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ANALYSIS OF E-LEARNING MEDIA IN ISLAMIC RELIGIOUS EDUCATION FROM A NEUROSCIENCE PERSPECTIVE

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Abstract

This study explores the integration of e-learning media in Islamic Religious Education (PAI) at SDN Somoitan from a neuroscience perspective. A qualitative case study approach was employed, involving in-depth interviews, classroom observations, and documentation. Data analysis was conducted using a descriptive approach to illustrate the impact of e-learning on students' cognitive functions, particularly in the context of neuroplasticity, attention, and memory retention. The findings reveal that e-learning media incorporating visual and auditory elements positively impacts student participation. The use of videos, animations, and interactive quizzes helps students better understand the material, aligning with neuroplasticity principles that demonstrate the brain's ability to adapt through diverse learning experiences. However, the study also identifies challenges in implementing e-learning, including technological infrastructure limitations, such as unstable internet connections, and teachers' competency in integrating technology into the learning process. Despite these challenges, the school has made

efforts to improve infrastructure and provide training to teachers to enhance their technical skills. This study offers valuable insights into how e-learning media can be optimized to improve student learning outcomes and provides strategic recommendations to address existing barriers. The study concludes that, despite the challenges, the effective implementation of e-learning media can have a significantly positive impact on the quality of education at SDN Somoitan.

Keywords: *Education; E-Learning; Islam; Media; Neuroscience*

Abstrak

Penelitian ini mengeksplorasi integrasi media e-learning dalam pembelajaran Pendidikan Agama Islam (PAI) di SDN Somoitan dengan perspektif neurosains. Penelitian ini menggunakan pendekatan kualitatif dengan metode studi kasus, melibatkan wawancara mendalam, observasi kelas dan dokumentasi. Analisis data dilakukan dengan pendekatan deskriptif untuk menggambarkan dampak e-learning terhadap fungsi kognitif siswa, khususnya dalam konteks neuroplastisitas, perhatian dan retensi memori. Temuan penelitian menunjukkan bahwa penggunaan media e-learning yang mencakup elemen visual dan auditori memberikan dampak partisipatif bagi siswa. Penggunaan video, animasi, dan kuis interaktif membantu siswa memahami materi pembelajaran dengan lebih baik, sejalan dengan prinsip-prinsip neuroplastisitas yang menunjukkan kemampuan otak untuk beradaptasi melalui pengalaman belajar yang beragam. Namun, penelitian ini juga mengidentifikasi beberapa tantangan dalam penerapan e-learning, termasuk keterbatasan infrastruktur teknologi, seperti koneksi internet yang belum stabil, serta kompetensi guru dalam mengintegrasikan teknologi dalam proses pembelajaran. Meski menghadapi tantangan ini, sekolah telah melakukan berbagai upaya untuk meningkatkan infrastruktur dan memberikan pelatihan kepada guru guna meningkatkan keterampilan teknis mereka. Penelitian ini menawarkan wawasan penting mengenai bagaimana media e-learning dapat dioptimalkan untuk meningkatkan hasil belajar siswa dan memberikan rekomendasi strategis untuk mengatasi hambatan yang ada. Penelitian ini menyimpulkan bahwa meskipun terdapat tantangan, penerapan media e-learning yang efektif dapat memberikan dampak positif signifikan terhadap kualitas pembelajaran di SDN Somoitan.

Kata Kunci: *E-learning; Islam; Media; Neurosains; Pendidikan*

INTRODUCTION

Digital technology has become an integral part of modern life, including in education, despite many challenges (Kim & Chung, 2023). Student satisfaction with online learning, influenced by perceptions of usefulness, technology fit, and motivation, greatly affects the effectiveness and dropout intentions in e-learning (Sitar-Tăut et al., 2024). In recent decades, advancements in information and communication technology have significantly changed how we access, process, and disseminate information, impacting various aspects of life, including education (Huang et al., 2024). The use of technology in education not only allows for broader access to learning resources but also opens opportunities to develop more interactive and personalized learning methods (Tisch & Metternich, 2017). One increasingly popular application of technology in education is the use of e-learning-based learning media (Husain & Suyadi, 2023).

E-learning, or electronic learning, is an approach to education that leverages information and communication technology to support the teaching and learning process. E-learning encompasses various forms, from online courses, educational videos, to interactive applications (Suyadi, 2022). The advantages of e-learning lie in its flexibility in time and place, access to diverse learning resources, and the ability to tailor learning to individual student needs. However, implementing e-learning also presents challenges, particularly in terms of technological infrastructure readiness, teacher

competence, and student response to learning methods that differ from traditional approaches (Aheto et al., 2024; He & Hak-soon, 2025; Sitar-Tăut et al., 2024).

