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Microsite-Based E-Learning as an Adaptive Pedagogical Tool: Enhancing Student Mastery of *Rukhsah* Concepts

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Abstract: Microsite-Based E-Learning as an Adaptive Pedagogical Tool: Enhancing Student Mastery of *Rukhsah* Concepts. Objective: Learning activities during the day and the insufficiency of the media used are obstacles for Islamic Religious Education (PAI) educators at SMP 1 Kudus, leading to low student attention and affecting students' mastery of the learning material. This article presents a novelty: the development of e-learning media based on Microsite S.Id. as an innovative, interactive, and aligned solution with the *Merdeka* Curriculum. **Methods:** The purpose of this article is to describe the development process, the media's feasibility, and its potential to enhance students' mastery of the *Rukhsah* concept. This research utilized the R&D method with the ADDIE model, involving 27 seventh-grade students at SMP 1 Kudus, Indonesia, and experts as validators. Data collection techniques included tests (pre-test and post-test) and non-tests (questionnaires, observations, interviews, and documentation). **Findings:** The media is classified as "Very Feasible" across the aspects of materials, media, teaching modules, and assessment. The results of concept mastery tests through the Wilcoxon Test showed a significance value of 0.000 (<0.05), along with an N-Gain Score of 0.8793 and an N-Gain Percent of 87.93%, which are categorized as "High" and "Very Effective." **Conclusion:** This article indicates that the use of e-learning media has the potential to improve students' mastery of concepts and can be recommended as an adaptive alternative to make Islamic Education learning more enjoyable, especially during less conducive learning times, such as during the day. This article also recommends the use of digital-based media in other studies and suggests further research with a broader range of materials and education levels.

Keywords: e-learning media, *merdeka* curriculum, microsite S.Id., concept mastery, *rukhsah*.

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INTRODUCTION

Departing from the social reality that technology is advancing along with the times (Alsaleh, 2024; Dub et al., 2023; Lubis et al., 2023). Handphones, as part of sophisticated technological developments, can support various human activities in the current digital era, including in education (Aeni et al., 2024; Emmenual V. Reddy et al., 2023; Fütterer et al., 2023; Sthuthi et al., 2022; Valverde-Berrocoso et al., 2020). This technological advancement needs to be utilized properly (Husain et al., 2025; Wahyudi et al., 2025). However, in reality, educators still do not utilize technology optimally (Farha et al., 2020; Reksiana et al., 2024). Various actions have been undertaken to raise educational standards, including efforts to develop digital-based learning media (Cecep & Daddy, 2023; Degner et al., 2022; Setiawan & Rahman, 2025). This can help students increase motivation to

learn, creativity, critical thinking, and successful mastery of learning material concepts (Agus et al., 2024; Daryanes et al., 2023; Mahendra & Agustiana, 2024; Rohles et al., 2022).

Observation studies at SMP 1 Kudus found that some conventional learning is limited to book-based media, leading students to get bored and sleepy. To address this challenge, it is necessary to implement innovative digital learning adaptations that actively involve students in the learning process (Anafi et al., 2021). One of the relevant efforts is digital-based media known as e-learning, which makes students feel the interaction of learning experiences directly and dynamically with learning materials in depth (Garrison, 2011; Han, 2025; Hrastinski, 2019; Okyere et al., 2024; Raj Kapur Shah & Barkas, 2018; Reffiane et al., 2024; Tianyi, 2025; Wienand et al., 2024). The use of e-learning platforms as learning media is increasingly in demand among students in schools (Nusaibah & Khusniyah, 2024; Safitri & Susilo, 2024; Saleh et al., 2022; Salybekova et al., 2023; Zheng et al., 2025). This is because students currently interact more with technology-based media than with conventional media (Dolch & Zawacki-Richter, 2018; Rizal et al., 2024; Rachmadtullah et al., 2019; Rizal et al., 2025). Taking this step can lead to engaging, interactive learning that motivates and involves them in mastering the concepts in the learning materials (Akram et al., 2022; Valverde-Berrocoso et al., 2021).

The adaptation of digital media in education is currently being developed gradually year by year, which is considered to create a new model of education to improve learning (Hidayat et al., 2022; Mhlongo et al., 2023; Scherer et al., 2021; Susanti et al., 2024). The necessity for quality education has led to the implementation of digital-based learning tools that are applicable across all educational stages and areas, particularly in Islamic Religious Education (PAI), so that educators need to utilize them optimally in responding to the challenges of digital era learning (Gutierrez et al., 2023; Partono, 2020). The use of this media aligns with the *Merdeka* Curriculum because it is more humanistic, reflecting students' characteristics and learning needs (Ahmad, Pratama, Nusaibah, et al., 2025; Amaruddin et al., 2024; Winangun, 2024). The *Merdeka* Curriculum offers diverse learning experiences to provide learners with sufficient time to deepen their mastery of learning material concepts independently (Ahmad, Pratama, & Jannah, 2025; Nurani et al., 2022). This is because this curriculum is founded on the principle of freedom in learning to foster independence in the learning process, relevant to the digital era (Noptario et al., 2024; Rizal et al., 2025). Thus, educators are entirely responsible for implementing the Merdeka Curriculum, including selecting learning media, so the development of e-learning media is crucial for learning by tailoring to students' characteristics (Rizal et al., 2024; Sutikno, 2021).

Moving on from the above problems, one of the e-learning media innovations presented by researchers is the use of websites in PAI learning. Website media can facilitate students' learning without space or time constraints while studying at school or independently at home (Faishol et al., 2022). Websites have been shown to enhance educational quality by integrating internet technology into the learning process (Nurhayati & Kurniati, 2025). Over time, the website has experienced significant development. In the midst of the proliferation of website technology, there are still some websites that require coding skills in their development. In this context, researchers develop media based on mini-websites or microsites, which are still rarely used in education. The microsite has several advantages. First, it is a mini website that can be developed quickly and easily, without coding skills. Secondly, the features can be customized to meet users' needs and characteristics. Third, the link can be shortened to the S.Id. web code followed by the

microsite name code that the developer wants. Fourth, microsites also offer a wide selection of complete components, accompanied by editor panels, that are easily accessible across devices ranging from cellphones and tablets to desktops (Aeni et al., 2024; Mingot & Marín, 2024; Nurfalah & Rahayu, 2023). The integration of microsite-oriented e-learning platforms offers potential for teachers and educational stakeholders in improving the quality of learning. Microsite-based learning media can deliver content in visual, audio, and audiovisual formats, playing a strategic role in delivering material to students and creating an innovative, interactive, and fun learning environment.

