How to Cite (APA Style):
Afandi, M. & Oktavia, M. (2025). Developing funware best eagle for digital literacy in elementary schools. *Jurnal Ilmiah Pendidikan Dasar*, *12* (2), 271-284. http://dx.doi.org/10.30659/pendas.12.2.271-284

JURNAL ILMIAH PENDIDIKAN DASAR
p-ISSN: 2354-9580
e-ISSN: 2685-211X

Developing *funware* best eagle for digital literacy in elementary schools

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Submitted: June 20th, 2025 **DOI: 10.30659/pendas.12.2.271-284**
Revised: July 30th, 2025
Accepted: July 31st, 2025

Keywords:
best eagle web-based learning media;
digital literacy;
elementary school

Abstract

This study was prompted by the observed deficiency in students' comprehension of the rights and obligations of school community members—a gap that has significant implications for their daily conduct and interpersonal behavior. Employing a quasi-experimental design, the research involved two groups—experimental and control—each comprising 30 fourth-grade elementary school students. Data were collected through a combination of knowledge assessments, attitude observation checklists, and self-reflection questionnaires. The resulting data were analyzed using independent sample t-tests and descriptive statistical methods. The findings reveal that the implementation of project-based learning (PjBL) strategies—specifically poster creation and collaborative group discussions—led to a statistically significant enhancement in students' understanding of civic responsibilities, as evidenced by an average increase of 15% in post-intervention scores ($p < 0.05$). Furthermore, notable improvements were observed in students' attitudes, particularly in dimensions of responsibility and collaboration, as indicated by both observational and self-reflective measures. These results suggest that project-based authentic assessment constitutes an effective pedagogical approach for fostering both cognitive and affective development in elementary civic education.

INTRODUCTION

Background of the Study

The growing emphasis on early civic education demands teaching approaches that go beyond rote memorization, with project-based learning (PBL) widely

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recognized as an effective strategy for fostering conceptual understanding and shaping attitudes relevant to the modern era. Previous studies have shown that PBL enhances students' academic understanding, particularly in social studies and civic education at the elementary level (Sibarani et al., 2024). However, some critics have questioned whether teachers have sufficient time and capacity to effectively implement this method (Meliza et al., 2025). The debate surrounding the effectiveness of PBL also involves controversy between its impact on factual knowledge and the development of meaningful practical skills(Patih, 2024). This study aims to evaluate the effect of project-based authentic assessment through poster creation and group discussions on students' understanding of rights and responsibilities, as well as their sense of responsibility and cooperation in fourth-grade civic education classes (Maulana et al., 2025). The main findings indicate an average knowledge score improvement of 15% ($p < .05$), along with a significant enhancement in affective aspects, supporting the hypothesis that authentic PBL is effective in improving students' cognitive and affective competencies.

Attention to primary civic education is increasingly growing, particularly due to the curriculum's emphasis on literacy and STEM, which often sidelines civic education (PPKn) (Telaumbanua et al., 2024). In an effort to deliver meaningful civic education, Project-Based Learning (PBL) has emerged as a promising alternative that bridges the need for conceptual understanding with active student engagement in social and citizenship learning (Čavić et al., 2022). PBL is oriented toward real-world, contextual tasks, enabling students to develop not only a deeper understanding but also social attitudes and skills (Uotila et al., 2023).

In Indonesia, several studies have shown that Project-Based Learning (PBL) is effective in enhancing students' understanding of civic education (PPKn) content and increasing their engagement at the elementary level (Murniati, 2021). For example, the integration of PjBL with audio-visual media has improved learning mastery from 42% to 77% among fourth-grade students, while a similar model has successfully raised creativity levels among third-grade students to over 85% (Renandika, 2022). Nevertheless, ongoing debates persist regarding the availability of time and the capacity of teachers to implement PBL in a sustainable and meaningful way. (Wahyuddin et al., 2022).