Previous studies have highlighted various important aspects of using technology in education (Blankesteijn et al., 2024; Ma et al., 2024; Wang, 2024). Research on the impact of intellectual and emotional intelligence from a neuroscience perspective in an educational context shows that these factors play a crucial role in the success of learning through digital technology (Damanik et al., 2023; Nurbayti & Hapzi Ali, 2024; Sari & Finthariasari, 2022). This research emphasizes that understanding how technology can affect students' brains and emotions is essential in designing effective learning media (Permata et al., 2024). Furthermore, in the study "Cognitive Neuroscience and Education," it is explained that the application of cognitive neuroscience in education has opened new avenues for understanding how students learn and how technology can support this process. They emphasize that cognitive neuroscience can provide insights into how the brain processes information during learning, especially when using digital media (Luk & Christodoulou, 2023).

At SDN Somoitan, the use of e-learning media has been integrated into Islamic Religious Education (PAI) as an effort to harness the potential of technology to improve the quality of education. PAI is an essential subject in the elementary school curriculum in Indonesia, aimed at shaping students' character and morals according to Islamic teachings. Therefore, it is important to ensure that the teaching methods used in PAI can effectively and engagingly convey the material, so students can understand and internalize religious values well.

The use of e-learning media in PAI at SDN Somoitan is designed to address various challenges faced in conventional learning. One of the main challenges is the limitation of time and space in classroom learning. By using e-learning media, teachers can provide learning materials in a digital format that can be accessed by students anytime and anywhere. Additionally, e-learning allows for the use of various multimedia formats such as video, audio, and animation, which can make learning more engaging and help students better understand the material being taught. Other research also shows that innovative learning media, such as e-learning, has great potential in religious education, especially in crisis situations (Zulkifli et al., 2024). The implementation of e-learning at SDN Somoitan, however, faces several challenges related to technological infrastructure and teacher competency. Unstable internet connections and limited access to devices like computers and tablets often disrupt the learning process and hinder seamless interaction with digital media. These technical constraints can reduce students' engagement with the material and impair their ability to retain information effectively. Furthermore, not all teachers possess the necessary skills to design and utilize e-learning media optimally. Many educators require additional training to integrate digital tools into their teaching practices effectively. These issues, compounded by insufficient institutional support, slow down the adoption of e-learning and limit its potential impact on the learning experience.

One important concept in neuroscience relevant to learning is neuroplasticity. Neuroplasticity is the brain's ability to change and adapt in response to new experiences. When someone learns something new, the brain forms new connections between the

neurons involved in the process. These connections are strengthened through repetition and practice, allowing the learned information to be remembered for longer. Research by Hutton et al. (2024) in "Digital Media and Developing Brains: Concerns and Opportunities" underscores that digital media can influence brain development, particularly in children, and therefore, it is important to design e-learning media that is appropriate to the cognitive development of children (Hutton et al., 2024).

In addition to neuroplasticity, attention is another important cognitive aspect in learning. Attention is the cognitive process that allows a person to focus on specific information while ignoring other information. In learning, attention is the first step that must be achieved before information can be further processed. If students do not pay attention to the material being presented, that information will not enter long-term memory. Therefore, engaging and interactive learning media are crucial to capturing students' attention and maintaining their focus during the learning process. Research by Gu et al. (2024) shows that the presence of an instructor in online learning videos can enhance students' neural synchronization and visual attention, which in turn improves material comprehension and retention (Gu et al., 2024).

Memory is another crucial cognitive aspect of learning. Memory allows us to store and recall the information we have learned. Short-term memory, which lasts only a few seconds to minutes, is the first place where new information is stored. If this information is considered important, it will be transferred to long-term memory, where it can be stored for longer periods. This process involves the repetition and strengthening of

neuronal connections associated with that information. In the context of e-learning, the use of repetition methods, such as quizzes and interactive exercises, can help strengthen long-term memory and improve information retention. Therefore, it is important to analyze how e-learning media applied in PAI at SDN Somoitan affects students' cognitive processes, particularly in terms of attention, memory, and neuroplasticity. This research is expected to provide deeper insights into how multimedia elements in e-learning stimulate brain regions responsible for visual, auditory, and memory processing, and how this impacts students' understanding and information retention.

The principle of neuroplasticity demonstrates that the brain can adapt and form new connections in response to diverse learning experiences, including those delivered through multimedia elements. When educational media are designed with bombastic elements—such as striking visual displays, the use of bright colors, attention-grabbing text, or dynamic animations—the brain responds more strongly to these stimuli. This response activates brain areas associated with attention and memory, such as the visual cortex and limbic system, which play a role in forming long-term memories. For instance, in Islamic Religious Education (PAI) at SDN Somoitan, videos with high-contrast colors or animations of prophets' stories accompanied by captivating background sounds can capture students' attention, creating unique stimuli that make it easier for the brain to retain the material. Additionally, the use of large, visually appealing text or a harmonious combination of visuals and audio can enhance students' emotional engagement, significantly reinforcing the memory process. In this way, multimedia elements designed to stand out not only serve as visual aids but

also act as mechanisms to optimize learning by strengthening neural connections in the brain.

