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The Effectiveness of Integrated Komsiga Media on Islamic Education Values in Improving Science Literacy among Elementary School Students

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Abstract

The science literacy score of Indonesian students is 383, far below the OECD average of 485 (OECD, 2023). This low score is due to the science learning process being considered abstract and difficult to understand. There is an urgent need for innovative media that not only visualizes scientific concepts concretely but also instills character values to bridge the cognitive and affective gaps among students. This study aims to examine the effectiveness of Komsiga media, which integrates Islamic educational values, in improving students' science literacy skills in the subject of Force. The study applied a quantitative approach with a one-group pretest-posttest pre-experimental design involving 30 fourth-grade elementary school students as the sole participants. The data were analyzed statistically using the mean difference test and Normalized Gain. The findings show a significant increase in learning outcomes, with the average student score jumping from 63.80 on the pre-test to 87.23 on the post-test. The N-Gain score of 0.65, which falls into the moderate category, confirms that Komsiga integrated with Islamic educational values is able to make science material easier to understand and more relevant to students. Komsiga has been proven to be effective as a bridge for conceptual understanding and character building. This study recommends that this model of integrating technology and values be expanded to other the IPAS materials to support holistic learning.

Keywords: digital comics, komsiga, science literacy, Islamic educational values

Efektivitas Media Komsiga Terintegrasi Nilai Pendidikan Islam dalam Meningkatkan Literasi Sains Siswa Sekolah Dasar

Abstrak

Skor literasi sains siswa Indonesia sebesar 383 jauh di bawah rata-rata negara OECD yaitu 485 (OECD, 2023). Rendahnya skor tersebut dikarenakan proses pembelajaran materi sains dianggap abstrak dan sulit dipahami. Kebutuhan akan media inovatif yang tidak hanya memvisualisasikan konsep sains secara konkret tetapi juga menanamkan nilai karakter menjadi sangat mendesak untuk menjembatani kesenjangan kognitif dan afektif siswa. Penelitian ini bertujuan untuk menguji efektivitas media Komsiga yang terintegrasi nilai pendidikan Islam dalam meningkatkan kemampuan literasi sains siswa pada materi Gaya. Penelitian menerapkan pendekatan kuantitatif dengan desain pre-experimental one-group pretest-posttest yang melibatkan 30 siswa kelas IV Sekolah Dasar sebagai partisipan tunggal. Data dianalisis secara statistik menggunakan uji beda rata-rata dan Normalized Gain. Temuan menunjukkan peningkatan hasil belajar yang signifikan, dengan rata-rata skor siswa melonjak dari 63,80 saat pre-test menjadi 87,23 pada post-test. Perolehan N-Gain sebesar 0,65 yang masuk kategori sedang menegaskan bahwa Komsiga terintegrasi nilai pendidikan Islam mampu membuat materi sains lebih mudah dipahami dan relevan bagi siswa. Komsiga terbukti efektif sebagai jembatan pemahaman konsep sekaligus penguatan karakter. Penelitian ini merekomendasikan agar model integrasi teknologi dan nilai ini diperluas ke materi-materi IPAS lainnya untuk mendukung pembelajaran holistik.

Kata kunci: *Komik Digital, Komsiga, Literasi Sains, Nilai Pendidikan Islam*

INTRODUCTION

In the 21st-century educational landscape, science literacy defined as the capacity to engage with scientific issues and ideas as a reflective citizen is recognized as a fundamental competency; yet, Indonesian elementary students continue to face significant challenges in mastering it (Nurpratiwi et al., 2023; Riyadi & Susongko, 2024). This prevailing low proficiency stems largely from the dominance of conventional teaching methods that treat science, particularly abstract physics topics like Force, as subjects of rote memorization rather than contextual knowledge. The urgency of addressing this educational gap is starkly highlighted by the OECD's 2023 PISA report, where Indonesian students attained a score of 383, lagging behind the global average (OECD, 2023). Furthermore, preliminary observations indicate that students perceive physics concepts as disconnected from their daily reality. Consequently, there is a critical need to shift from traditional textbooks to innovative, visually engaging media that can bridge the gap between complex concepts and young learners' cognitive capabilities (Siregar, 2021).

Digital comics, specifically formulated as Komsiga offer a pedagogical solution by leveraging visual narratives that align seamlessly with the concrete operational stage of elementary students. By synergizing text with dynamic visualization, comics reduce the cognitive load required to understand invisible forces. Extensive research has confirmed that digital comics are highly effective in improving conceptual mastery and student interest across various subjects (Arya et al., 2023; Juneli et al., 2022; Saputra & Pasha, 2021; Senjaya, 2022; Sulistriyaniva & Gunansyah, 2024). However, cognitive understanding alone is insufficient in the Indonesian context; character building is equally vital. Therefore, integrating Islamic Education Values provides a unique novelty. This approach ensures students understand the how of science while appreciating the value behind natural phenomena, fostering a holistic learning experience (Labibah et al., 2025; Wahib, 2021).