Many studies have examined the utilization of e-learning media in learning, which can be classified into three categories. First, studies that focus on learning outcomes through e-learning, both website- and application-based. These studies show that the application of digital media can significantly improve learners' academic achievement in PAI learning and other learning contexts (Aeni et al., 2024; Alirahman et al., 2023; Hanafi et al., 2020; Mardiana & Anggraini, 2019). Second, studies that highlight students' interest in e-learning media, emphasizing interactivity and media attractiveness to generate learning motivation (Khairial et al., 2022; Rohmah & Tegeh, 2022; Uliyandari et al., 2021; Yuniar & Nurdyansyah, 2023). Third, studies that specifically measure concept mastery through digital media in learning, both in general fields of study such as science and mathematics, and in the context of PAI learning (Barlian et al., 2022; Bashir & Lapshun, 2025; Juneli et al., 2022; Mustofa, 2019; Poon et al., 2024). However, to date, no studies have been found that specifically develop and test e-learning media based on the microsite S.Id to improve mastery of the concept of *Rukhsah* material on "*Rukhsah: Kemudahan dari Allah SWT dalam Beribadah kepada-Nya,*" which is integrated with the *Merdeka* Curriculum. This is the crucial basis for carrying out this research.

This article is directed to answer the void of previous studies by presenting an e-learning media development model based on microsite S.Id named "*Rukhsah Smart* Learning" to support the implementation of the *Merdeka* Curriculum in junior high school Islamic Education (PAI), this article focuses on developing microsite-based e-learning media using S.Id, validating its feasibility through expert assessment, and evaluating its an improvement was observed following the intervention of use as a treatment. By using the Research and Development (R&D) method through the ADDIE development model, this article offers a new perspective that distinguishes it from previous studies, both in terms of material focus, type of media, and the context of its implementation at the formal education level at the secondary level in responding to the challenges of religious education in the digital era.

METHOD

Partisipants

The participants in this study were 27 students from Class VII H of SMP 1 Kudus, selected as the research sample. The population included all seventh-grade H students at SMP 1 Kudus during the 2024/2025 academic year. The sample was selected purposively, as Class VII H had characteristics relevant to the research objectives and learning conditions for PAI subjects.

Research Design and Procedures

This research used the Research & Development (R&D) method, which focused on developing products whose outcomes will be tested and examined for feasibility, validity, and potential to improve learning outcomes after treatment intervention with the developed product (Sugiyono, 2023). This design was chosen because it provides a systematic, iterative

framework for producing a valid and feasible learning product (Patel et al., 2018; Shakeel et al., 2023).

The final product is an e-learning medium based on the S.Id microsite, designed to support the implementation of the *Merdeka* Curriculum in junior high school Islamic Education (PAI). The One Group Pretest-Posttest Design approach was used to conduct field testing of media development (Rafli et al., 2024). Operationally, this approach was carried out with one group of subjects. At the beginning of learning, a pre-test was conducted, followed by treatment with the developed media; finally, a post-test was conducted with the same instrument (Neolaka, 2016). The development process is in line with the ADDIE Model (Analyze - Design - Develop - Implement Evaluate) (Sucipto et al., 2022). The following is the flow of the ADDIE model implemented:

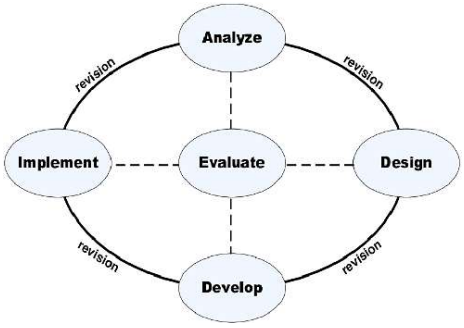

Figure 1. Flow of the ADDIE model

The ADDIE model process starts: (1) Analyze, which involves conducting observations and interviews with PAI teachers and seventh-grade students. This phase includes three types of analysis: identifying students' needs, reviewing the curriculum, and assessing available infrastructure. (2) Design, designing products developed through the process of designing material content, media components, and media design content according to the results of the analysis. (3) Develop, develop e-learning media based on the microsite S.Id, then validated by material, media, teaching module, and assessment experts. (4) Implement, apply media trials to students from the revised results of the experts' validation to determine the increase in mastery of the concept of *Rukhsah* material at school. (5) Evaluate, conduct an evaluation to measure how much students improve mastery of the material concept through the results of the pre-test and post-test in learning.

The research was conducted from March to June 2025, with the following procedures: (1) Analysis phase (March 2025): carried out through observation and interviews with PAI teachers and students to identify learning needs and challenges, especially during afternoon sessions. (2) Design phase (March-April 2025): formulation of learning objectives, preparation of the storyboard, and initial draft of the microsite-based e-learning media. (3) Development phase (April 2025): creation of media using the S.Id microsite platform and validation by experts (lecturers and PAI teachers). (4) Implementation phase (April 17 and 21, 2025): product trials were conducted in two meetings (a total of three lesson periods) with Class VII H students at SMP 1 Kudus. (5) Evaluation phase (May–June 2025): data collection, analysis of pretest-posttest results, and preparation of the final product revision.

Thus, although the writing and submission process began after these stages (in July-August 2025), the data collection and analysis had been fully completed prior to submission. This approach aligns with the developmental nature of R&D studies, which emphasize refining educational media before dissemination (Han, 2025; Tianyi, 2025).

Instruments

The instruments used in this study included: (1) Validation sheets for media experts, material experts, lesson module experts, and assessment

experts to assess the feasibility of the developed e-learning media. (2) Student response during the implementation of media. (3) Pretest and posttest instruments to measure students' concept mastery of the material of *Rukhsah*.

The instruments were adapted from validated instruments in previous Islamic Education media development research (with adjustments to the context of microsite-based learning). Instrument validity was assessed through expert judgment, involving validators with the expertise described above (Taherdoost, 2016).

In addition, before the implementation phase, pilot testing was conducted with 25 students from another class, a group not part of the main study sample, to obtain empirical data on item validity and instrument reliability.

Data Collection

Data collection techniques included test (pre-test and post-test) and non-test (questionnaire, observation, interview, and documentation) techniques. The instruments used include validity instruments and testing of improvements observed after the intervention (Leny et al., 2024). This validity instrument uses a type of validity analysis to measure the feasibility of media that refers to four indicators, namely material, media, teaching modules, and assessment, consisting of 8 validators.