Thus, this research has the potential to make a significant contribution to the development of more effective learning strategies, particularly in the context of Islamic Religious Education. The findings can be used to design more interactive and engaging learning media, helping students better understand and internalize the material. Additionally, this research also contributes to the field of educational neuroscience by providing insights into how technology can be used to support a teaching and learning process that aligns more closely with how the brain works.

Researching Islamic Religious Education (PAI) at SD N Somoitan from a neuroscience perspective, this research aims to fill a gap in the existing literature where studies on the connection between neuroscience and e-learning media in Islamic education at the elementary level are limited. Specifically, the study seeks to answer how elements of learning media on e-learning platforms affect students' cognitive processes, such as attention, memory, and neuroplasticity. This study employs a qualitative approach, focusing on how neuroscience principles are reflected in the use of e-learning media rather than quantitatively measuring cognitive benefits. The research examines how specific elements of e-learning media—such as visual and auditory components, interactive features, and repetitive exercises—align with neuroscience concepts like neuroplasticity, attention, and memory retention. Observations and interviews were used to understand how these elements impact students' learning experiences in the context of PAI at SD N Somoitan. The study aims not to measure cognitive

outcomes through quantitative metrics but to explore and describe how neuroscience principles influence the design and implementation of e-learning media. The research questions include: How do e-learning media elements influence student engagement and retention? What are the cognitive benefits and challenges associated with using e-learning in Islamic Religious Education?

METHOD

This study employs a qualitative approach with a case study design to analyze the use of e-learning media in Islamic Religious Education (PAI) at SD N Somoitan from a neuroscience perspective. Purposedly selected to ensure that participants have direct experience with e-learning media, participants in this study include fourth and fifth-grade students and Islamic Religious Education teachers involved in teaching using e-learning media at SD N Somoitan.

The sample characteristics include age range, gender, role in education, and level of experience in using technology in learning. By involving various informants, this study aims to obtain a comprehensive picture of the implementation of e-learning at the school. Below is a table describing the demographics of the informants in this study:

Table 1. Demographics of Informants

No	Nama Inisial	N	Jenis Kelamin	Peran Informan
1	Rs	V	Female	Student
2	Kh	V	Male	Student
3	Af	VI	Female	Student
4	Df	VI	Male	Student
5	Ibu Vn	-	Female	PAI Teacher

No	Nama Inisial	N	Jenis Kelamin	Peran Informan
6	Ibu Tp	-	Female	Principal

Data were collected through in-depth interviews, participatory observations, and document analysis. The interviews used semi-structured guidelines to gain deep insights into participants' experiences and perceptions regarding the use of e-learning media. Observations were conducted during the learning process to record interactions between students and e-learning media, as well as their responses to various multimedia elements used. Document analysis included evaluating the e-learning materials used in Islamic Religious Education (PAI) instruction.

The data obtained were analyzed using thematic analysis methods. The steps in this analysis included coding the data, identifying key themes, and interpreting the findings. The researcher's competency in conducting qualitative analysis and data interpretation was ensured through prior training and experience in qualitative research. To ensure the validity and reliability of the data, method triangulation was conducted by combining data from interviews, observations, and document analysis. Validity testing was performed through member checking, where interview results and initial interpretations were confirmed with the research participants.

RESULTS AND DISCUSSION

In today's digital era, the integration of technology in education has become essential to enhance the effectiveness and efficiency of the learning process. Technology facilitates material delivery, interaction between teachers and students, and

learning evaluation. At SD Negeri Somoitan, e-learning media has been integrated into Islamic Religious Education (PAI) instruction to leverage the potential of technology in improving educational quality . This e-learning implementation aims not only to address the limitations of time and space but also to meet the challenges of 21st-century education, where digital skills are crucial for students (Nurcahyani, 2024g).

The e-learning design at SD Negeri Somoitan is aimed at improving the quality of PAI instruction through the use of technology and multimedia. The school's principal, Mrs. TP, explained that the purpose of implementing e-learning media is to provide access to more interactive learning resources. By utilizing digital technology, learning becomes more dynamic and engaging for students (Nurcahyani, 2024f).

> *"The implementation of e-learning media at SD Negeri Somoitan, particularly in PAI instruction, generally improves education quality by providing access to more interactive learning resources. E-learning media allows the use of various multimedia formats such as video, audio, and animation, making learning more engaging and interactive, and also helps develop teachers' technological skills" (Interview with Mrs. TP, Principal of SDN Somoitan, June 30, 2024, in Somoitan)(Purwanti, 2024b).*

The e-learning design at SD Negeri Somoitan aims to create engaging and interactive learning experiences in PAI. Mrs. Vn, a PAI teacher, emphasized that e-learning media enhances students' enthusiasm and comprehension compared to conventional teaching methods. The use of digital technology, such as videos, animations, and audio, aids students in better understanding and retaining the material taught. For instance, stories of prophets and prayer movements are presented through

videos and audio, making the material more engaging and easier for students to grasp (Nurcahyani, 2024d).