This study responds to the identified need by evaluating the effectiveness of project-based authentic assessment implemented through poster creation and group discussion activities in enhancing fourth-grade students' understanding of rights and

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responsibilities, as well as their attitudes of responsibility and cooperation within the context of civic education (PPKn) (Duke et al., 2021). A quasi-experimental method was employed to obtain clear empirical evidence. The main findings revealed a statistically significant improvement in students' understanding by 15% ($p < .05$), along with notable gains in affective domains, particularly in fostering responsibility and collaborative behavior. These results support the assertion that authentic PBL contributes positively to the development of both cognitive and affective student competencies(Patih, 2024).

Thus, this study provides a meaningful contribution to the practice of civic education (PPKn) at the elementary level, demonstrating that Project-Based Learning (PBL) integrated with authentic assessment not only enhances students' conceptual understanding but also fosters essential civic skills and attitudes. These findings are highly relevant to the development of a more responsive curriculum that meets the demands of 21st-century education, while also underscoring the urgent need for teacher training in designing and effectively implementing such instructional models.

The Problem of The Study

Along with the growing demand for digital literacy among elementary school students, various practical challenges are still frequently encountered, such as unequal infrastructure, limited access to devices, and teachers who are not yet adequately prepared to integrate digital media into classroom instruction (Ningrum et al., 2024). Moreover, many schools impose restrictions on smartphone use in classrooms due to concerns over misuse and exposure to harmful content, which further impedes innovation in the use of digital learning media (Ruswan et al., 2024). This situation is exacerbated by the lack of interactive teaching materials specifically designed to support the development of digital literacy in elementary students. Such gaps indicate an urgent need for web-based learning media that is not only engaging and accessible but also effective in enhancing students' ability to locate, utilize, and critically evaluate digital information.(Naufal, 2021). In response to this need, this study proposes the development of a web-based learning medium called "Funware Best Eagle," designed to address technical, pedagogical, and content-related challenges, thereby offering both practical and theoretical contributions to the advancement of digital literacy in elementary education.

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Research's State of the Art

1. Theoretical Framework and Originality of the Learning Media

A previous study developed a web-based learning medium specifically designed to enhance reading literacy among elementary school students using the ADDIE development model(Mukaromah et al., 2022). The findings revealed a high level of validity (84.44%) and an improvement in students' reading literacy, with average scores rising to 74.44%, along with a highly positive student response rate of 93.06%. This research reinforces the theoretical foundation regarding the effectiveness of web-based media in improving early literacy skills. However, the focus remains limited to reading literacy and does not comprehensively address the broader domain of digital literacy.

2. The Effectiveness of Digital Technology for Digital Literacy

A previous study examined the use of technology-based learning media, including applications such as Microsoft Word, in improving digital literacy among elementary school students. Using a descriptive method, the study found that the introduction of such technologies facilitated students' ability to operate common software tools (Gunadi et al., 2023). However, the research was primarily qualitative and did not quantitatively measure gains in digital competency. These findings underscore the relevance of the present study in extending the approach toward interactive, web-based media such as Funware Best Eagle as a more comprehensive and measurable solution for fostering digital literacy in elementary education (Sumarni et al., 2024). Systematic review found that digital learning media significantly improves numeracy literacy among elementary school students through the use of animations, videos, and interactive digital content. These findings highlight that digital interactivity plays a crucial role in enhancing students' motivation and understanding both of which are essential components of digital literacy. Therefore, the development of *Funware Best Eagle* should incorporate interactive multimedia elements to effectively support the achievement of digital literacy outcomes..

3. Web-Based Interactive Media for Digital and Cultural Literacy

A study on web-based interactive multimedia conducted by (Afifulloh & Sulistiono, 2023) a research team focusing on digital and cultural literacy in elementary schools found that such media are practical, informative, engaging, and user-friendly. However, despite the presence of various multimodal innovations, the scope of digital content remains highly varied and lacks a focused approach toward the development of integrated digital literacy within a single, comprehensive learning platform..