Based on these theoretical foundations, this study aims to rigorously analyze the effectiveness of Komsiga integrated with Islamic values in improving the science literacy of fourth-grade students. Unlike general media research, this study focuses on how value-laden visual narratives address both cognitive deficits and affective engagement. Utilizing a Pre-Experimental One-Group Pretest-Posttest design, the research measures improvement across three key PISA literacy dimensions: explaining scientific phenomena, evaluating inquiry, and interpreting data. It is hypothesized that Komsiga will yield a significant improvement in learning outcomes compared to baseline competence, offering a strategic framework for harmonizing science, technology, and character education.

METHODS

The study adopted a quantitative approach utilizing a Pre-Experimental One-Group Pretest-Posttest Design. This specific design was chosen to assess the direct impact of the Komsiga intervention on student competence by comparing scores before and after the treatment without disrupting the natural classroom structure. According to Creswell (2018) this design is appropriate for educational settings where random assignment to a control group is logistically unfeasible. It is crucial to acknowledge a fundamental limitation of this design: the absence of a control group means that external confounding variables such as student maturation or outside learning resources cannot be entirely ruled out. However, this limitation is offset by the study's high ecological validity, as it evaluates the media's effectiveness within the actual instructional environment of the IPAS curriculum. Thus, the design prioritizes the measurement of individual learning progression and the feasibility of the media in a real world context over strict comparative generalization.

The participants comprised 30 fourth-grade students from State Elementary School (SDN) 2 Kajen, Pekalongan Regency, selected through a saturation sampling technique where the entire class population served as the sample. The decision to strictly utilize this sample size was driven by the need to capture the complete learning dynamics of the target instructional group. While a sample size of N=30 is relatively small compared to large-scale national surveys, it satisfies the minimum threshold for statistical power in parametric analysis as posited by the Central Limit Theorem. This size allows for an in-depth analysis of how Komsiga is received by students with varying abilities. Nevertheless, regarding the generalization of findings, it must be admitted that the results are context specific. Consequently, readers should interpret the findings as indicative of potential outcomes in similar demographic settings rather than universally applicable to all elementary students in Indonesia.

Data were collected using valid and reliable test instruments designed to measure Science Literacy based on the PISA framework, specifically targeting three core competencies: explaining scientific phenomena, evaluating and designing scientific inquiry, and interpreting data and evidence. The

intervention utilized Komsiga to teach the topic of Force within the IPAS subject, explicitly bridging these scientific competencies with Islamic values to enhance engagement. To analyze the obtained data, the study employed the Paired Sample T-Test to determine the statistical significance of the score differences ($p<0.05$) and the Normalized Gain (N-Gain) score to quantify the magnitude of improvement. This dual-analysis approach ensures a robust evaluation, confirming not only that a statistical change occurred, but that the improvement in science literacy was substantial and directly attributable to the integrated learning media used in the intervention.

RESULTS AND DISCUSSION

The initial phase of the intervention revealed that integrating Komsiga into the classroom fundamentally shifted the learning dynamics from passive reception to active engagement. In traditional IPAS instruction, students often struggle with the abstract nature of physics concepts like Force, leading to disinterest and low retention. The digital comic format directly addresses this barrier by aligning the material with the visual learning preferences of fourth-grade students. As documented in Figure 1, qualitative observations showed students demonstrating sustained attention and enthusiasm while interacting with the media. Unlike text-heavy books, the visual narrative allowed students to immediately visualize the application of forces in daily life, effectively bridging the gap between abstract theory and concrete reality. This heightened engagement is a critical pedagogical finding, suggesting that the first step to improving literacy is removing the psychological barrier of boredom through interactive and visually stimulating media.

Figure 1. Students' engagement during the implementation of Komsiga media

Quantitative analysis using inferential statistics confirms that the implementation of Komsiga yielded a highly significant improvement in students' science literacy. To validate the effectiveness of the media beyond mere observation, it is necessary to determine whether the observed improvements were statistically robust or merely coincidental. As detailed in Table 1, the class average score surged from a pre-test baseline of 63.80 to a post-test score of 87.23. Furthermore, the Paired Sample T-Test resulted in a significance value (Sig. 2-tailed) of 0.000, which is substantially lower than the alpha threshold ($p < 0.05$). This result indicates improvements across all tested PISA dimensions: explaining phenomena, evaluating inquiry, and interpreting data. Consequently, the Null Hypothesis is rejected, providing conclusive statistical evidence that Komsiga is a significant determinant in enhancing science competence in the target group.