Mrs. Vn also noted that the selection of materials for e-learning media is based on the existing syllabus, with a focus on historical and practical content. Materials such as stories of prophets and worship practices are well-suited for e-learning presentations, such as YouTube videos or short historical films (Nurcahyani, 2024c).

> *"The learning materials are already in the syllabus. For selecting media used in e-learning, we typically choose materials with historical significance, like the stories of prophets. For example, YouTube videos or short historical films about prophets. Prayer movements and recitations can be taught using audio and images. Exemplary behavior can also be conveyed through e-learning media." (Interview with Mrs. Vn, PAI Teacher at SDN Somoitan, July 1, 2024, in Somoitan) (Nurcahyani, 2024b).*

Additionally, prayer movements and recitations are presented through audio and images, helping students understand and memorize the movements and recitations better. This use of multimedia not only makes learning more engaging but also helps students develop their digital skills. One aspect analyzed is how e-learning media can stimulate various parts of the brain to enhance understanding and retention of information. The following is an example of e-learning implementation at SDN Somoitan, illustrating the use of visual and audiovisual elements in learning.

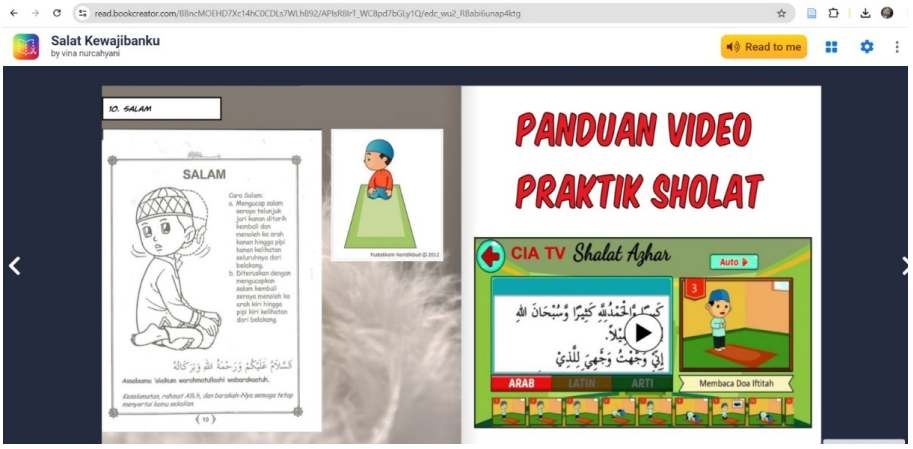

Figure 1. *E-Book Learning: Prayer Practices*

The image above shows an e-book used in PAI instruction at SDN Somoitan. This e-book not only contains text and images but is also equipped with videos of prayer practices. This media provides a step-by-step guide to performing prayers, from intention to salutation, using a combination of images, text, and videos.

From a neuroscience perspective, using visual and audiovisual elements like this is highly effective in stimulating brain areas responsible for visual and auditory processing. When students simultaneously see and hear information, their brains work more effectively in absorbing and remembering the material. This aligns with the theory of neuroplasticity, which shows that the brain can adapt and form new connections through diverse learning experiences. The e-book with prayer practice videos also helps students with different learning styles. Visual learners can understand the prayer movements through images and videos, while auditory learners can listen to instructions and prayers. This combination makes learning more inclusive and effective for all students.

Moreover, from a neuroscience perspective, media that features visually and audiovisually engaging and impactful elements at the beginning of a presentation can stimulate the brain to pay more attention. This occurs because the human brain is naturally attracted to strong and different stimuli from what it usually receives, resulting in a higher cognitive response to the material presented. This increases students' focus on learning, which in turn can strengthen memory retention and understanding of the material. Thus, using media that employs this technique can positively impact the effectiveness of learning, particularly in religious education that requires deep understanding and practical application.

In addition, using such media also increases student engagement and motivation. With an attractive and interactive display, students become more enthusiastic about learning and can concentrate more easily. This is crucial to ensure that students do not merely memorize the material but also truly understand it and can apply it in their daily lives.

Essentially, e-learning media allows the use of various multimedia formats, such as video, audio, and animation. Educational videos are used to explain complex concepts, providing visual illustrations that help students better understand the material. For example, in PAI instruction, videos about the stories of prophets or worship practices can give students a clearer and more contextual understanding. Furthermore, animations are used to explain abstract concepts in a way that is easier to grasp, while audio aids students who are more inclined to learn by listening.

Moreover, e-learning media also enables the integration of various types of interactive content. Online quizzes and

interactive exercises are examples of how this technology is used to make learning more engaging and challenging. With interactive quizzes, students can immediately test their understanding after learning a topic. This not only helps improve information retention but also provides immediate feedback to students about their strengths and weaknesses.

