. IKN icons such as the Garuda, the National Axis, and the Forest City concept are not merely aesthetic visual elements, but also convey ideological meanings that are important to introduce to students from an early age (DJ & Jumardi, 2022). These visual representations carry messages related to national unity, ecological sustainability, and the direction of national development. However, learning materials related to IKN icons are still limited, especially in the form of digital learning media that are engaging, analytical, and accessible to elementary school students (Kalalinggi et al., 2023).

These limitations have implications for learning quality in schools. Preliminary findings at SDN 016 Sepaku indicate that students' ability to understand the symbolic meanings associated with IKN icons remains relatively low, with an average score of 60.00, which is below the Minimum Mastery Criterion (KKM) of 75.00. Teachers identified that learning activities are still dominated by textbook-based instruction with minimal integration of digital technology, resulting in learning processes that have not yet encouraged students to engage in in-depth visual analysis (Kurniawan, 2024). The limited use of digital media restricts students' opportunities to explore symbolic meanings in a contextual and meaningful manner (Rosyadi, 2022).

The guided inquiry learning model is considered relevant for enhancing students' critical thinking abilities. This model provides learners with opportunities to observe phenomena, formulate questions, seek information, and draw conclusions in a structured manner under teacher guidance (Sugiarti & Adela, 2024). Guided inquiry emphasizes systematic analytical processes, thereby facilitating the development of critical literacy among elementary school students (Kubikova et al., 2024). Nevertheless, the effectiveness of this model is optimized when it is supported by appropriate digital media capable of clearly and interactively representing visual symbols in accordance with students' cognitive development stages (Febrina & Setiawan, 2024).

Interactive digital media have considerable potential to enhance student engagement and comprehension, as they present information in rich, dynamic, and easily explorable visual formats. Digital media also provide opportunities for students to conduct independent visual analysis, thereby supporting the development of critical literacy (Marchesani et al., 2026). Previous studies have demonstrated that digital media are effective in increasing student motivation and learning outcomes compared to conventional media (Septiawan & Nandiyanto, 2022). However, to date, there has been limited research that specifically focuses on the development of IKN icon-based digital learning media aimed at improving elementary students' critical literacy skills. This gap indicates the need for further research in this area.

Based on these considerations, this study develops digital learning media based on IKN icons using the ADDIE model. The media are designed to support contextualized and analytical learning aligned with the Merdeka Curriculum. The developed product is expected to demonstrate validity, practicality, and effectiveness, particularly in fostering students' critical literacy through meaningful and conceptually rich visual representations.

II. LITERATUR REVIEW

1) Learning Media

Learning media refer to all forms of intermediaries used in the educational process to deliver messages, information, or instructional content from educators to learners. Advances in technology have expanded the definition of learning media from merely visual aids to multimodal communication tools capable of stimulating multiple sensory channels. Learning media function to enhance the quality of instructional interaction, clarify conceptual understanding, and facilitate students' active engagement throughout the learning process (Menrisal, 2022).

In primary education, learning media play a particularly crucial role because learners are at a cognitive developmental stage that requires concrete visual stimulation to connect abstract concepts with everyday experiences. Appropriate learning media can reduce the gap between real-life experiences and symbolic representations, thereby enabling students to develop a deeper and more meaningful understanding of the subject matter (Lestari & Nurkholis, 2024). Furthermore, engaging learning media can increase students' learning motivation and support more active, creative, and collaborative learning environments (Wulandari & Harjanto, 2023).

2) Digital Media

Digital media represent an extension of learning media that utilize information and communication technologies to present instructional content in interactive formats. Digital media are characterized by flexibility, multi-representation, adaptability, and the capacity to facilitate two-way communication between learners and learning materials (Jiang & Cohen, 2026). Within the context of primary education, digital media play a strategic role as they enable abstract concepts to be visualized more concretely, provide exploratory learning experiences, and promote deeper learning interactions.

Based on their form and modality, digital media may be categorized as visual, audio, or audiovisual. Visual media, such as images, illustrations, and diagrams, assist students in understanding symbolic representations more clearly (Azhura et al., 2024). Audio media strengthen comprehension through structured verbal explanations (Yu, 2022), while audiovisual media integrate visual and auditory elements to create more comprehensive learning experiences (Harverson et al., 2026). Key characteristics of

digital media that are relevant to educational contexts include interactivity, connectivity, participation, personalization, and flexible access (Nasrullah Pramudito & Farah, 2021).

