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VALIDITY OF WEEBLY-BASED NATURAL AND SOCIAL SCIENCE TEACHING MATERIALS FOR ELEMENTARY SCHOOL STUDENTS

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ABSTRACT
The rapid advancement of digital technology has transformed the educational landscape, driving an urgent need for interactive learning materials in elementary schools. Despite this, conventional resources continue to dominate classrooms, often resulting in suboptimal student engagement, particularly in comprehensive subjects like Natural and Social Sciences. To address this gap, this study aimed to evaluate the validity of a newly developed Weebly-based teaching material tailored for fourth-grade students. A descriptive quantitative research design was employed, focusing on the expert validation phase. The evaluation involved comprehensive assessments by one media expert and one content expert. Data were systematically collected using structured validation questionnaires and analyzed using descriptive statistics alongside the Aiken's V formula to measure expert agreement. The results yielded a high average score of 4.60 for the media aspect and 4.47 for the content aspect. Furthermore, the Aiken's V indices reached 0.90 for media and 0.87 for content, both confirming a very high level of validity. These findings substantiate that the developed Weebly-based platform is a highly feasible and interactive digital learning solution. The study significantly contributes to elementary education by providing teachers with an effective, practical digital alternative to overcome the limitations of traditional instruction, thereby fostering a more engaging learning environment.

INTRODUCTION

The rapid advancement of digital technology has fundamentally reshaped learning in elementary education, including Integrated Natural and Social Sciences. However, this transformation has not been fully reflected in classroom practices, where instruction continues to rely predominantly on conventional teaching materials. Such resources are insufficient to accommodate students' visual and exploratory learning characteristics, resulting in low motivation, limited engagement, and persistent difficulties in understanding abstract concepts that require strong

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visualization support (Muskania et al., 2024; Andary et al., 2025). Moreover, the limited integration of interactive media constrains opportunities for meaningful learning and weakens students' knowledge construction processes (Hossain, 2023; Aryfien et al., 2025;Syawaludin et al., 2019). This gap between technological advancement and pedagogical practice highlights a critical issue: the need is not merely for digitalization, but for the development of pedagogically grounded digital teaching materials capable of transforming how students learn.

Within this context, teachers are positioned as key agents in designing learning experiences. Nevertheless, their capacity to develop effective digital instructional materials remains uneven, largely due to limited digital competence and insufficiently sustained professional development support (Aydin et al., 2024; Huang et al., 2024). While various digital platforms have been introduced, many require advanced technical skills, creating additional barriers for teachers. Weebly offers a more accessible alternative through its intuitive drag-and-drop interface, enabling the integration of multimodal content such as text, images, videos, and interactive activities into a structured learning environment (Irnawati & Rahmawan, 2024). Empirical evidence suggests that Weebly-based learning media are positively received and capable of accommodating diverse student learning styles (Belinda et al., 2024). However, existing studies largely emphasize usability and student responses, leaving a critical gap regarding the rigorous validity and academic feasibility of such materials in elementary education.

From a theoretical perspective, the development of digital teaching materials must be anchored in robust learning theories to ensure their effectiveness. The Cognitive Theory of Multimedia Learning posits that meaningful learning occurs when verbal and visual information are integrated in ways that optimize cognitive processing while minimizing cognitive load (Mayer, 2024). Supporting this, multimedia design principles such as coherence, modality, and personalization have been shown to enhance the quality and effectiveness of digital learning environments (Al-Khalifi et al., 2025). In parallel, constructivist theory emphasizes that knowledge is actively constructed through interaction, exploration, and experience, underscoring the importance of interactive and student-centered features in digital platforms (Le & Nguyen, 2024; Aoonlamai & Kwangmuang, 2025). Despite these well-established theoretical foundations, many digital teaching materials fail to systematically integrate these principles, resulting in products that are technologically rich but pedagogically weak.