Mrs. TP emphasized that one of the main challenges in implementing e-learning media is the unstable internet connection. Inconsistent internet connectivity can disrupt the learning process and reduce the effectiveness of e-learning media.

> *"The challenges we face include the first one, the unstable internet connection, and then teacher competency because not all teachers at SD Negeri Somoitan have adequate competence in using technology. Then, there's also the need for monitoring processes because, with technology, we must ensure appropriate content for students." (Interview with Mrs. TP, Principal of SDN Somoitan, June 30, 2024, in Somoitan)(Purwanti, 2024a).*

To address this issue, the school has made efforts to improve technological infrastructure and collaborate with parents to ensure students have adequate access to technology at home. Parents are expected to provide devices such as laptops or computers and monitor their children's use of technology to ensure they use appropriate content for their development.

Teacher competency in using technology is also a challenge. Not all teachers at SDN Somoitan have a sufficient understanding of technology and how to integrate it into learning. To address this, the school has held various training sessions and workshops to enhance teachers' competencies. This training includes creating learning media through platforms like Canva and creating interactive quizzes that can be used in the

learning process. Mrs. TP stated that this training is crucial to ensure that teachers have the necessary skills to develop effective and engaging digital content (Nurcahyani, 2024a).

The e-learning media design also considers various student learning styles. Some students prefer to learn visually, while others prefer to listen to audio. With e-learning media, the school can provide various material formats that students can choose based on their preferences. This helps create a more personal and effective learning experience. For instance, students who prefer to learn visually can watch educational videos, while those who prefer listening can utilize podcasts or audio recordings from teachers.

The e-learning media design process at SDN Somoitan also involves continuous evaluation and feedback. Each material presented through e-learning media is periodically evaluated to ensure its effectiveness. Teachers at SDN Somoitan use the evaluation results to improve and develop better learning content. Furthermore, feedback from students is highly valued. Students are encouraged to provide input on their experiences using e-learning media, and this feedback is used to enhance the quality of learning.

To support the implementation of e-learning media, the school also strives to improve technological infrastructure. Although internet facilities are already in place, network stability remains an issue at times. Therefore, the school continues to work on improving the quality of the internet network to make it more stable and reliable. Additionally, technological devices such as laptops and computers are provided for teachers. However, for students, there is still a need to improve the availability of adequate technological devices.

Collaboration with parents is also an important factor in the e-learning media design. Parents are expected to support their children by providing adequate learning facilities at home. Additionally, supervision and motivation from parents are crucial to ensuring that children use technology wisely and in line with learning objectives (Nurcahyani, 2024e).

Implementation Process of E-Learning Media

The implementation of e-learning media at SDN Somoitan involves various steps designed to ensure that technology can be effectively utilized in the learning process. Mrs. Vn explained that one of the main challenges in implementing e-learning media is the time required to prepare learning materials. Creating effective learning media takes considerable time and effort, often cutting into time that could be used for direct classroom instruction. Additionally, the absence of a dedicated room with a fixed projector at the school requires teachers to set up and dismantle the projector every time it is used, which consumes time and energy.

Mrs. Vn also mentioned that another challenge is the limited time for PAI lessons, which are only two teaching hours (JPL) per day. With limited time, using e-learning media often requires additional time to set up devices such as projectors and laptops, reducing the time available for direct instruction. However, despite these challenges, Mrs. Vn continues to use e-learning media in PAI lessons due to its perceived benefits in enhancing student motivation and understanding.

The process of implementing e-learning media at SDN Somoitan begins with initial steps designed to ensure that technology can be effectively integrated into Islamic Religious Education (PAI) learning. The Principal of SDN Somoitan, Mrs.

TP, explained that the first step in this process is assessing the readiness and competence of teachers in using e-learning technology. Many teachers still have limited technological understanding, so training and workshops are crucial initial steps to improve their skills.

The implementation process also involves strict monitoring of the content used in learning. Mrs. TP explained that it is important to ensure that the content presented is appropriate for the students' development and needs. The school conducts a selection and monitoring process to ensure that the content used is not only engaging but also educational and relevant to the learning material. Teachers are also encouraged to create interactive and engaging content to help students better understand the material being taught.

In classroom practice, e-learning media is used to present materials through videos, animations, and interactive quizzes. Educational videos are used to provide in-depth visual explanations of PAI concepts. For example, videos depicting worship practices or stories of prophets help students understand the material better. Animations are used to explain abstract concepts in ways that are easier for students to understand, while interactive quizzes allow students to test their understanding immediately after learning a topic. Mrs. TP noted that using this technology makes learning more vibrant and engaging, ultimately increasing student interest and motivation in learning.

Evaluation and monitoring of the effectiveness of e-learning media are essential parts of the implementation process. SDN Somoitan regularly evaluates student learning outcomes before and after implementing e-learning media. These results

are then compared to see if there is an improvement in students' understanding and information retention. Besides academic evaluations, the school also monitors students' participation and engagement in learning. Other indicators of success include increased student interest in learning and active participation during the teaching and learning process. Based on the monitoring results, the school can identify areas that need improvement and develop strategies to enhance the effectiveness of e-learning media.