Eight expert validators as comprising lecturers and PAI teachers, were involved to ensure the validity and feasibility of the developed e-learning media. To make this section more concise and systematic, the details of the validators are presented in Table 1 below.

Table 1. Expert validators of e-learning media

Code	Specific Expertise	Institutional Affiliation
Material Validator 1	PAI Curriculum Development, Teacher Professional Development, Academic Writing & Scientific Publication	UIN Sunan Kudus
Material Validator 2	Islamic Education Teacher	SMP 1 Kudus
Media Validator 1	Media Literacy and Islamic Education Learning Technology, Academic Writing & Scientific Publication	UIN Sunan Kudus
Media Validator 2	Media Literacy and Islamic Education Learning Technology	UIN Sunan Kudus
Teaching Module Validator 1	Development of Learning Planning	UIN Sunan Kudus
Teaching Module Validator 2	Islamic Education Teacher	SMP 1 Kudus
Assessment Validator 1	Development of Learning Assessment Instruments	UIN Sunan Kudus
Assessment Validator 2	Planning the PAI Learning System	UIN Sunan Kudus

This composition of validators ensured comprehensive coverage of both pedagogical and technological aspects of the developed e-learning media, aligning it with academic standards and practical classroom needs. This combination was intended to ensure both content validity and e-learning feasibility of the developed e-learning media (Han, 2025; Reffiane et al., 2024).

Meanwhile, in analyzing the assessment of media feasibility using a Likert scale, following

Nadawiyyah & Anggraeni (2021) and Sari et al. (2024). The validation rating scale is presented in Table 2.

Table 2. Validation rating scale

Value	Feasibility Category
5	Very Good
4	Good
3	Good Enough
2	Less Good
1	Not Good

After the above assessment is obtained, the next step is to convert the assessment results into a scale of media-achievement levels. This conversion is carried out to determine the feasibility category based on the percentage of achievement scores that refer to Nadawiyyah & Anggraeni (2021) and Sari et al. (2024) as follows:

Table 3. Feasibility achievement score

Percentage of Achievement Score (%)	Category
81 – 100	Very Feasible
61 – 80	Feasible
41 - 60	Feasible Enough
21 – 40	Less Feasible
0 – 20	Not Feasible

Meanwhile, the instrument for testing the potential of media in improving mastery of the concept of *Rukhsah* was analyzed using a type of analysis of media potential improvement (type of statistical test) through Normality Test, Non-Parametric Test in the form of Wilcoxon Test, and NGain Test in measuring the success of a lesson with the help of statistical analysis on SPSS. The results of the N-Gain Test are then used to determine the potential level of improvement in learning outcomes after intervention from the developed product (Nadawiyyah & Anggraeni, 2021; N. Sari et al., 2024), with the assessment score category formula and potential score for improvement in learning outcomes below:

Table 4. N-Gain assessment score

Value	Category
(G) > 0.7	High
0.3 < (G) ≤ 0.7	Medium
(G) < 0.3	Low

Table 5. N-Gain effectiveness score

Percentage of Achievement Score (%)	Effectiveness Level Category
76 – 100	Very Effective
51 – 75	Effective
26 – 50	Less Effective
0 – 25	Not Effective

Data Analysis

Data analysis was conducted using both quantitative and qualitative approaches. The quantitative data included validation results, student responses, and pretest–posttest learning outcomes. (1) Validity and Feasibility data from validation sheets were analyzed using percentage formulas to determine the level of validity and feasibility of the developed media. (2) Learning outcome data (pretest and posttest) were first tested for normality using the Shapiro–Wilk test because the sample size was below 50 students. The results showed that the data were not normally distributed; therefore, a non-parametric test was employed. (3) The Wilcoxon Signed-Rank Test was then applied to determine whether there was a significant difference between students' pretest and posttest scores.

Because this article did not include a control group, the analysis focused only on identifying significant differences within the same group, not on determining the potential for improvement in learning outcomes after the intervention. The findings are interpreted as an indication of increased potential for concept mastery. In addition, qualitative data obtained from interviews

and observations were analyzed descriptively to support quantitative results and to explain students' engagement and responses during the learning process (Reffiane et al., 2024; Tianyi, 2025).

Limitations

This study has several limitations that should be acknowledged. First, the design used was a one-group pretest–posttest model without a control group. This study cannot fully show the potential of the developed media compared to other learning approaches. Future research is recommended to employ experimental or quasi-experimental designs with control groups to validate the causal impact of the microsite-based e-learning model.

Second, the sample size was relatively small (n = 27) and limited to one class at SMP 1 Kudus, potentially limiting the generalizability of the findings. *Third*, the study was conducted over a short implementation period (two meetings), so long-term effects on students' learning retention and motivation could not be fully measured.

Nevertheless, these limitations do not reduce the value of this research as a developmental study that successfully produced and validated an innovative Islamic Education learning media integrating digital technology with microsite platforms. The results of this study provide a valuable basis for further research examining the potential of media in a broader educational context.

■ RESULT AND DISCUSSION

Development of E-Learning Media Based on Microsite S.Id

The process of developing e-learning media based on Microsite S.Id used the ADDIE development model. The results obtained by researchers are as follows:

Analyze

This analyze stage was divided into three parts: student needs, curriculum and materials, and infrastructure analysis. First is a needs analysis. This study began on March 8, 2025, with observations at SMP 1 Kudus, Indonesia, and interviews with the seventh-grade PAI Teachers. In addition, the needs analysis was conducted through a non-cognitive diagnostic assessment questionnaire administered to 27 seventh-grade students at SMP 1 Kudus. This stage aimed to identify students' actual learning characteristics, cognitive tendencies, and media preferences as foundation for designing microsite S.Id-based e-learning media. The results of the needs analysis are presented in Table 6.

Table 6. Results of needs analysis

Analysis	Findings	Result
Learning Style	Diverse with more dominant in visual	Based on diagnostic questionnaire responses, 15 students (55.6%) preferred learning through visuals such as images, videos, and teacher demonstrations; 7 students (25.9%) preferred auditory learning; and five students (18.5%) preferred kinesthetic learning. The dominant tendency is visual learning.
Intelligence of Learners	Tendency towards multiple intelligences, the visual part	Students demonstrated a stronger inclination toward visual–spatial intelligence, as evidenced by frequent references to liking "drawing," "watching videos," and "observing pictures." A smaller number showed linguistic–verbal and bodily–kinesthetic strengths.
Learners' Cognitive	Cognitive mastery starts	Observation data and pre-tests show that students' cognitive mastery generally ranges from C1 (remembering) to C4

Development	at the C1 - C4 level	(analyzing), with some students completing pre-tests in categories C1-C4, demonstrating the ability to remember, explain, demonstrate, solve, and analyze material related to *Rukhsah* based on the pre-test questions provided.
Characteristics of Learners	Classified as active and responsive	Based on classroom observations and questionnaires, students are active, responsive, and motivated to learn independently or in groups. They enjoy interactive tasks, visual exploration, and learning through games or group activities.