The use of digital media in instructional settings has been shown to enhance learning effectiveness through more engaging content presentation, increased student participation, and greater ease in knowledge construction through guided exploration (Santoso & Rahayu, 2024). These advantages make digital media particularly relevant for supporting thematic learning in primary schools, including learning activities related to the interpretation of visual symbols such as the icons of the Nusantara Capital City (IKN).

3) The Icons of the Nusantara Capital City as Learning Content

The establishment of the Nusantara Capital City as Indonesia's new administrative center has introduced a set of official icons imbued with strong symbolic and philosophical values. The IKN icons are designed to represent national identity, developmental aspirations, and a commitment to sustainability. Several prominent icons, such as the Garuda, the National Axis, and the Forest City concept, convey profound meanings related to national unity, modernity, ecological consciousness, and sustainable development (DJ & Jumardi, 2022).

Within the context of primary education, IKN icons possess significant potential as instructional content for developing students' visual interpretation skills and critical literacy. Visually rich content allows learners to analyze visual elements, explore symbolic meanings, and connect visual representations with national values (Kalalinggi et al., 2023). However, learning materials related to IKN icons are still rarely presented in the form of systematic and interactive digital learning media, resulting in difficulties for teachers in integrating this content into classroom instruction (Kurniawan, 2024). The limited availability of such media also restricts students' opportunities to optimally develop analytical skills related to symbolic visual representations (Rosyadi, 2022).

4) Critical Literacy

Critical literacy refers to the ability to understand, interpret, evaluate, and reflect on information by considering the social, cultural, and ideological contexts in which it is produced. Critical literacy occupies a central position in twenty-first-century education, as it enables learners to develop higher-order thinking skills necessary for engaging with complex and diverse sources of information (Rohman, 2022). Core competencies of critical literacy include the ability to deconstruct assumptions, read from multiple perspectives, identify implicit messages, and make evidence-based judgments (Bolanle, 2023). In primary education, critical literacy is essential for habituating students to engage in deep and reflective reading of various visual and symbolic representations, including IKN icons. Learners are not only expected to recognize symbols at a literal level, but also to interpret the philosophical, aesthetic, and ideological meanings embedded within them (Maylidia & Asih, 2025). Persistently low levels of students' critical literacy indicate that learning practices remain focused on basic cognitive outcomes and have not yet sufficiently incorporated analytical learning patterns that foster deeper understanding.

5) Learning Theories Supporting Media Development

a) Mayer's Multimedia Learning Theory

The development of effective digital learning media should be grounded in Mayer's Multimedia Learning Theory, which emphasizes the importance of integrating visual and verbal elements to minimize cognitive load. This theory asserts that learning becomes more effective when students receive information through structured combinations of text, audio, and visuals. In this regard, the visual presentation of IKN icons through digital media can assist students in conducting systematic analysis and constructing meaningful understanding.

b) Constructivist Perspective

Constructivist learning theory, particularly as proposed by Vygotsky, emphasizes that knowledge is actively constructed through social interaction and learning experiences. Students build understanding through exploration, discussion, and visual interpretation. Interactive digital media can serve as effective tools to facilitate this process, enabling learners to construct knowledge more independently while remaining supported through instructional scaffolding.

c) Critical Pedagogy

Freire's perspective on critical pedagogy is highly relevant to the development of critical literacy. Students need to be guided to "read the world" by critically analyzing visual representations, symbols, and texts encountered in everyday life. Digital media that present IKN icons can function as pedagogical tools that encourage learners to engage in critical readings of national symbols and reflect on their broader social meanings.

RESEARCH METHOD

This study employed a Research and Development (R&D) approach using the ADDIE model, which consists of Analysis, Design, Development, Implementation, and Evaluation. The selection of this model was based on the research objective to produce a digital learning media product based on the Icons of the Nusantara Capital City (IKN) that is valid, practical, and effective for use

in elementary school learning. The analysis stage was conducted to identify students' and teachers' needs, curriculum alignment, and the characteristics of the instructional content to be developed.

During the design and development stages, the digital learning media were developed using an HTML5-based platform, taking into account multimedia learning theory and the cognitive characteristics of elementary school students. The media content incorporated official IKN icons presented through interactive visual features to support students' analytical abilities. Validation was carried out by subject-matter experts and media experts to ensure the appropriateness of content, visual presentation, and functional performance of the media. The validation results served as the basis for product revision prior to field implementation.

The implementation stage involved limited trials and full-class trials to assess the practicality and effectiveness of the media. Research data were collected through validation sheets, teacher and student response questionnaires, and critical literacy tests. Data analysis employed descriptive statistics to evaluate the levels of validity, practicality, and effectiveness, while qualitative data were analyzed thematically to strengthen the interpretation of the findings.