To support the implementation of e-learning media, the school also strives to improve its technological infrastructure. Although internet facilities are already in place, network stability remains an issue at times. Therefore, the school continues to work on improving the quality of the internet network to make it more stable and reliable. Additionally, technological devices such as laptops and computers are provided for teachers. However, there is still a need to improve the provision of adequate technological devices for students. These steps are taken to ensure that all students have equal opportunities to utilize e-learning media optimally.

Monitoring the content used in e-learning media is also a primary concern. The content presented must align with the curriculum and support the achievement of learning objectives. The school conducts strict content selection to ensure that the material presented is not only engaging but also educational. Teachers at SDN Somoitan are encouraged to continue innovating in creating digital content that can attract students' interest and help them better understand the lesson material.

The evaluation process also involves monitoring student participation levels in learning. Students are expected to actively

participate in teaching and learning activities, whether through online discussions, interactive quizzes, or project assignments. Active student participation indicates their engagement in learning and serves as an indicator of the success of e-learning media implementation. Mrs. TP stated that with high participation, students can better understand the material and achieve better learning outcomes.

Moreover, the school has developed specific indicators to measure the success of e-learning media implementation in PAI learning. These indicators include an increase in students' academic scores, a comparison of scores before and after e-learning implementation, and the level of student engagement in learning. These indicators help the school measure the effectiveness of e-learning media and make necessary adjustments to improve the quality of learning.

The implementation process of e-learning media at SDN Somoitan also involves efforts to expand the use of technology in learning. The school plans to extend the use of e-learning media to other subjects such as mathematics and science. By utilizing technology, the school hopes to make learning more engaging and motivate students to study harder. The use of simulation videos and interactive quizzes is expected to help students understand complex concepts in easier and more enjoyable ways.

In the long term, SDN Somoitan envisions creating an innovative and adaptive learning environment that leverages technology to improve education quality. Mrs. TP hopes that with technological support, teachers can teach more effectively and students can learn more efficiently. To achieve this vision, the school continues to improve its technological infrastructure,

provide teacher training, and develop collaborations with external parties such as educational institutions and technology companies.

Thus, the implementation process of e-learning media at SDN Somoitan involves various steps designed to ensure the effective integration of technology into learning. From teacher training and competency enhancement, technological infrastructure improvement, content monitoring, to evaluation and effectiveness monitoring, each stage is carefully executed to ensure that e-learning media can provide maximum benefits to students. With continuous support from teachers, parents, and the community, it is hoped that e-learning media can continue to evolve and make significant contributions to improving the quality of education at SDN Somoitan.

The implementation process of e-learning media at SDN Somoitan demonstrates the various steps taken to ensure effective integration with the existing learning system. This implementation includes teacher training, content monitoring, and the use of interactive media to enhance learning quality. Despite its successes, this process also faces several challenges that affect the effectiveness of e-learning media implementation. The following table summarizes the main findings related to the e-learning media implementation process at SDN Somoitan.

Table 2. E-Learning Media Implementation Process

No	Process	Description
1	Teacher Training	Teachers are given training to enhance their competence in using e-learning technology.
2	Content Monitoring	E-learning content is monitored to ensure its relevance and quality according to the curriculum.

3	Use of Interactive Media	Interactive media such as videos, animations, and quizzes are used to make learning more engaging.
4	Effectiveness Evaluation	The effectiveness of e-learning media is evaluated by comparing student learning outcomes before and after its implementation.
5	Technological Infrastructure	Provision of adequate technological infrastructure, such as computers and internet connectivity.
6	Curriculum Integration	E-learning media is integrated with the PAI curriculum to ensure relevant and goal-aligned material.
7	Time and Effort Challenges	Teachers face difficulties in preparing e-learning media due to time and effort constraints.
8	Space Limitations	The absence of a dedicated room with a fixed projector requires setting up and dismantling devices each time.

The implementation process of e-learning media at SDN Somoitan shows that although there are various challenges, the strategic steps taken have successfully improved the quality of learning. Teacher training and the use of interactive media have proven effective in engaging students. However, infrastructure and time constraints remain challenges that need to be addressed to optimize the use of e-learning media. These results provide valuable insights for further development and refinement of e-learning implementation strategies in the future.

Student Responses and Reactions to E-Learning Media

The use of e-learning media in Islamic Religious Education (PAI) at SDN Somoitan has received positive feedback from students. Students generally feel more engaged and focused when learning using computers, as the larger screens and

appealing visuals create a more interactive learning experience, which boosts their enthusiasm and motivation.

One student, identified as Rs, expressed that learning with computers is fascinating due to the large screen and interactive visuals. Rs finds that e-learning is more engaging and less monotonous compared to traditional methods.