Second, curriculum and material analysis. PAI learning at SMP 1 Kudus has followed the *Merdeka* Curriculum policy in line with the Ministry of Education and Culture's 2022 policy since 2022. While the results of the material analysis, researchers chose the material "*Rukhsah: Kemudahan Dari Allah Swt Dalam Beribadah Kepada-Nya*" in Chapter 9, to develop e-learning media based on Microsite S.Id. The selection of this material is based on the 7th-grade PAI teacher's consideration and direction: it is still unfamiliar to students. Hence, improving mastery of the concept requires interesting, innovative, and interactive media. Researchers also analyzed the material against the learning outcomes and objectives outlined on the official platforms of the Ministry of Primary and Secondary Education, namely *guru.kemdikbud.go.id* and *datadikdasmen.com*, for the *Merdeka* Curriculum.

Third is the analysis of infrastructure facilities. The facilities available at SMP 1 Kudus are quite complete, especially in supporting the implementation of digital-based learning. This is evidenced by observations made directly to the class, which is equipped with a projector. Based on this observation, researchers are developing digitally integrated media in the form of e-learning based on *Microsite S.Id*, as this is supported by the availability of facilities and infrastructure at SMP 1 Kudus.

The use of e-learning as a forum for delivering material, implementing the learning process, and conducting learning assessments allows for flexible, independent, interactive, and fun learning, in response to the need for PAI learning innovation, in line with the proximity of technology for the current generation of students in the *Merdeka* curriculum. The learning objectives are also aligned with phase D, grade 7, through learning activities that involve independence and assessments that engage their learning interests, as concrete ways to implement the *Merdeka* curriculum. This finding aligns with studies (Rizal et al., 2024; Noptario et al., 2024; Nurani et al., 2022) that the Merdeka Curriculum should provide space for students to actively and independently explore knowledge. The realization of this independent learning curriculum's characteristics requires flexible, engaging digital learning media that accommodate diverse learning needs and styles. Therefore, the development of digital learning media, such as e-learning, is essential (Aeni et al., 2024; Rizal et al., 2025).

Design

The design stage of the researcher designs the product made through 3 aspects including material content content, media components, and media design content according to the results of the analysis. In this aspect of material content content, researchers use the learning outcomes of phase D (grade 7) of the *Merdeka* Curriculum, which reads "*Peserta didik memahami internalisasi nilai-nilai dalam sujud dan ibadah salat, memahami konsep mu¿âmalah, riba, rukhsah, serta mengenal beberapa mazhab fikih, dan ketentuan mengenai ibadah qurban*". While the content of the main material in the form of "*Rukhsah: Kemudahan Dari Allah*

Swt Dalam Beribadah Kepada-Nya". The content of the material includes learning objectives developed by researchers, which read "*(1) Peserta didik dapat memahami makna rukhsah dalam ibadah. (2) Peserta didik dapat memahami hukum rukhsah dalam ibadah. (3) Peserta didik dapat memahami alasan diperbolehkan rukhsah dalam ibadah. (4) Peserta didik dapat mengklasifikasikan macam-macam rukhsah dalam ibadah. (5) Peserta didik dapat menerapkan macam-macam rukhsah dan hikmah rukhsah dalam melaksanakan ibadah.*" In addition, the content of the material as a whole can be accessed in teaching modules and flipbook teaching materials that are integrated into e-learning media to make it easier for students to master the content of the material anytime and anywhere.

In the component aspect, it consists of media identity, teaching modules according to the CP & TP of the *Merdeka* Curriculum, a deeper introduction by media users through non-cognitive & cognitive diagnostic assessments, exciting flipbook-based *rukhsah* subject matter teaching materials, additional materials, and YouTube-based learning videos, as well as formative assessment evaluations in the form of *Rukhsah Crossword Puzzle* and summative assessments in the form of *Quizizz*. In addition, it is equipped with a media developer profile and social media from the media developer. In the design content aspect, researchers began by creating non-cognitive diagnostic assessment components, formative assessments, and flipbook teaching materials in *Canva*. At the same time, the components of the teaching module, the cognitive diagnostic assessment, and additional materials were created in *Microsoft Office*. Researchers also conducted summative assessments using *Quizizz* and selected *YouTube* videos aligned with the material. After all components are collected, the design content continues by creating a storyboard on the *microsite S.Id* platform. The storyboard description in this media design can be seen from the following figure:

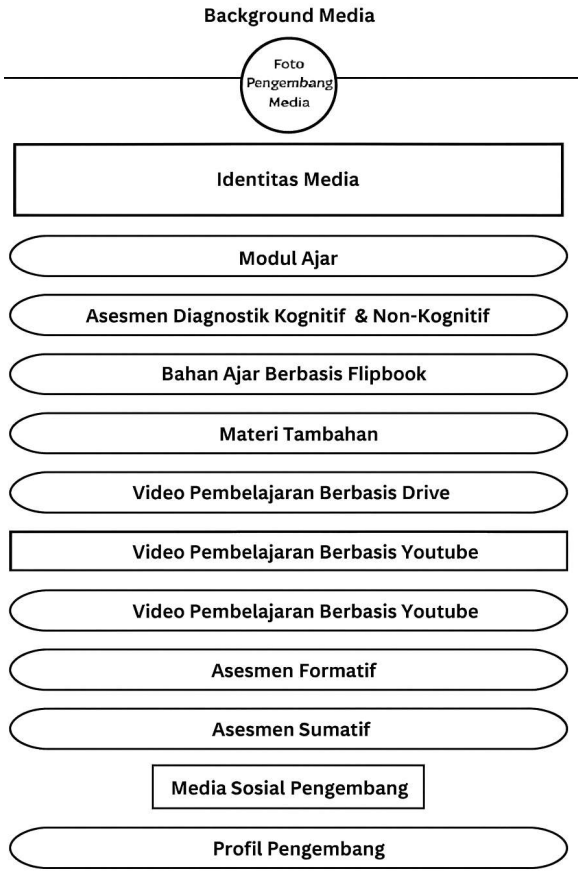

Figure 2. Storyboard of e-learning media based on microsite S.Id

Develop

This development stage involved creating e-learning media products based on *Microsite S.Id*. The finished product undergoes feasibility testing in advance through expert validation. A feasibility test was conducted on the materials, media, teaching modules, and assessment experts to determine the feasibility of this media development. After receiving the experts' feasibility test results, the researcher revised and developed the product before conducting a trial

with students at SMP 1 Kudus. In this development, in more detail, can be accessed through https://s.id/rukhsahsmartlearning or through the following barcode:

The following is the result of the development stage in the form of e-learning media visualization, ready for testing with students at SMP 1 Kudus.