RESULTS AND DISCUSSION

Media Validity

The validation stage constitutes a central phase in the ADDIE model, particularly at the transition from the Development stage to the Implementation stage. Validation was conducted to ensure that the IKN digital learning media met academic, technical, and pedagogical feasibility standards. Two groups of experts were involved: (1) subject-matter experts, who evaluated content appropriateness, knowledge structure, and relevance to the enhancement of critical literacy, and (2) media experts, who assessed visual design, navigation, interactivity, and technical quality in accordance with Mayer's Multimedia Learning principles.

The subject-matter experts' evaluation indicated that the media fulfilled content feasibility criteria, achieving high scores on indicators of conceptual accuracy, relevance, and readability. The IKN icon materials were considered conceptually sound, up to date, and relevant to the local context of students in Sepaku as a supporting area of the new capital. Moreover, the materials demonstrated strong potential to stimulate students' interpretative, analytical, and evaluative abilities within a critical literacy framework.

From the media experts' perspective, the visual design, consistency, and interactivity of the media were rated very highly. Navigation was found to be responsive and intuitive, while color schemes and typography were aligned with the characteristics of elementary school learners. Interactive elements such as hotspots, animations, and team-based quizzes successfully fostered student engagement. Functional validity testing confirmed that all buttons, animations, and visual components operated stably without technical issues.

Table 1. Validation Results of Material Experts and Media Experts

Assessment Components	Subject Matter Expert (%)	Media Expert (%)	Average (%)	Category
Content Suitability	90	–	90	Very Valid
Accuracy of Information	88	–	88	Very Valid
Language Compatibility	88	–	88	Very Valid
Visual Design	–	92	92	Very Valid
Navigation and Interactivity	–	90	90	Very Valid
Average Total	**89**	**91**	**90**	**Very Valid**

Source: Processed by researchers, 2025

The overall average score of 90% confirms that the media are categorized as *Highly Valid* and suitable for implementation without major revisions. These results also indicate the successful integration of Mayer's Cognitive Multimedia Theory, constructivist principles, and Slavin's cooperative learning components within the pedagogical structure of the media.

Media Practicality

Media practicality represents an important implementation indicator, reflecting the extent to which the media can be easily used by teachers and students in real classroom settings. In this study, practicality analysis was derived from teacher response questionnaires, student response questionnaires, and observations conducted during both limited and large-scale trials. The practicality assessment aimed to ensure that the media were not only theoretically valid but also feasible and user-friendly in authentic instructional contexts.

Teachers reported that the media were easy to operate, required no additional devices beyond school-provided Chromebooks, and could be seamlessly integrated into lesson plans aligned with Slavin's cooperative learning phases. Teachers also noted that

the media helped expedite explanations of abstract concepts such as symbols, meanings, and philosophical values embedded in IKN icons, thereby improving instructional efficiency. Students expressed positive responses, indicating that the media were visually appealing, comfortable to view, dynamically presented, and that interactive features such as drag-and-drop activities, hotspots, and team-based quizzes greatly supported their understanding of IKN content.

Table 2. Results of Media Practicality Assessment by Teachers and Students

Respondents	Practicality Indicator	Score (%)	Category
Teacher	Ease of Use	92	Very Practical
Teacher	Compliance with Material	88	Very Practical
Teacher	Efficiency in Learning	90	Very Practical
Student	Appearance Attractiveness	90	Very Practical
Student	Ease of Navigation	86	Practical
Student	Interaction Convenience	88	Very Practical
Average	–	**89**	**Very Practical**

Source: Processed by Researchers, 2025

These findings confirm that the media fall within the *Highly Practical* category and can be effectively implemented in fifth-grade classrooms without technical or pedagogical obstacles.

Media Effectiveness

Media effectiveness was examined using a quasi-experimental Pretest–Posttest Control Group design involving two homogeneous classes: an experimental class that utilized the IKN digital learning media and a control class that received conventional instruction. Effectiveness was analyzed using N-Gain and Paired Sample t-tests to determine the significance of improvements in students' critical literacy skills. Pretest results indicated that students' initial critical literacy levels in the experimental class were relatively low, with a mean score of 60.32. After the implementation of the IKN digital learning media, the posttest mean score increased significantly to 83.75. This increase of 23.43 points, equivalent to 38.8%, reflects a substantial improvement in students' abilities to interpret, analyze, evaluate, and infer meanings from IKN-related visual materials.