> *"I enjoy learning using a computer because the large screen makes it more engaging and less boring. Learning with e-learning is more enjoyable because it is interactive and keeps me interested. Videos make the learning process more exciting and easier to understand, especially when studying PAI with e-learning. However, I have sometimes faced difficulties using e-learning, but my mother usually helps me. When PAI lessons include videos, it becomes easier to grasp the material, and the quizzes on the computer help me understand the lessons better." (Interview with Rs, Grade 5 Student at SDN Somoitan on July 8, 2024, in Somoitan) (Hartanto, 2024).*

This learning experience contrasts with conventional methods that rely solely on verbal explanations from teachers. With e-learning media, educational material is presented in a more captivating and varied manner, helping students better comprehend and retain the information delivered. Learning through videos has proven particularly effective in increasing student interest. Rs feels that educational videos provide clear and engaging illustrations that simplify understanding the material. Additionally, Rs finds that learning with e-learning media is more enjoyable because it is not monotonous and always introduces something new to learn. This has led Rs to hope that e-learning methods will also be applied to other subjects to facilitate understanding.

However, not all students find using e-learning media easy. Rs admitted to occasionally facing difficulties with the technology, particularly in understanding how e-learning tools

work. In such situations, parental support is crucial. Rs often receives help from their mother when encountering technical challenges, which enables Rs to continue learning despite the obstacles.

The use of videos and quizzes in e-learning also significantly aids students like Rs in understanding the material. Educational videos provide visualizations that help students remember and comprehend the concepts being taught, while quizzes offer an opportunity to test their understanding. Rs feels that the computer quizzes help better grasp the material and provide immediate feedback on the level of understanding achieved.

To provide a clearer picture of the implementation of e-learning media at SDN Somoitan, here is an image showing the learning atmosphere in the classroom using e-learning media:

Figure 2. PAI Learning Process for Grade 5 at SDN Somoitan

The included image depicts the learning atmosphere in the classroom using e-learning media. Several students are seen

sitting attentively at their desks, focusing on the projector screen displaying the educational material. The use of a projector and computer to show educational videos is part of the implementation of e-learning media at SDN Somoitan. The students appear focused and enthusiastic about the lesson, reflecting their positive response to the use of e-learning media.

The image illustrates that e-learning media helps create a more engaging and conducive learning environment. Students seem more involved and motivated to learn, which can ultimately enhance their academic outcomes. With better visualization and higher interaction, students can understand the material more effectively.

Thus, it can be concluded that e-learning media positively impacts students' motivation, participation, and understanding in PAI learning at SDN Somoitan. Despite some challenges, such as technical difficulties and the need for parental support, the use of e-learning media can still be optimized to improve the overall quality of education. Proper support from teachers and parents is crucial to ensure that students can fully benefit from e-learning media and achieve optimal learning outcomes.

Table 2. Implementation Process of E-Learning Media

No	Student Responses and Reactions	Description
1	Increased Learning Motivation	Students show increased motivation to learn with interactive and engaging e-learning media.
2	Easier Material Understanding	Students find the material easier to understand because it is presented in an engaging and interactive way.

3	Enthusiasm and Student Engagement	Students become more enthusiastic and actively involved in the learning process with e-learning media.
4	Positive Feedback	Feedback from students indicates that they enjoy using e-learning media.
5	Challenges in Technology Usage	Some students experience difficulties using technology but receive help from teachers and peers.
6	Preference for E-Learning Media	Students prefer e-learning media over conventional learning methods.
7	Parental Support	Parental support is crucial in helping students overcome technical difficulties they encounter.
8	Technical Barriers	Some students face technical barriers, such as internet access issues or inadequate devices.

From the table above, it is evident that e-learning media provides many positive benefits for students at SDN Somoitan, such as increased learning motivation and easier material comprehension. However, there are also challenges that need to be addressed, such as technical barriers and the need for parental support. These findings suggest that while e-learning media has great potential to enhance the quality of education, further efforts are needed to overcome the existing challenges. Therefore, additional strategies and support are necessary to maximize the benefits of e-learning media for all students.

This study indicates that the use of e-learning media in Islamic Religious Education (PAI) at SDN Somoitan significantly impacts students' neuroplasticity and memory retention. The technology enhances student engagement and strengthens their cognitive processes through multisensory stimulation, a crucial

aspect of deep and sustainable learning. In this discussion, we delve into how these findings relate to neuroscience theory and previous literature while considering the challenges and opportunities that exist.

The Influence of E-Learning on Neuroplasticity

Neuroplasticity, the brain's ability to adapt and form new connections in response to learning experiences, is a key concept in explaining how e-learning can enhance students' memory and comprehension. The use of multimedia elements such as videos, animations, and interactive e-books in e-learning simultaneously stimulates various brain areas, supporting the formation of stronger and more efficient neural connections. This process allows students not only to process information better but also to store it in long-term memory, essential for sustained learning.