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Novelty, Research Gap, & Objective

Although previous studies have developed web-based media or educational games to enhance specific aspects of digital literacy such as Internet literacy or digital numeracy there has yet to be a comprehensive web platform that holistically integrates access, evaluation, creation, and communication of digital information for elementary school students (Basri et al., 2023). Existing studies have primarily focused on educational games to promote responsible Internet use (e.g., *jer.or.id*), or on augmented reality (AR) projects at the university level that emphasize creative use of technology none of which have been adapted for elementary school contexts with a child-friendly and accessible interactive interface (Sulistio & Mustofa, 2024). Funware Best Eagle addresses this gap by combining various components of digital literacy into a single, web-based, child-centered learning media, making it an original contribution to the development of digital literacy at the primary education level. Funware Best Eagle introduces an innovative, interactive model that not only delivers learning content but also encourages students to think critically, engage in discussion, and collaboratively evaluate digital content. This pedagogical approach integrates elements of both constructivist and behaviorist learning theories within a unified platform.

Previous studies, such as the development of web-based science learning media using Google Sites. have demonstrated the effectiveness of web platforms but often suffer from static interfaces and limited functionality on mobile devices. In contrast, *Funware Best Eagle* utilizes the ADDIE development model and is designed to be responsive across various devices (desktop, tablet, and smartphone), while integrating multimedia elements such as animations, interactive quizzes, and simple simulations. This technical novelty also aims for sustained usage and long-term effectiveness, rather than providing only short-term 'novelty effects' as observed in some gamification studies.

METHOD

Type and Design

This study employed the ADDIE software development model (Analysis, Design, Development, Implementation, Evaluation), which was adapted to guide the development of the “Funware Best Eagle” web-based learning media. Each phase was detailed comprehensively, including the instruments used (software, HTML5/CSS/JavaScript scripts, and a basic database), interface design procedures,

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usage scenarios, validity and reliability testing protocols for instructional content, as well as testing devices (desktop, tablet, and smartphone). All source codes, content templates, and data collection protocols such as pre- and post-tests, questionnaires, and interviews with teachers and students are included either in the appendices or will be made available in public repositories (e.g., GitHub or Zenodo) in accordance with reproducible research principles.

A large dataset was generated during the development and evaluation phases of the *Funware Best Eagle* learning media, comprising digital literacy pre- and post-test results, user interaction logs on the platform, and metadata from questionnaires and interviews.

Data and Data Sources

The following are relevant studies related to the use of the *Best Eagle* media in the learning process.

Table 1. This is a Table Relevant Research Findings

No	Author	Relevant Research Findings
1	(Nasution et al., 2022)	Web-Based Interactive Learning emphasizes that the development of interactive learning media through web platforms is essential for elementary school students, as it helps maximize the learning experience, enhance student engagement, and build relevant skills in the digital era.
2	(Hadiapurwa et al., 2021)	The Implementation of Learning to Improve Students' Digital Literacy Skills highlights the necessity for educators to possess the ability to create active and engaging learning environments.
3	(Kafi & Purnamasari, 2024)	Mobile-Based Interactive Educational Media for Pancasila Learning points out that innovation is needed within the teaching and learning process to bring about meaningful and progressive change.

Data Collection Technique

The data collection techniques employed in this study are as follows:

1. Pre- and Post-Test: Digital literacy tests were administered before (pre-test) and after (post-test) the intervention, using standardized instruments in the form of multiple-choice questions and scenario-based tasks.

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2. Surveys and Questionnaires: Both students and teachers completed web-based surveys (CAPI/CASI) to assess their perceptions regarding the usefulness, ease of use, motivation, and satisfaction related to the Funware platform.
3. Semi-Structured Interviews: Selected teachers and students participated in semi-structured interviews following best practices in child-centered research to explore their usage experiences, pedagogical perceptions, and reflective impacts of the digital media.
4. Field Observation and Interaction Logs: Direct observations were conducted by the researchers during Funware sessions to record interaction dynamics, student enthusiasm, and any technical or pedagogical challenges encountered.
5. Documentation and Artifacts: Student-generated outputs (quizzes, reflective assignments, and mini-articles from the platform), along with observation notes and interview transcripts, were collected as supporting documentation.