In this regard, expert validation becomes a decisive stage in bridging the gap between design and instructional quality. Validation processes involving material, media, and language experts are essential to ensure content accuracy, instructional coherence, visual effectiveness, and linguistic appropriateness (Andary et al., 2025; Mayasari et al., 2023). High validation outcomes indicate not only technical feasibility but also alignment with academic and pedagogical standards, thereby increasing the likelihood of successful classroom implementation (Dewi et al., 2025).

However, limited studies have rigorously validated Weebly-based instructional materials using standardized validity measures such as Aiken's V. Furthermore, there is a lack of empirical research systematically integrating multimedia learning principles and constructivist approaches at the elementary school level. This study offers novelty by addressing this gap, focusing specifically on the comprehensive validation of Weebly-based Natural and Social Sciences teaching materials that explicitly incorporate these theoretical foundations. Therefore, this study aims to examine the validity of these materials for elementary school students, ensuring that digital innovation is both theoretically grounded and pedagogically sound. Ultimately, this research contributes theoretically by integrating the Cognitive Theory of Multimedia Learning and constructivist principles into the evaluation process, and practically by providing empirically validated guidelines for developing accessible and interactive digital learning resources for elementary schools.

METHOD

This study used a descriptive quantitative design supported by expert feedback to test the validity of Weebly-based Natural and Social Sciences learning materials for elementary school students. The main variable in this study was the validity of the learning materials, operationalized through two dimensions: content validity and media validity. This design was deemed appropriate because this study aimed to determine the feasibility of the developed product

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before its implementation in classroom learning, particularly since the quality of digital media is influenced by the accuracy of the content, visual presentation, and technological support.

Participants in this study consisted of two expert validators: one content expert and one media expert. The validators were selected using purposive sampling based on their expertise, professional experience, and relevance to the fields of Natural and Social Sciences education and digital media development. Content validation was crucial to ensure conceptual accuracy and alignment with learning objectives, while media validation ensured that the digital product met usability and design standards.

The research instrument consisted of expert validation sheets designed to assess the feasibility of the teaching materials. The instrument included quantitative rating-scale items and open-ended questions to capture qualitative feedback. The content validation instrument covered aspects such as conceptual accuracy, completeness of material, relevance to learning outcomes, and suitability for fourth-grade elementary school students based on the Merdeka Curriculum. Meanwhile, the media validation instrument assessed interface clarity, navigation, visual integration, and overall presentation quality on the Weebly platform. Each indicator was developed to represent the overall quality of the teaching materials. Aspects and Indicators of Media Expert Validation of Weebly-Based Natural and Social Sciences Teaching Materials are presented in Table 1 below.

Table 1. Aspects and Indicators of Media Expert Validation of Weebly-Based Natural and Social Science Teaching Materials

Aspect	Indicator
Visual Design	Neat, attractive, and consistent layout
	Colors, icons, and illustrations support readability
Readability and Visuals	Text and contrast are easy to read
	Visuals clarify the material
Navigation and Accessibility	Navigation is easy and functions well
	Accessible across various devices
Interactivity	Interactive features encourage participation
	Visual presentation is engaging and motivating
Alignment with Learning Objectives	Design supports learning objectives
	Multimedia aligns with the material

Source: (Mayer, 2024; Al-Khalifi et al., 2025)

Aspects and Indicators of Expert Validation of Material for Weebly-Based Natural and Social Sciences Teaching Materials are presented in Table 2 below.

Table 2. Aspects and Indicators of Expert Validation of Material for Weebly-Based Natural and Social Sciences Teaching Materials

Aspect	Indicator
Content Feasibility	Aligned with basic competencies and learning objectives.
	Scientific accuracy and relevance
Depth and Breadth of Material	Main concepts are complete and well-structured
	Encourages critical thinking
Contextual Integration	Relevant to daily life
	Examples match students' experiences
Language and Readability	Simple and communicative language
	Scientific terms are easy to understand
Presentation and Concept Clarity	Logical sequence
	Illustrations clarify concepts

Source:(Hanifah et al., 2023; Devi & Rusdinal, 2023)