Other research highlights that the integration of neuroscience into education, particularly through techniques like EEG recordings, can provide valuable insights into how the brain processes and stores information during learning (Gashaj et al., 2024). These studies align with the findings of this research, which indicate that multisensory stimulation through e-learning media enhances neuroplasticity and supports improved memory retention. However, this study adds a unique dimension by situating these findings within the context of Islamic Religious Education (PAI) at the elementary level, where the integration of values-based content, such as prayer recitation and stories of prophets, demands a culturally sensitive approach.

At SDN Somoitan, the use of interactive e-books in prayer instruction demonstrates how e-learning media can effectively address the cognitive and emotional aspects of learning. These e-books combine text, images, and videos to stimulate students'

visual and auditory senses, aligning with principles of cognitive neuroscience to enhance memory retention. Unlike generic e-learning implementations, this approach is tailored to the unique needs of Islamic education, ensuring that both the cognitive processes and the spiritual values integral to the curriculum are addressed. Furthermore, the findings highlight that improving teachers' neuroscience literacy is critical for optimizing the use of technology-based media in this context. This aligns with previous studies emphasizing the importance of teacher preparedness in leveraging neuroscience principles for effective learning (Ching et al., 2020).

Educational videos also play a crucial role in enhancing students' memory. By visualizing abstract concepts like the stories of prophets, these videos not only make learning more engaging but also more memorable. The use of multimedia in learning can increase cognitive efficiency by engaging more senses in the learning process, as also found in this study. Classroom observations showed that students were more enthusiastic and engaged when materials were presented through videos, which strengthened visual associations and helped in long-term information retention.

Challenges in Implementing E-Learning

However, despite these benefits, significant challenges remain, particularly regarding infrastructure and teacher competency. A successful relationship between neuroscience and education requires strong infrastructure support and ongoing professional development for teachers (Zadina, 2015). Infrastructure limitations, such as internet connection stability and the availability of adequate technological devices, are major obstacles that need to be addressed to ensure the effectiveness of

e-learning at SDN Somoitan. Unequal access to this technology can hinder the full potential of e-learning in supporting students' neuroplasticity and memory retention.

More intensive training for teachers is also needed to ensure they have sufficient competence in operating and integrating this technology into everyday teaching practices. Mrs. VN, a PAI teacher at SDN Somoitan, noted that the time required to prepare and manage e-learning media often cuts into direct instructional time. This becomes an additional challenge when adequate facilities, such as classrooms with fixed multimedia equipment, are not available. It should also be recognized that global challenges in neuroscience education include the need for adequate infrastructure development and training for educators, which aligns with the challenges faced in this study (Nishi et al., 2016).

Despite these significant challenges, it is important to acknowledge that e-learning has great potential to become an integral component of a broader learning strategy. In the long term, e-learning can increase student engagement, motivation, and cognitive abilities in ways that conventional learning methods cannot achieve. However, realizing this potential requires better support for teachers, improvements in technological infrastructure, and a deep understanding of how neuroscience can be integrated into education.

As we have highlighted, the successful relationship between neuroscience and education requires a holistic approach supported by ongoing research and innovation in teaching practices. With these measures, e-learning can not only increase student engagement and motivation but also strengthen

their cognitive abilities by enhancing neuroplasticity and memory retention.

These findings provide a strong foundation for further research on how e-learning can be more widely implemented in other elementary schools. With appropriate adaptations, this technology can help address diverse learning challenges in various educational contexts, ensuring that all students have equal opportunities to achieve academic success.

CONCLUSION

Overall, this study confirms that e-learning media, when used effectively, can enhance student engagement and retention in Islamic Religious Education (PAI). The use of multimedia elements not only makes learning more engaging but also helps students better understand and retain the material. However, to fully optimize this potential, targeted improvements in technological infrastructure and teacher training are essential. For instance, addressing barriers such as unstable internet connections requires investment in more reliable network infrastructure and collaboration with stakeholders to ensure equal access to devices for students. Additionally, comprehensive training programs for teachers are necessary to build their technical and pedagogical competencies, enabling them to integrate e-learning media effectively into their teaching practices.

The study provides strategic recommendations that include the establishment of partnerships with external organizations to provide funding or technological resources, the development of modular and flexible training programs tailored to teachers' needs, and the introduction of hybrid learning models that

combine e-learning with traditional methods to accommodate infrastructure limitations. These strategies can be adapted to other educational contexts by considering local needs and constraints. For instance, schools in rural areas may prioritize community-driven initiatives for shared internet access or device lending programs, while urban schools may focus on scaling up advanced digital tools. By aligning these strategies with the unique demands of each educational environment, the effectiveness of e-learning implementation can be significantly enhanced.

This research makes an important contribution to the literature on e-learning and neuroscience, particularly in the context of religious education at the elementary school level. The practical implications of these findings highlight the need for further development of interactive learning media that align with students' cognitive processes. Future research should explore the long-term impact of e-learning on student outcomes and how technology-based interventions can be better integrated into the educational curriculum.

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