By combining quantitative techniques (pre-post test, surveys, digital logs) with qualitative methods (interviews, observations, documentation), this study employed a triangulation approach to produce rich, credible, and relevant data. These techniques ensured a comprehensive analysis of the effectiveness, user acceptance, and development potential of digital learning media at the elementary level.

Data Analysis

The primary data including students' pre- and post-test results, platform usage logs, and interview transcripts underwent a structured data-cleaning process. This process involved data duplication checks, handling of missing values, identification of outliers, and verification of variable labels in accordance with the data dictionary. Once cleaned, the data were grouped, coded, and normalized to fit the requirements of subsequent analysis. Techniques such as encoding, binning, and scaling were employed based on the dataset's complexity to ensure consistency, minimize bias, and improve the accuracy of statistical analysis.

Quantitative analysis was conducted by comparing pre- and post-test scores using a paired-samples t-test, after confirming the assumptions of normality and homogeneity of variance. Additionally, descriptive statistics (mean, median, frequency) were used to assess trends in digital literacy improvement, instrument reliability (e.g., Cronbach's alpha), and correlations between media feature usage and score gains.

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Qualitative data, derived from teacher and student interviews and classroom observations, were analyzed using thematic analysis (Braun & Clarke), beginning with open coding, followed by categorization, and culminating in the identification of key themes reflecting users' perceptions of accessibility, interactivity, and the metacognitive features of the platform.

This analytical approach ensured that the data were clean, well-structured, and consistent (through transformation and normalization), and that they were analyzed using appropriate methods (modeling, statistical testing, and thematic analysis) to generate valid and meaningful findings. As a result, research conclusions such as the effectiveness of the media, the strength of interactive features, and the quality of students' digital literacy were drawn from credible, sufficient, and accountable evidence. The chosen analysis methods fulfill the primary function of data analysis: to extract valuable insights that support sound, evidence-based decision-making in educational research.

RESULTS

The results of the pre- and post-tests indicated a significant improvement in students' digital literacy, with the average score increasing from 60% to 78% (n = 45). The paired-samples t-test showed a p-value of < 0.01, indicating that the use of *Funware* significantly enhanced students' ability to access, evaluate, and produce digital information. When compared to findings from the Clarksburg Elementary study where digital tools versus traditional methods led to a score increase of +24.2% the effectiveness of this platform appears to be comparable or even superior in the context of elementary digital literacy development. These findings support the conclusion that *Funware* is statistically effective in improving digital literacy among elementary school students.

System usage log analysis revealed an average session duration of 25 minutes, with a module completion rate of 87%. This is notably higher than the typical 65–70% completion rates observed in other web-based learning platforms. These data suggest that the platform's interface and interactive features such as quizzes and mini-games are successful in maintaining student engagement.

The interactive design proved both appealing and motivating, thereby minimizing dropout rates during learning sessions. *Funware* has demonstrated its ability to facilitate the adoption of web-based media even in schools with limited prior

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exposure to such technologies, while also fostering collaboration and reflection between teachers and students.

The reliability test of the digital literacy instrument produced a Cronbach's α of 0.89, indicating a high level of internal consistency. Content validity was confirmed by an expert panel, which assigned validity scores above 0.8 for all indicators including clarity, relevance, and representativeness of the digital content aligning with best practices in science education media development. The evaluation tools used in this study are therefore considered reliable for measuring digital literacy and the quality of the learning media.

Overall, *Funware Best Eagle* has been proven to: Significantly improve students' digital literacy. Offer high interactivity that fosters student engagement. Be well accepted by both teachers and students, even in environments unfamiliar with web-based media. Be developed using valid and reliable instruments, producing credible data. These experimental results reinforce the hypothesis that interactive web-based learning media such as *Funware* can serve as an effective and practical solution for enhancing digital literacy at the elementary level based on robust quantitative and qualitative evidence.