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Data were directly collected using structured validation questionnaires employing a 5-point Likert scale. Qualitative feedback and suggestions from the validators were also gathered concurrently to serve as the basis for product revisions. The validation data were analyzed using both quantitative and qualitative approaches. Quantitative analysis was conducted using Aiken's V index to measure the level of agreement among experts for each assessment indicator. Aiken's V produces values ranging from 0 to 1, where values closer to 1 indicate higher validity (Nurjanah et al., 2023). This method was selected because it is suitable for assessing content validity based on expert judgment. In addition, qualitative descriptive analysis was used to interpret comments and suggestions from validators to identify areas requiring revision. The combination of these approaches provided a comprehensive understanding of the validity of the developed teaching materials. Mathematically, Aiken's V formula is formulated as follows:

$$V = \frac{\sum s}{n(c-1)}$$

V = Content validity coefficient (Aiken's V).
s = Scores given by experts for specific items
l= The lowest score on a Likert scale (e.g., $l = 1$)
c= highest score on a Likert scale (e.g., $c = 5$)
n= the number of experts who provide assessments

The conversion process from quantitative data from the five-scale validation results to qualitative data using guidelines is presented in Table 3 below.

Table 3. Categories of Need Levels Based on the Likert Scale (1–5)

Average Score Range	Need Level Category
4,50 – 5,00	Very High
4,00 – 4,49	High
3,25 – 3,99	Moderate
2,75 – 3,24	Low
0,00 – 2,74	Very Low

Source: (Soulisa et al., 2022)

This study adhered to ethical research principles by ensuring voluntary participation of the expert validators. Informed consent was obtained prior to data collection, and the confidentiality of the validators' identities and responses was maintained. The data were used solely for research purposes and reported objectively to ensure the integrity and credibility of the findings.

RESULT AND DISCUSSION

Result

Media Expert Validation

Media expert validation was conducted to assess the feasibility of Weebly-based Natural and Social Sciences teaching materials in terms of visual appropriateness, readability, navigation, interactivity, and alignment with learning objectives. This effort is crucial because Natural and Social Sciences learning in elementary schools still faces challenges such as limited digital media availability, low learning motivation, and insufficient contextual learning resources. These conditions highlight the need for innovative teaching materials that can provide more engaging and relevant learning experiences. Developing teaching materials using the Weebly platform offers an effective solution, as the platform is easy to use, flexible, and supports multimedia integration. Previous studies have also emphasized that Weebly-based materials consistently receive high feasibility ratings due to their ability to increase student motivation and engagement in elementary-level learning environments. The results of media expert validation show that the teaching materials obtained a total score of 138 out of 150, with an overall average of 4.60, placing them in the highly feasible category. Details of the expert assessment are presented in Table 4.

Table 4. Summary of Media Expert Validation of the Weebly-Based Natural and Social Sciences Teaching Materials

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No	Aspect	Indicator	V1	V2	V3	Total	Average	Category
1	Visual Design	Neat, attractive, and consistent layout	4	4	5	13	4.33	High
		Colors, icons, and illustrations support readability	5	4	5	14	4.67	Very High
2	Readability and Visuals	Text and contrast are easy to read	5	5	5	15	5.00	Very High
		Visuals clarify the material	4	4	5	13	4.33	High
3	Navigation and Accessibility	Navigation is easy and functions well	4	4	5	13	4.33	High
		Accessible across various devices	4	5	4	13	4.33	High
4	Interactivity	Interactive features encourage participation	5	5	5	15	5.00	Very High
		Visual presentation is engaging and motivating	4	5	5	14	4.67	Very High
5	Alignment with Learning Objectives	Design supports learning objectives	5	4	5	14	4.67	Very High
		Multimedia aligns with the material	4	5	5	14	4.67	Very High
Scores Obtained			44	45	49	138	4.60	
Total Score Obtained				138				
Maximum Score			50	50	50			
Total Maximum Score				150				
Validity Rating and Criteria					Very High			

Source: (Research data)