Table 1. Descriptive Statistics of Science Literacy Results

Statictics	Pre-Test	Post-Test
Sample Size (N)	30	30
Lowest Score (Min)	45	79
Highest Score (Max)	80	98
Mean	63,80	87,23
Standard Deviation	9,87	5,43

Beyond statistical significance, the magnitude of the learning gain classifies the *Komsiga* intervention as moderately effective in elevating student competence. Statistical significance indicates *that* a change occurred, but the Normalized Gain (N-Gain) score is required to measure *how meaningful* that change was in the context of educational standards. The analysis produced an N-Gain score of 0.65.

According to standard gain interpretations, this falls within the Medium category, approaching the High threshold. Figure 2 visually illustrates this trajectory, showing a steep incline in mastery levels post-intervention. This metric suggests that the media is not only statistically valid but practically impactful, offering a substantial boost in literacy that justifies its integration into the standard curriculum.

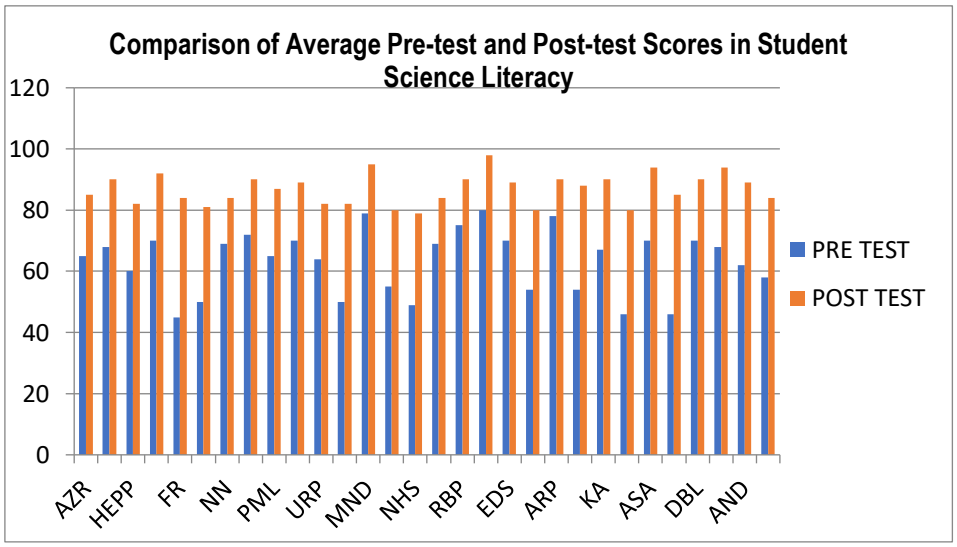

Figure 2. Comparison of Average Pre-test and Post-test Scores for Student Science Literacy

A deeper analysis of individual student performance reveals that Komsiga facilitates inclusive learning, benefiting students across the ability spectrum rather than just high achievers. An effective educational medium must demonstrate pedagogical equity; it should scaffold learning for struggling students while enriching those who are already advanced. The distribution data presented in Figure 3 highlights that 97% of the participants experienced improvement in the Medium to High categories. Specifically, only one student remained in the Low gain category, while the vast majority moved significantly upward from their baseline. This uniform distribution of improvement proves that the visual and narrative nature of Komsiga acts as an effective equalizer, making complex science accessible to students with diverse cognitive capabilities.

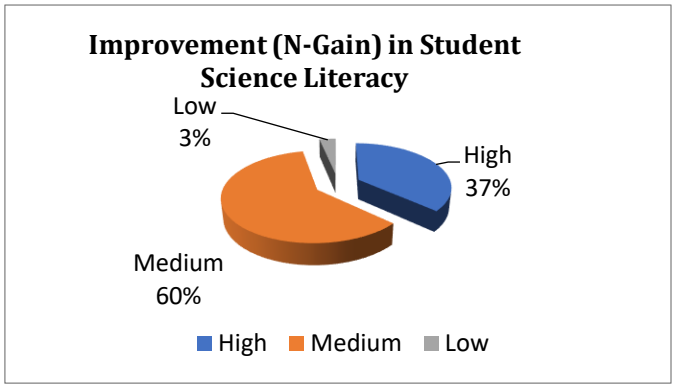

Figure 3. Distribution of Student Science Literacy Improvement Categories (N-Gain)

The findings in this study are in line with and reinforce the positive trend of using digital media in science learning in elementary schools, but with added value in terms of value integration. The results of this study support the findings of Juneli et al. (2022) and Arya et al. (2023), which state that narrative visualization in comics can reduce the abstraction of physics concepts. However, unlike the research by Maryam et al. (2023), which found that conventional methods often fail to establish relevance, this study proves that adding the context of Islamic educational values makes the material more relevant to the lives of madrasah/elementary school students. While Alwanda (2025) found a 64.7% increase in understanding

with general multimedia, Komsiga achieved similar effectiveness (N-Gain 0.65) but with the added advantage of internalizing religious character, which was not discussed in previous studies.

