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The development of BIMASAKTI mobile learning as a learning resource for middle school students in Indonesia

Dwi Putri Ayu
Universitas Negeri Malang, Indonesia
Jl. Semarang No.5, Malang, 65145
dwi.putri.1907416@students.um.ac.id

Neni Wahyuningtyas*
Universitas Negeri Malang, Indonesia
Jl. Semarang No.5, Malang, 65145
neni.wahyuningtyas.fis@um.ac.id

Aprilia Melinda Sholihah
Universitas Negeri Malang, Indonesia
Jl. Semarang No.5, Malang, 65145
aprilia.melinda.2107416@students.um.ac.id

Ravinesh Rohid Prasat
Fiji National University, Republic of Fiji
Natabua Rd, Lautoka, 5529
raviro28@gmail.com

* Corresponding Author

Abstract
This research and development (R&D) aim to develop BIMASAKTI mobile learning as a learning resource to support material on activities in the Hindu-Buddhist community life for grade VII junior high school students. This R&D uses research methods and the Borg & Gall model. Validation results from material experts and media experts show that BIMASAKTI products are included in the "Appropriate" criteria for product readability testing. This is because BIMASAKTI products have fulfilled all validated aspects, namely aspects of material relevance, material organization, evaluation, language, learning strategies, software engineering, and visual appearance. Apart from that, BIMASAKTI was developed to contain various forms of material, namely illustrated modules, podcasts, and videos, so that it can support learning activities per the differentiation of students' learning styles. The product readability test activity was carried out in two meetings with 34 students of grade VII F of SMP Negeri 4 Malang. The product readability test results fall within the "Very Appropriate" criteria to be used as a learning resource. The recommendations and suggestions for further research are expected to be able to test the practicality and effectiveness of the product. For further development, it can be done by adding tiered game and quiz features with varying levels of difficulty, and BIMASAKTI can be distributed through the Google Play Store platform.

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Keywords: *mobile learning; BIMASAKTI; learning resource.*

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INTRODUCTION

The integration of information technology is a key element in the 5.0 Industrial Revolution, marking significant changes in work processes and human lifestyles. This era emphasizes human-centered technology, where artificial intelligence, automation, and digital tools collaborate with human intelligence to enhance efficiency and personalization in various fields, including education (Amalia, 2022; Sasikirana & Herlambang, 2020). In facing this change, the education sector needs to provide space for practitioners to develop critical and creative thinking skills, one of which is through the development of mobile learning. Mobile learning has become a crucial educational strategy because it allows for a more flexible, personalized, and accessible learning experience, in line with the dynamic demands of Industry 5.0. By utilizing mobile technology, education can promote the strengthening of 21st-century skills known as the 4Cs—critical thinking, communication, collaboration, and creativity—which are essential for preparing learners to adapt and thrive in an era increasingly driven by technology (Listiyani, 2021; Nastiti & Abdu, 2020).

The implementation of mobile learning in education is inseparable from the optimization of digital learning resources as the main means of supporting technology-based learning processes. Digital learning resources refer to a combination of hardware and software elements that can present learning material interactively (Cahyadi, 2019; Susanti, 2021). Digital learning resources allow students to access materials anytime and anywhere, thereby addressing challenges such as limited access to teaching materials, lack of student engagement, and varying effectiveness of learning according to individual needs. In addition, digital learning resources can enhance student engagement through interactive multimedia content, gamification, and real-time feedback, thereby creating a more immersive and enjoyable learning experience (Wahyuningtyas & Idris, 2020). With the support of this technology, learners not only acquire materials more flexibly but also can optimally develop 4C skills (Sukmawati & Imron, 2024). However, to ensure that digital learning resources can be used effectively in supporting mobile learning, their implementation must adhere to three main principles: a systems approach that ensures smooth technology integration, a student-centered approach that prioritizes engagement and independence, and a varied and adaptive design of digital learning resources to maximize learning outcomes (Salsabila & Agustian, 2021).

The integration of digital learning resources aligns with the principles of the independent curriculum, which serves as the current reference for the teaching and learning process. This curriculum emphasizes the use of technology to facilitate differentiated learning, ensuring that educational experiences cater to diverse student needs. The principle of differentiated learning is explained by Martanti et al. (2022) as an approach that accommodates the diversity of students' learning needs, learning styles, talents, and interests. Differentiated learning can be

viewed through the differentiation of processes, content, and products that are in line with learning principles. Changes in curriculum policy mean that teachers must be able to prepare learning conditions that are enjoyable for students. Teachers must also be able to provide a variety of learning resources and recognize the differentiation of students' learning styles. The introduction of learning styles is a very important learning modality so that teachers can facilitate differentiated learning.