A visual overview of the distribution of average scores for each indicator is presented in Figure 1, showing that all indicators received very high scores, ranging from 4.33 to 5.00. The graph illustrates that the indicators “text and contrast are easy to read” and “interactive features encourage student participation” achieved perfect scores, demonstrating that the teaching materials effectively support both readability and learner engagement. These two components are essential in digital learning environments, particularly for elementary students who rely heavily on clear visual cues and interactive elements to understand abstract Natural and Social Sciences concepts. Meanwhile, the remaining indicators, which also fall within an excellent range, reflect the consistency of the materials in terms of visual design, accessibility, navigation flow, and alignment with learning objectives. This overall pattern indicates that the media components of Weebly-based learning materials have been designed in accordance with pedagogical principles and user-friendly digital learning standards.

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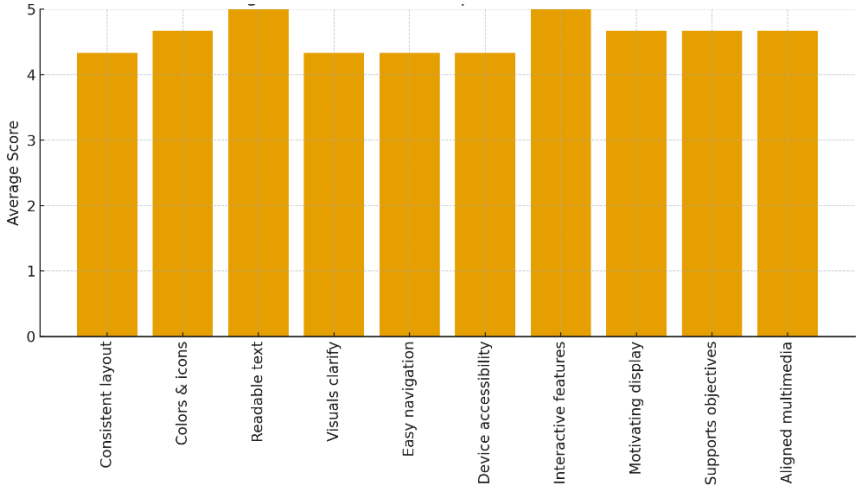

Figure 1. Average Scores of Media Expert Validation
Source: Research Results

Based on Figure 1, it is clear that text readability and interactive features are the indicators with the highest scores. This indicates that the media has met the visual needs of elementary school students, who are at the concrete thinking stage and rely heavily on clear visual presentation and visualization of material to effectively understand Natural and Social Science concepts.

To determine the level of feasibility of the learning design, a media validity analysis was used using the Aiken's V index with the provisions of the lowest score (l = 1), the highest score (c = 5), the number of validators (n = 3), and the number of indicators as many as 10. The following is the calculation using the Aiken's V formula:

$$V = \frac{\sum s}{n(c-1)} = \frac{138-(3x10)}{3x10x(5-1)} = \frac{108}{120} \approx 0{,}90$$

This value is in the range of 0.80 to 100 which is included in the very high or very reasonable validity category.

Material Expert Validation

Validation by subject matter experts was conducted to assess the appropriateness of the content presented in the Weebly-based science and science learning materials. This process is crucial because science and science learning requires the presentation of concepts that are scientifically accurate, up-to-date, and relevant to the developmental stage of the students. Overall, the subject matter experts gave a total score of 134 out of a maximum of 150, with an average score of 4.47, placing the learning materials in the appropriate or high category. Detailed assessments from the subject matter experts are presented in Table 5.