Figure 3. Barcode of e-learning media based on microsite S.Id

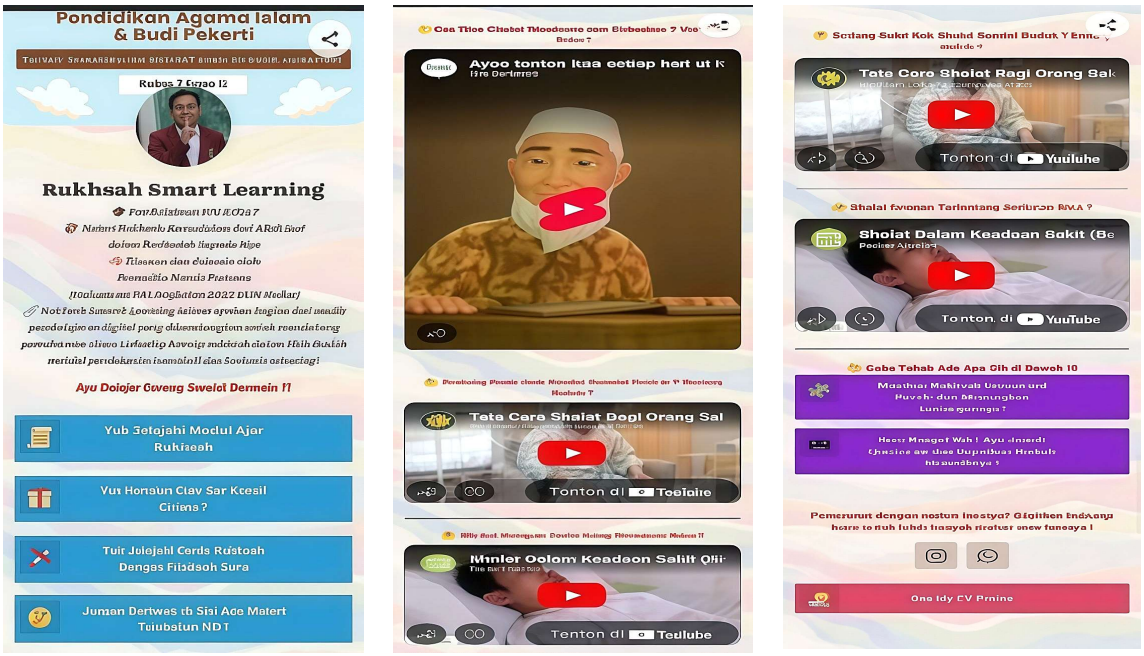

Figure 4. Media display

Implement

Media products that have been revised and developed are then carried out field trial implementation in class 7H SMP 1 Kudus using One Group Pretest-Posttest Design for two meetings totaling 3 JP on Thursday, April 17, 2025, in hours 7 & 8 (11.40 - 13.00), and Monday, April 21, 2025, at hour 6 (10.40 - 11.20). Researchers used the cooperative learning model with the Teams Games Tournament method at the first meeting through formative assessment in the form of a Rukhsah *Crossword Puzzle*, followed by the game-based learning method at the second meeting through summative assessment (post-test) in the form of *Quizizz*.

These characteristics align with the needs of students who tend to have visual and kinesthetic learning styles. In addition, the cooperative learning model, combined with the teams games tournament method and game-based learning method, has shown the potential of media to strengthen their active involvement, increase

enthusiasm, and develop critical thinking skills collaboratively and competitively. These findings are in line with studies (Jalinus et al., 2022; Sukmasari & Rosana, 2017) that emphasize the importance of collaborative-based digital learning media in increasing activeness and problem-solving skills in teamwork.

This is also reinforced by the findings of Lumbantoruan & Manalu (2024), which show that the use of digital media in the form of emodules, combined with cooperative learning models, can significantly enhance the potential of media for learning, student involvement, and understanding of concepts in school learning materials. At the first meeting, students were asked to complete a cognitive diagnostic assessment (pre-test) to assess their mastery of the Rukhsah material. Furthermore, at the end of the meeting, they were asked to complete a summative assessment (post-test) in the form of *Quizizz* to measure their mastery of the learning material's concepts. This trial has been successfully implemented. Overall, students are very enthusiastic and eager to learn actively because they have never participated in a digital integrated learning experience that is interesting and interactive, as in this e-learning media.

Furthermore, this study's findings align with previous research, which shows that digital media such as flipbooks, digital comics, e-modules, and other formats can improve students' conceptual mastery. Studies by Fendi et al. (2025), Ikhlas et al. (2025), and Juneli et al. (2022) indicate that the use of digital-based media can improve students' engagement and learning outcomes. Meanwhile, Aeni et al. (2024), Nurfalah & Rahayu (2023), and Nurhayati & Kurniati (2025) have confirmed that S.Id. based Microsite media is very suitable for learning media because its development is not too difficult, easily accessible, cost-saving, and flexible to be used by teachers at various levels of education. Therefore, the development of S.Id. Microsite-based e-learning media can be considered a real contribution to improving students' learning outcomes in the context of PAI learning.

Evaluation

This evaluation stage measures how much students improve their mastery of material concepts through pre-test and post-test results. The results of this evaluation consist of 2 aspects, namely perception evaluation and performance evaluation. First is the perception evaluation. This evaluation is based on learner response question naire data collected during the implementation stage. Overall, students' comments indicate that this media is acceptable and helps them understand the material presented. This is evidenced by AA's statement: "The presentation/ means of learning is exciting, fun, and not boring." Then AKK also added "Fun and easy to understand". A student named AFF also gave a positive affirmation, saying, "It is really nice to study with IAIN seniors, it is easier to understand the material. Of course, very excited." Meanwhile, SD expressed his gratitude "I am grateful to Kak Nanda because I can understand the *rukhsah* material easily and easily remembered". A student named VT also added, "It is good and suitable to be a teacher. The problem is that it is good to be taught by you, you understand better". Thus, the results of the perception evaluation indicate that their responses were highly interested and enthusiastic, suggesting that this media could support students in mastering the material, even though it was still quite unfamiliar to them.