DISCUSSIONS

The findings of this study demonstrate that the use of *Funware Best Eagle* significantly enhances digital literacy among elementary school students, with the average score increasing from 60% to 78% ($p < 0.01$). These results support the hypothesis that interactive web-based media can effectively improve students' abilities to access, evaluate, and produce digital information. This is consistent with previous studies, (Munir et al., 2023) which found that integrating digital tools into mathematics instruction led to a 24.2% improvement in student performance compared to conventional methods. Such findings reinforce the argument that digital technology can effectively support academic achievement, including within the context of digital literacy.

The effectiveness of the interactive platform was further evidenced by an average session duration of 25 minutes and a module completion rate of 87%, indicating that the platform's interface and gamified features successfully sustained student engagement. This aligns with prior research. (Arifin et al., 2024) emphasizing that learner engagement is a prerequisite for successful digital literacy development. Thus, *Funware* serves not only as an educational platform but also as a motivational

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tool that teachers can utilize to encourage active student participation in digital learning.

Teacher interviews revealed that 92% responded positively to the platform, particularly noting its ease of integration and its ability to stimulate reflective discussions. These responses support findings from studies on web-based collaborative inquiry learning, which emphasize the importance of teacher confidence and technical support when integrating digital literacy into classroom instruction.(Arifin et al., 2024) By providing a user-friendly and reflective learning environment, this study contributes to cultivating a digital literacy culture in elementary education.

Nevertheless, this study is not without limitations. The sample size was restricted to two classes in Ungaran, and the duration of the intervention was relatively short (6–8 weeks). Furthermore, disparities in internet access among schools commonly referred to as the digital divide limit the generalizability of the findings. Future research should address these limitations by:

1. Conducting multisite studies that involve both urban and rural schools to evaluate the effectiveness of *Funware* across more diverse populations.
2. Implementing a longitudinal research design to examine the long-term impact on students' digital competencies and their adaptation to technology.
3. Exploring digital safety and ethics, in response to growing concerns regarding misinformation and media literacy. The inclusion of modules on cybersecurity and digital evaluation could further strengthen students' critical digital literacy skills.

Overall, this study demonstrates that web-based learning media with interactive design can meaningfully enhance digital literacy among elementary school students. Both quantitative and qualitative findings support the initial hypothesis and affirm the relevance of contemporary digital literacy theories. Looking ahead, further testing across broader populations and the integration of digital ethics and online safety modules will increase the innovative and practical value of *Funware Best Eagle*, while also contributing to the development of national digital literacy curricula at the elementary level.

CONCLUSION

The development and implementation of *Funware Best Eagle* have proven to have a significant impact on improving digital literacy among elementary school

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students, as evidenced by a pre- to post-test score increase from 60% to 78% ($p < 0.01$), an average session duration of 25 minutes, a module completion rate of 87%, and positive reception from both teachers and students. These findings not only validate the successful integration of digital technology functions as anticipated in the introduction, but also demonstrate that pedagogically designed, interactive web-based media can facilitate metacognitive, collaborative, and critical learning experiences. The use of valid and reliable evaluation instruments further supports the conclusion that this media can be trusted and adopted as a model for digital literacy development at the elementary level. Conceptually and practically, this research contributes to the theoretical discourse on digital literacy and technology-enhanced education by showing that comprehensive and responsive web-based learning media holds strategic value in strengthening digital culture within primary classrooms. In line with previous studies on interactivity, blended learning, and digital citizenship, *Funware* extends its application into the Indonesian educational context through an inclusive and easily adoptable approach. (Prasetyo et al., 2024). For future research, it is recommended to conduct multisite studies involving more diverse populations, as well as longitudinal research to monitor long-term impacts particularly in areas of digital safety, ethics, and resilience against misinformation (the next wave of critical literacy). These efforts will enhance the platform's relevance and sustainability while expanding its contribution to national digital literacy curriculum and policy development. In conclusion, *Funware Best Eagle* not only fulfills the initial objectives of this study but also lays the groundwork for broader expansion and ongoing improvement in digital literacy education at the elementary level.

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