Komsiga's success is an important sign that science education in Indonesia is moving towards a more holistic direction, where science and Islamic educational values are no longer dichotomized. Indonesia's low PISA scores are often caused by students' inability to connect science texts with real-world contexts (OECD, 2023). The results of this study reflect that when science is taught through a language that children like (comics) and is linked to their beliefs (Islamic values), students' cognitive barriers collapse (Senjaya, 2022). This shows that science literacy is not only a matter of intellectual intelligence, but also about how the material touches the emotional and spiritual dimensions of students, creating truly meaningful learning.

The practical implication of this finding is that teachers now have a valid alternative to abandoning boring lecture methods for abstract material such as Force (Nabila et al., 2025). The high post-test average (87.23) implies that learning completion targets can be achieved more easily if the tools are appropriate. Elementary schools, especially Islamic-based ones, no longer need to hesitate to adopt technology-based media that integrates verses from the Quran, as it has been proven not to reduce the weight of science, but rather to strengthen its understanding. This means that a curriculum that combines IPAS with character building is not just an idealistic jargon, but an effective and measurable pedagogical strategy. This significant improvement occurred because Komsiga successfully applied the Dual Coding and Contextual Teaching and Learning theories simultaneously. The main reason is that the digital comic format reduces students' cognitive load through the visualization of concrete friction, springs, and magnets, while the Islamic narrative provides long-term memory (Nabila et al., 2025). Students find it easier to remember the concept of friction when it is visualized in an attractive way and associated with gratitude for all of God's creations. The synergy between entertaining visuals and narratives that touch on personal values is what makes students' knowledge retention increase sharply compared to conventional methods.

The most distinct contribution of this study is the finding that integrating Islamic Education Values enhances the contextual relevance of science literacy. In the Indonesian context, education aims to be holistic. Science instruction that is detached from students' core beliefs can feel alien or purely academic. By embedding *ayat kauniyah* (signs of God in nature) into the narrative, Komsiga connects scientific facts with spiritual meaning. This corroborates Wahib's (2021) assertion that integrating intellectual and spiritual quotients fosters deeper character building. Furthermore, as noted by Nurpratiwi et al. (2023), literacy improves when students perceive the subject matter as relevant to their personal identity. Ultimately, this study demonstrates that connecting science with faith does not dilute scientific rigor; rather, it strengthens student interest and retention, offering a model for value-based science education.

Seeing its proven effectiveness, the next step that needs to be formulated is expanding the accessibility and coverage of this media material. The education office or school curriculum developers need to consider adopting media similar to Komsiga for other the IPAS materials, not only for Force material. In addition, teachers need to be given training in designing or at least operating comic-based digital learning media. For future researchers, it is necessary to develop Komsiga in the form of mobile apps or websites so that students can access it independently at home, thereby building science literacy not only in the classroom but also as a lifelong learning culture. This study still has limitations in terms of the small scale of participants and the single scope of material. Testing was only conducted in one class (30 students) and on one topic, so the results cannot be generalized broadly to all school contexts. The lack of testing of independent use at home is also a gap that has not been explored. Therefore, further research is recommended to expand the sample to various schools and transform Komsiga into mobile apps or websites so that learning access becomes more flexible and widespread.

CONCLUSION

Based on the analysis, this study concludes that the integrated Komsiga media is effective in improving the science literacy of fourth-grade elementary students. Statistical evidence demonstrates a significant increase in learning outcomes (Sig. 0.000) with a Medium N-Gain of 0.65. The findings confirm that combining the visual-narrative strength of digital comics with the contextual relevance of Islamic Education Values successfully reduces the cognitive abstraction of physics concepts while fostering a more holistic learning engagement. Responding to the need for scalability and long-term application, it is recommended that future development of *Komsiga* transitions from simple digital files to accessible mobile applications or web-based platforms. This evolution would facilitate self-directed learning outside the classroom, supporting a sustainable culture of science literacy. Furthermore, future research should

expand the scope beyond the topic of "Force" to other IPAS materials and employ a Quasi-Experimental design with a control group to rigorously validate the consistency and generalizability of this pedagogical model across broader populations.

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