The presence of this media, of course, is inseparable from the uniqueness of the S.Id. Microsite media is flexible and easy to use, requiring no programming skills for development. The presentation of multimedia content integrated with e-module features, flipbooks, YouTube-based learning videos, interactive student worksheets, and Quizizz for learning assessment is the main attraction that makes the learning process more engaging, visual, and easily accessible anytime, anywhere (Winangun, 2024).

Second, there is the performance evaluation. This evaluation is based on the researcher's observations during field trials of this e-learning media in class 7H, with evaluations conducted on diagnostic, formative, and summative assessments. The presence of formative assessments in the form of *Rukhsah Crossword Puzzles* in groups demonstrates students' active involvement in discussing and thinking critically as they complete student worksheets. At the same time, the evaluation of diagnostic (pre-test) and summative (post-test) assessments was used to determine the increase in learning outcomes observed after the e-learning media intervention, developed to improve understanding of the Rukhsah material, through normality tests, non-parametric tests (Wilcoxon test), and N-Gain tests.

Feasibility of E-Learning Media Based on *Microsite S.Id*

To assess the feasibility of the developed media, expert validation is necessary. These experts consist of material, media, and teaching module experts. This data acquisition includes qualitative data in the form of suggestions, input, or comments from experts through the distribution of questionnaires and quantitative data in the form of the results of the validation questionnaire assessment of material, media, and teaching module experts. In addition, researchers involved assessment experts to validate the assessment instruments used, ensuring their validity in measuring students' mastery of concepts after the implementation of diagnostic (pre-test) and summative (post-test) assessment trials. The results of the experts' assessment of the e-learning media developed are presented as follows:

Table 7. Material expert validation results

No	Aspect	Validator Score 1	Validator Score 2
1	Material Content	21	23
2	Presentation	23	25
3	Evaluation	23	23
Total Score		67	71
Maximal Score		75	75
Percentage		89.3%	94.7%
Category		"Very Feasible"	"Very Feasible"

Based on the table above, the average results of material experts resulted in 92% with a qualitative conversion assessment, namely the "Very Feasible" category, obtained from the results of Material Expert 1 (Lecturer of PAI Program at UIN Sunan Kudus) of 89.3% and Material Expert 2 (PAI Teacher of SMP 1 Kudus) of 94.6%.

Table 8. Media expert validation results

No	Aspect	Validator Score 1	Validator Score 2
1	Media Presentation	23	24
2	Content Presentation	23	21
3	Effectiveness	23	25
Total Score		69	70
Maximum Score		75	75
Percentage		92%	93,3%
Category		"Very Feasible"	"Very Feasible"

Based on the table above, the average result of media experts is 92.65% with a qualitative conversion assessment, namely the "Very Feasible" category obtained from the results of Media Expert 1 (Lecturer in PAI Program at UIN Sunan Kudus) of 92% and Media Expert 2 (Lecturer of PAI Program at UIN Sunan Kudus) of 93.3%.

Table 9. Teaching module expert validation results

No	Aspect	Validator Score 1	Validator Score 2
1	General Information Component	47	53
2	Core Competency Component	81	102
3	Appendix Component	12	15
Total Score		140	170
Maximum Score		175	175
Percentage		80%	97,1%
Category		"Feasible"	"Very Feasible"

Based on the table above, the average assessment results from teaching module experts show a percentage of 88.6% with a qualitative conversion category of "Very Feasible", obtained from Teaching Module Expert 1 (Lecturer of PAI Program at UIN Sunan Kudus) of 80% and Teaching Module Expert 2 (PAI Teacher of SMP 1 Kudus) of 97.1%. Furthermore, to ensure the validity of the assessment instruments used to measure students' mastery of concepts after the diagnostic assessment (pre-test) and the summative assessment (post-test), researchers also involved assessment experts in the validation process. The assessment results from the assessment experts are presented in the following table:

Table 10. Assessment expert validation results

No	Aspect	Validator Score 1	Validator Score 2
1	Understand the meaning of *rukhsah* in worship	18	19
2	Understand the law of *rukhsah* in worship	5	5
3	Understand the reasons for allowing *rukhsah* in worship	17	20
4	Classify the kinds of *rukhsah* in acts of worship	17	20
5	Apply various kinds of *rukhsah* in worship and the wisdom of *rukhsah* in performing acts of worship	34	29
Total Score		91	93
Maximum Score		100	100
Percentage		91%	93%
Category		"Very Feasible"	"Very Feasible"

Based on the table above, the average result of the assessment expert shows a percentage of 92% with a qualitative conversion category of "Very Feasible", obtained from the results of Media Expert 1 (Lecturer of PAI Program at UIN Sunan Kudus) of 91% and Media Expert 2 (Lecturer of PAI Program at UIN Sunan Kudus) of 93%. Based on these results, it can be concluded that the S.id Microsite-based e-learning media developed falls into the "Very

Feasible" category and can be used as an alternative solution for PAI learning at the junior high school level. This media is considered innovative because it has never been applied in PAI learning, especially on the concept of *Rukhsah* material.

The media development process certainly goes through the stages of validation by experts, with results showing the feasibility of the media, including the materials, media, teaching module structure, and assessment. All of them were answered with results from expert validation in the "very feasible" category, namely the average of the two material experts (92%), the two media experts (92.65%), the two teaching module experts (88.6%), and the two assessment experts (92%). These results are in line with studies (Nadawiyyah & Anggraeni, 2021; Ramansyah et al., 2021; N. Sari et al., 2024), which emphasize that the quality and validity of media feasibility will impact students' mastery of concepts.

In addition, before the implementation phase, pilot testing was conducted with 25 students from Class VIII A. This group was not part of the main study sample, to obtain empirical data on the validity and reliability of the pre-test and post-test instruments. The instruments consisted of 25 multiple-choice questions designed to measure students' mastery of the *Rukhsah* concept. The empirical validity test using the Corrected Item-Total Correlation technique indicated that 20 items were deemed valid. In comparison, five items were found to be invalid and subsequently excluded from the main implementation. Thus, only the 20 valid items were used in the experimental (Pre-Test and Post-Test) phase. Furthermore, the reliability test using Cronbach's Alpha produced a coefficient value of 0.822 with a total of 25 items, indicating a "high level of reliability". This means that the research instrument has strong internal consistency and is suitable for measuring students' understanding of the *Rukhsah* material.