Table 5. Summary of Material Expert Validation of the Weebly-Based Natural and Social Sciences Teaching Materials

No	Aspect	Indicator	V1	V2	V3	Total	Average	Category
1	Content Feasibility	Aligned with basic competencies and learning objectives.	5	5	5	15	5.00	Very High
		Scientific accuracy and relevance	4	4	5	13	4.33	High

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No	Aspect	Indicator	V1	V2	V3	Total	Average	Category
2	Depth and Breadth of Material	Main concepts are complete and well-structured	4	5	4	13	4.33	High
		Encourages critical thinking	4	5	4	13	4.33	High
3	Contextual Integration	Relevant to daily life	5	4	4	13	4.33	High
		Examples match students' experiences	4	5	4	13	4.33	High
4	Language and Readability	Simple and communicative language	5	5	4	14	4.67	Very High
		Scientific terms are easy to understand	4	5	5	14	4.67	Very High
5	Presentation and Concept Clarity	Logical sequence	4	5	4	13	4.33	High
		Illustrations clarify concepts	4	4	5	13	4.33	High
Scores Obtained			43	47	44			
Total Score Obtained				134		134	4.47	
Maximum Score			50	50	50			
Total Maximum Score				150				
Validity Rating and Criteria					High			

Source: (Research data)

To clarify the distribution of indicator ratings, Figure 2 below presents the average scores for each evaluated component.

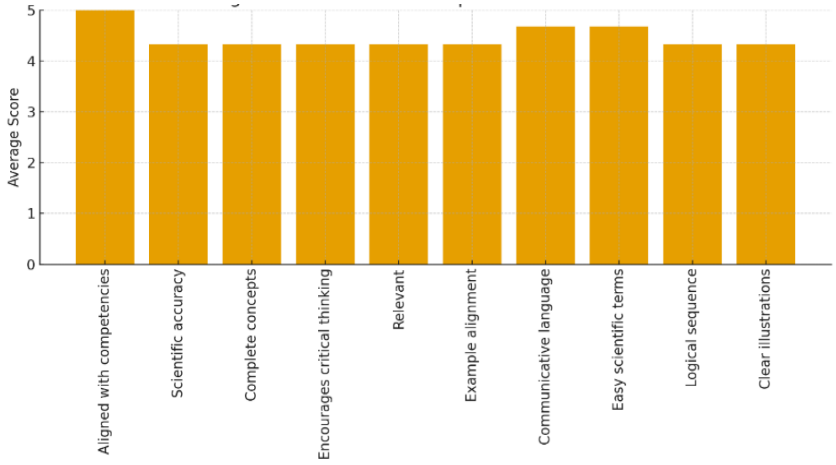

Figure 2. Average Scores of Material Expert Validation
Source: Research Results

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The representation in Figure 2 allows readers to more clearly observe the relative strength of each indicator and identify patterns in expert evaluations. By displaying the data graphically, comparisons between indicators become easier to interpret, particularly highlighting which aspects of the instructional materials achieved the highest level of feasibility and which areas maintained consistently strong performance. This visual representation also supports a more comprehensive understanding of the overall quality of the Weebly-based science instructional materials as assessed by the content and media experts. To strengthen these quantitative findings, a validity analysis using Aiken's V was conducted. The calculation results are as follows:

$$V = \frac{\sum s}{n(c-1)} = \frac{134-(3x10)}{3x10x(5-1)} = \frac{104}{120} \approx 0{,}87$$

Aiken's V value of 0.87 indicates a high level of expert agreement. This value confirms that all evaluated indicators have strong relevance to the presented Natural and Social Sciences content, in line with established content validity standards.

Discussion

The media validation results demonstrated that the Weebly-based teaching materials are highly feasible for elementary school use. Rather than merely listing indicator scores, the analysis reveals that the product excels in text readability, contrast, and interactive features, which are critical for maintaining young learners' attention. Although the functional design is robust, minor refinements in interface consistency across devices will further optimize the user experience. These findings indicate that effective digital teaching materials for elementary learners must prioritize visual attractiveness alongside operational ease to support cognitive engagement. This expands upon the findings of Pujiariani & Cathrin (2025) while their study broadly highlighted the role of visual support in digital learning, our results specifically demonstrate that the interactive modular layout of a Weebly-based platform effectively prevents visual fatigue and sustains reading interest in young learners. Similar conclusions regarding the correlation between interactive design and learner engagement have been reported in other recent studies (Rizal et al., 2025; Wijaya et al., 2024). Furthermore, this supports the assertion by Saleha et al. (2025) that digital platforms enhance scientific literacy, particularly when they provide dynamic stimuli that traditional textbooks lack.