Table 3. Results of Pretest and Posttest of Critical Literacy Skills

Test Types	Average Value	Difference	% increase	Category
Pretest	60,32	–	–	Low
Posttest	83,75	+23,43	38,8%	Tall
Gain Score	–	23,43	38,8%	Very Effective

Source: Processed by Researchers, 2025

The results demonstrate that the digital media contributed significantly to the improvement of students' critical literacy. This achievement reflects not only successful knowledge transfer but also the media's effectiveness in stimulating higher-order thinking. Students were able to identify visual elements, connect icons with philosophical, social, and environmental values, and construct deeper, more structured understanding through interactive exploration. Inferential statistical analyses were conducted to ensure that the observed improvement in students' critical literacy resulted from the use of the IKN digital learning media. These analyses included a Paired Sample t-test to examine the significance of pretest–posttest differences, effect size calculation using Cohen's d to measure the magnitude of the media's impact, and N-Gain analysis to determine the level of learning effectiveness.

Table 4. Paired Sample t-test Results

Statistics	Mark
Mean Pretest	60,32
Mean Posttest	83,75
Average Difference	23,43
Standard Deviation Difference	12,50
t-count	14,98
Df	29
Sig. (2-tailed)	0,000
Test Decision	Significant

Source: Processed by Researchers, 2025

The Paired Sample t-test revealed a significance value of 0.000, far below the α level of 0.05, indicating a statistically significant difference between pretest and posttest scores following the use of the IKN digital media. The high t-value (14.98) further confirms the strong impact of the media on students' analytical abilities. Pedagogically, these findings suggest that visual interactivity, intuitive navigation, and multimedia design aligned with Mayer's principles effectively promote active engagement and deeper interpretation of IKN symbols.

Table 5. Effect Size Calculation Results (Cohen's d)

Calculation Components	**Mark**
Mean Difference	23,43
Standard Deviation	12,50
Cohen's d	1,87
Effect Category	Very high

Source: Processed by Researchers, 2025

The effect size calculation yielded a Cohen's d value of 1.87, categorized as *very high*. This indicates that the impact of the media on students' critical literacy was not only statistically significant but also practically substantial. Students experienced qualitative improvements in thinking processes, particularly in interpreting images, comparing concepts, and evaluating visual-symbolic information. This strong effect is consistent with Mayer's Multimedia Learning Theory, which emphasizes that integrated text, visuals, and interactivity enhance knowledge transfer and higher-order cognitive processing.

Table 6. Results of N-Gain Score Calculation

Pretest Average	**Posttest Average**	***N-Gain***	**Category**
60,32	83,75	0,70	Tall

Source: Processed by Researchers, 2025

The N-Gain value of 0.70 falls within the *High* category, indicating that the improvement in students' critical literacy skills resulting from the use of digital media was strongly effective. Students demonstrated consistent progress in identifying visual information, linking symbols to social contexts, and constructing in-depth interpretations based on visual evidence. This high level of effectiveness confirms that the IKN digital learning media not only support learning objectives but also foster meaningful learning experiences that cultivate critical, analytical, and independent learners. These findings are further supported by a literature study conducted by Saputra et al. (2025), which reported that digital learning media play a significant role in developing elementary students' critical questioning skills. The study found that interactive multimedia elements such as dynamic visuals, informational links, and opportunities for independent exploration directly contribute to students' ability to identify problems, formulate analytical questions, and evaluate information reflectively.

CONCLUSIONS

This development research concludes that the IKN Icon–based digital learning media meet the three primary criteria of Research and Development (R&D), namely validity, practicality, and effectiveness. Expert validation results indicate that the media fall within the *Highly Valid* category, with an overall average score of 90%, covering both content feasibility and the quality of visual design and interactivity. These findings demonstrate that the media were designed in accordance with Mayer's Multimedia Learning principles, are relevant to students' contextual backgrounds, and are appropriate for use in classroom instruction. In terms of practicality, the media achieved an average score of 89%, categorized as *Highly Practical*, based on teacher and student responses as well as observational data. Teachers reported that the media were easy to use, efficient, and well aligned with lesson plans, while students perceived the interface as visually appealing, the navigation as clear, and the interactive features as supportive of content comprehension. These results indicate that the media can be optimally implemented in classroom settings without technical or pedagogical constraints.

Regarding effectiveness, the IKN digital learning media were proven to significantly enhance students' critical literacy skills. The increase in pretest–posttest scores by 23.43 points, the statistically significant Paired Sample t-test results (Sig. = 0.000), the very high effect size (Cohen's d = 1.87), and the high N-Gain value (0.70) collectively demonstrate that the media are effective in developing students' abilities in interpretation, analysis, and evaluation. These findings confirm that the IKN digital learning media function not only as instructional tools but also as effective pedagogical instruments for fostering higher-order thinking skills in elementary education.

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