Table 11. Summary of instrument validation and reliability results

Type of Test	Total Items	Valid Items	Invalid Items	Cronbach's Alpha	Reliability Category
Pre-Test & Post-Test Instrument	25	20	5	0.822	High Reliability

These findings demonstrate that the research instruments meet the criteria for empirical validity and reliability, thereby ensuring the accuracy and consistency of measurements before use in actual classroom implementation. These 20 valid items will be used in the research sample implementation in this study in class 7H of SMP 1 Kudus.

Enhancing the Potential of Microsite-Based E-Learning Media S.Id

Researchers processed the data from students' pre-test and post-test scores on the Rukhsah material to determine the statistical averages, as presented in Table 12. below:

Based on the table above, the average pre-test score is 48.89, and the post-test score is

Table 12. Results of descriptive statistical analysis of pre-test and post-test

Descriptive Statistics							
	N	Range	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
PRETEST	27	65	30	95	48.89	3.023	15.710

POSTTEST	27	20	80	100	94.44	1.111	5.774
Valid N (listwise)	27						

94.44, as reported in SPSS. There is a difference between the two, reaching 45.55, indicating an increase in students' mastery of the Rukhsah material concept after using e-learning media.

Furthermore, researchers analyzed the results of data before using Microsite S.Id based e-learning media (Pre-Test) and the results of data after using Microsite S.Id based e-learning media (Post-Test) to determine whether the data obtained were normally distributed or not with the Prerequisite Test in the form of Normality Test using Shapiro-Wilk, considering that the sample size was less than 50 respondents, namely 27 students. The level of significance used is 0.05, if Sig. If the p-value is greater than 0.05, then the data are normally distributed. The results of the normality test are presented in Table 13. below:

Table 13. Normality test data results

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
PRETEST	.200	27	.007	.877	27	.004
POSTTEST	.239	27	.000	.844	27	.001
a. Lilliefors Significance Correction						

Based on the results above, the significance value (Sig.) for both Shapiro-Wilk tests is <0.05 for the pre-test and post-test. Thus, the data is not normally distributed, so the analysis continues with a nonparametric test, namely the Wilcoxon Test. In this Wilcoxon test, the null hypothesis H0 is that there is no increase in concept mastery after using the media, and the alternative hypothesis H1 is that there is an increase in concept mastery. Then the decision-making criteria are determined based on the significance value (á = 0.05), provided that if Asymp. Sig. < 0.05 than H0 is rejected and H1 is accepted. The results of the Wilcoxon Test are presented in Table 14. below:

Based on these results, the Asymp. Sig. value of 0.000 < 0.05, so that H0 is rejected and H1 is accepted, indicating a significant increase

Table 14. Non-parametric test data results with the wilcoxon test

Test Statistics	
	POSTTEST – PRETEST
Z	-4.546[b]
Asymp. Sig. (2-tailed)	.000
a. Wilcoxon Signed Ranks Test	
b. Based on negative ranks.	

in students' mastery of the concept after using e-learning media based on Microsite S.Id. This indicates that the developed media has the potential to help students improve their understanding of Rukhsah concepts.

Furthermore, to determine the extent to which media potential enhances mastery of concepts, an analysis was conducted using the N-Gain test. The results of the analysis are presented in Table 15. below:

Table 15. N-Gain test results

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
NGAIN_SCORE	27	.56	1.00	.8793	.13263
NGAIN_PERSEN	27	55.56	100.00	87.9294	13.26333
Valid N (listwise)	27				

Based on these results, the average value of N-Gain Score is 0.8793 > 0.7, which is included in the "High" media potential category. Meanwhile, the average value of N-Gain Percent is 87.93% > 76%, indicating the level of effectiveness in the "Highly Effective" category. These findings indicate that the S.id Microsite-based e-learning media developed can have a significant positive impact on students' mastery of concepts, especially on the material "*Rukhsah: Kemudahan dari Allah Swt dalam Beribadah kepada-Nya*".

The results showed that the development of e-learning media based on Microsite S.Id. using the ADDIE model had a significant positive impact on students' mastery of concepts in the *Rukhsah* material. The results of the statistical analysis showed that the average pre-test score of 48.89 increased to 94.44 in the post-test, increasing to 45.55. This increase is supported by the Wilcoxon test, which shows a p-value of 0.000 (<0.05), indicating a significant difference between the scores before and after using the media. This finding is also supported by the results of the N-Gain Score test of 0.8793 which is included in the "High" effectiveness category and the N-Gain Percent Test of 87.92% in the "Highly Effective" category which indicates that the media developed is not only attractive, but also has the potential to support the achievement of PAI learning objectives, especially *Rukhsah* material at the junior high school level with high potential effectiveness. This finding is consistent with studies (Aeni et al., 2024; Alirahman et al., 2023; Hanafi et al., 2020) that have confirmed that the use of website-based e-learning or applications can improve students' achievement of learning outcomes.

To reinforce the statistical analysis results presented using the Wilcoxon and N-Gain tests, data visualization is needed to clearly show the improvement in student learning outcomes. This visualization uses box plots and scatter plots. Box plots are used to show the distribution of students' pre-test and post-test scores descriptively, using the median, quartiles, and the presence of outliers. Meanwhile, scatter plots illustrate the relationship between pre-test and post-test scores, showing patterns of improvement in students' mastery of concepts after using the Microsite S.Id-based e-learning media.

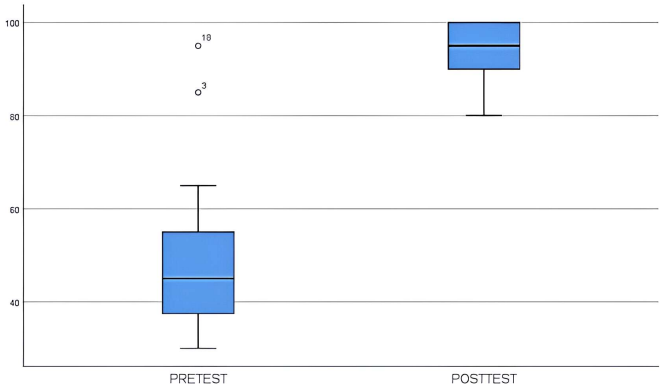

Figure 5. Comparison of pre-test and post-test score distribution (box plot)

The interpretation of Figure 5 above, from the box plot, shows a comparison of the distributions of pre-test and post-test scores for students. The median post-test score is much higher than the pre-test score, and the data range is narrower. This shows that the improvement in learning outcomes did not only occur in a small number of students, but was spread evenly across the entire class. In addition, no significant outliers were found, indicating a consistent increase in conceptual understanding among students after participating in learning using Microsite-based e-learning mediaS.Id. Thus, the box plot indicates a significant and stable increase in mastery of the *Rukhsah* material concepts.