Similarly, the material validation indicated a strong level of appropriateness, particularly in its alignment with basic competencies and learning objectives. The evaluation confirmed the content's scientific accuracy, material depth, and presentation clarity. However, the analysis also identified a crucial area for growth: the necessity of incorporating deeper conceptual elaboration and contextual enrichment. Content validity extends beyond mere curriculum conformity; it necessitates coherence and direct relevance to students' daily experiences to foster meaningful learning. While previous research heavily emphasized structural validity and language clarity, our findings underscore that scientific accuracy alone is insufficient without contextual adaptation (Rohmawati et al., 2024; Susanti et al., 2025; oding Bua et al., 2025). Adding to this, Arifin & Nugroho (2023) argued that integrating students' cultural and contextual realities into digital content profoundly impacts their analytical comprehension. Therefore, bridging the gap between abstract science topics and students' real-world environments becomes the primary pedagogical challenge for future content iterations.

In terms of language and concept presentation, the materials effectively utilized simple, communicative language and understandable scientific terminology. This linguistic appropriateness is essential because elementary students are still developing their scientific vocabulary. The evaluation of logical sequence suggests that while the conceptual flow is acceptable, it benefits from being more gradual and visually reinforced to prevent cognitive overload. Pedagogically, young learners require this synthesis of accessible language and structured visual presentations to successfully grasp abstract scientific phenomena (Yuniarsih & Setiawan, 2025). This aligns with Nurhaedah & Achmad (2025), as well as Rahayu et al. (2025), who showed that digital instructional media becomes significantly more effective when language, instruction, and visual organization are not treated as separate elements, but developed in an integrated manner to reduce students' intrinsic cognitive load.

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Overall, the high consensus among experts in both media and material validations confirms that this Weebly-based prototype provides a solid, theoretically sound foundation for elementary science education. The unique contribution of this study lies in its synthesis of pedagogical theory and practical web development; it does not merely digitize conventional science materials, but transforms them into an interactive, developmentally appropriate digital environment tailored to young learners' cognitive capacities. Acknowledging the limitations of this study, it is important to note that expert validation primarily measures theoretical feasibility rather than actual instructional effectiveness. Consequently, the next critical step involves rigorous classroom trials to evaluate the product's practicality and its direct impact on learning outcomes in dynamic, real-world settings. This methodological trajectory aligns with Susanti et al. (2025). Proceeding to field testing is a necessary step, as valid digital teaching materials must ultimately prove their practical value and effectiveness in authentic learning environments ((Pujiariani & Cathrin, 2025; Riyanti et al., 2026).

CONCLUSION

This study successfully establishes the high validity and feasibility of Weebly-based Natural and Social Sciences teaching materials for fourth-grade students. As evidenced by the strong consensus from both media and material experts, the developed prototype transcends the mere digitization of conventional textbook content. Instead, it effectively leverages the Weebly platform to deliver a structured, highly interactive, and pedagogically aligned learning experience tailored specifically to elementary education. The profound impact and primary contribution of this research lie in its potential to transform conventional science instruction into a dynamic, accessible digital ecosystem. By seamlessly integrating visual appeal with rigorous content accuracy, these teaching materials directly address the critical need for engaging, age-appropriate digital resources that accommodate the cognitive and developmental needs of young learners. Practically, the implementation of such validated web-based materials empowers educators to significantly enhance instructional quality, fostering greater student autonomy and conceptual comprehension in the classroom.

While the product possesses a robust theoretical and structural foundation, optimizing its pedagogical potential requires minor refinements in cross-device accessibility and layout consistency. Moving forward, future research must transition this validated prototype into rigorous classroom trials to evaluate its practical effectiveness in real-world learning environments, thereby shifting the focus from structural feasibility to its actual impact on student engagement and learning outcomes. Ultimately, this study demonstrates that educational technology achieves its greatest impact when technological innovation is firmly grounded in strong content and media validity.

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