Furthermore, to provide deeper insight into individual learning progress, Figure 6 displays a scatterplot comparing students' pre-test and post-test scores. Each point represents one student, with the x-axis corresponding to the pre-test score and the y-axis representing the post-test score. The diagonal line (x = y) serves as a reference for equal performance between the two tests.

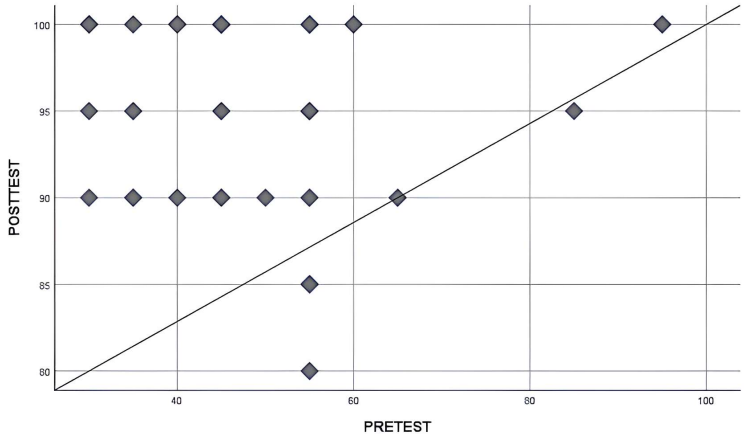

Figure 6. Relationship between pre-test and post-test scores (scatter plot)

The interpretation of Figure 6 above, from the scatter plot, shows the relationship between pre-test and post-test scores. The points on the graph show a fairly sharp upward trend, indicating a positive correlation between initial scores and scores after learning. Students with low pre-test scores showed significant improvement after using this media, while those with high initial scores continued to improve in learning outcomes. The upward, rightward distribution pattern reinforces the potential of this medium to improve students' mastery of concepts.

Based on the findings, it can be concluded that the contribution of e-learning media development based on *Microsite S.Id* is not only valid and highly feasible to use but also has "High" media potential for improving students' mastery of Rukhsah material concepts at the junior high school level. This media can provide an interactive, fun, and adaptive learning experience. The significant increase in learning outcomes shows that this media development has become an excellent learning alternative, especially in supporting PAI learning, which often monotonous and less attractive. In addition to improving concept mastery, this media also facilitates active engagement by integrating multimedia features with a combination of collaborative and participatory cooperative learning models. Therefore, this result has real implications for the development of PAI learning in the Merdeka Curriculum, which requires learning that is independent, flexible, and relevant to today's technological developments for today's students.

However, this article has limitations in scope, focusing on one material, one grade level, and one school, so it cannot be generalized to broader learning contexts. The use of the One Group Pretest Posttest design limits the ability to draw causal conclusions about the effectiveness of the media (Knapp, 2016; Marsden & Torgerson, 2012; Spurlock, 2018). Other factors, such as student motivation and teacher guidance, indicate that external factors continue to influence learning outcomes with technology-based media, despite the One Group Pretest-Posttest design's limitations. This article consistently shows that while technology-based media (multimedia, gamification, augmented reality) can also enhance student motivation and learning outcomes, these effects are not isolated from other variables. Student motivation is a critical mediator; technology often boosts motivation, which in turn improves outcomes, but the degree of impact varies by individual and context (Çoban Sural & Yaþar Saðlýk, 2024; Safaruddin et al., 2020). Teacher guidance is also essential; studies highlight that active teacher involvement, feedback, and Instructional design significantly influence the potential of media after technology-based intervention (Fidan & Gencel, 2022; Sezer, 2017).

In addition, limited access to mobile phones in schools and to internet networks is a limitation that needs to be anticipated if this medium is to be applied on a larger, more diverse scale. The implications of these limitations open up opportunities for future research, including the development of similar media for other PAI clusters and other fields of study, to enrich students' learning experience. Future studies are recommended to use a quasi-experimental design with a control group and a larger sample size to more robustly validate these findings (Sugiyono, 2023). Thus, this e-learning media has great potential to be further adapted as a PAI learning innovation that is responsive and transformative to the demands of the *Merdeka* Curriculum.

CONCLUSION

This study successfully developed a microsite-based e-learning media for Islamic Education (PAI) through a systematic research and development process. The development stages, comprising needs analysis, design, expert validation, and product trials, produced a media that met high feasibility and validity standards. Validation by media and material experts yielded "very feasible" criteria, while student responses showed that the media was "very practical" and engaging. These findings demonstrate that the product not only fulfills pedagogical and technological quality requirements but also addresses the need for adaptive digital learning tools that make PAI learning more interactive and accessible. The improvement in students' posttest scores and high N-Gain values further indicate that this media has the potential to enhance students' conceptual mastery and engagement in Islamic Education learning, especially during less optimal learning hours such as afternoon sessions. The success of this media is proven by a statistically significant increase in the average pre-test and post-test scores, as seen from the Wilcoxon test results with a significance value of 0.000 (<0.05) and an N-Gain value of 0.8793, which falls into the "High" category, and 87.93% in the "Very Effective" category. Therefore, these findings make a meaningful contribution to educational innovation, highlighting the role of microsite-based learning as a potential bridge between technology and religious education in the digital age.

The implications of this study extend to both educational theory and classroom practice. Theoretically, the research reinforces the growing importance of integrating digital technology into religious learning to promote student-centered, enjoyable, and independent learning experiences. In practice, the developed media offers a feasible and replicable model for teachers to design engaging Islamic Education learning resources aligned with the *Merdeka* Curriculum. However,

this study also has limitations in its methodological scope, particularly the use of a One-Group Pretest–pretest-posttest design without a control group and a relatively small sample size. Therefore, while the results indicate positive improvements, they cannot be generalized or claimed as causal effects. Future research should employ stronger quasi-experimental designs involving larger, more diverse participants to validate and extend the promising findings of this study.

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