The results of observations and interviews with Licin Wijaya, S.Pd, as a social studies teacher at SMPN 4 Malang, show that grade VII F students tend to use auditory and visual learning styles. The main learning resource used by grade VII students is the Ministry of Education and Culture textbook. The material contained in textbooks tends to be general, abstract, and nonspecific. This results in students finding it difficult to understand and master the material according to their learning style. Students' learning difficulties are reflected in their average social studies scores, which are below the school's minimum competency standard for grade VII F students at SMPN 4 Malang.

One of the learning outcomes contained in the grade VII social studies subject is material on community life activities during the Hindu-Buddhist era. This material requires learning resources that suit students' needs, to help students identify and analyze events in the surrounding environment, one of which is describing the life activities of the Hindu-Buddhist society. This is because the scope of the material is very broad and conceptual, so that if it were explained classically, it would be confusing. As a result of these problems, supporting learning resources are needed that are interactive and can help students to understand the material more easily. To overcome this problem, interactive and engaging learning resources are very important. Articulate Storyline 3 was chosen for this purpose due to its ability to create interactive learning modules as well as supporting multimedia integration, branching scenarios, and responsive assessment. These features increase student engagement, accommodate various learning styles, and facilitate a more personalized learning experience (Norsidi, 2024). By utilizing Articulate Storyline 3, students can explore the material dynamically, making it easier to understand complex concepts through visual and interactive elements.

Several previous studies have developed mobile learning applications using Articulate Storyline 3. Rohmah & Bukhori, (2020) developed an Android-based interactive learning medium for correspondence subjects at SMK Muhammadiyah 5 Kepanjen, demonstrating that while mobile learning can be accessed easily, it requires significant storage space and has slow loading times. Similarly (Mardita, 2020) also developed a mobile learning product for students at SMK PGRI 2 Malang, revealing that the content was limited to text and video, failing to accommodate diverse learning styles. Additionally, the large file size made smartphone usage inefficient (Utomo, 2021). Damanik & Yarshal (2022) also examined mobile learning for science subjects, highlighting that the application did not fully motivate students to learn independently, as teacher explanations were still necessary.

These research findings indicate several existing gaps, including usability issues (e.g., lack of zoom in/ zoom out features), large product sizes, limited content variations, and inadequate accessibility features. To address these gaps, this R&D aims to develop BIMASAKTI mobile learning as a learning resource for understanding Hindu-Buddhist community life in grade VII social studies. Designed as an Android-based application, BIMASAKTI integrates various multimedia elements, such as illustrated modules, podcasts, and videos, along with features for downloading materials, reviewing answers, and reporting learning outcomes via WhatsApp to teachers. By optimizing Articulate Storyline 3, this mobile learning application seeks to enhance engagement, improve accessibility, and provide a more personalized learning experience (Wahyuningtyas et al., 2021). With these improvements, mobile learning can serve as a creative and interactive educational tool that offers flexible, location-independent learning (Wahyuningtyas & Idris, 2020; Wahyuningtyas & Yahya, 2021).

METHOD

This research uses the research and development (R&D) method with the Borg & Gall model, which has been simplified into seven stages to meet the needs of the research, learning subjects, and the level of student saturation. This research aims to develop innovative and effective social studies learning media. The main stages include problem identification, data collection, product design and validation, revision based on expert feedback, as well as product testing and refinement before broader use. The complete procedure for this research and development can be seen in Figure 1.

The validation of BIMASAKTI involves two groups of experts: subject matter experts and media design experts. As many as 2 experts participated, each selected based on specific criteria to ensure credibility and relevance to the research. These experts hold at least a Master's degree and have a minimum of five years of work experience in their respective fields, with expertise in learning design and Social Science education. The validation process consists of qualitative and quantitative assessments. Qualitative data is collected through recommendations and input from experts regarding content accuracy, instructional feasibility, and media design. Meanwhile, quantitative data is obtained from validation scores given by experts, which summarize the overall quality and effectiveness of the product. After validating, the next step was to collect research data by conducting a readability test on 34 grade VII F students at SMP Negeri 4 Malang to determine the level of product suitability. Data collection step using a questionnaire that is arranged based on a 1-4 Likert scale. Meanwhile, qualitative data is a description of suggestions from students, and quantitative data is a recapitulation of readability tests obtained from student responses. The acquired data is then quantitatively processed using the following formula:

$$P = \frac{\sum x}{\sum xi} \; x \; 100\% \qquad (1)$$

Information:
P = Percentage
∑x = Total response
∑xi = Total ideal answer
100% = Constant number

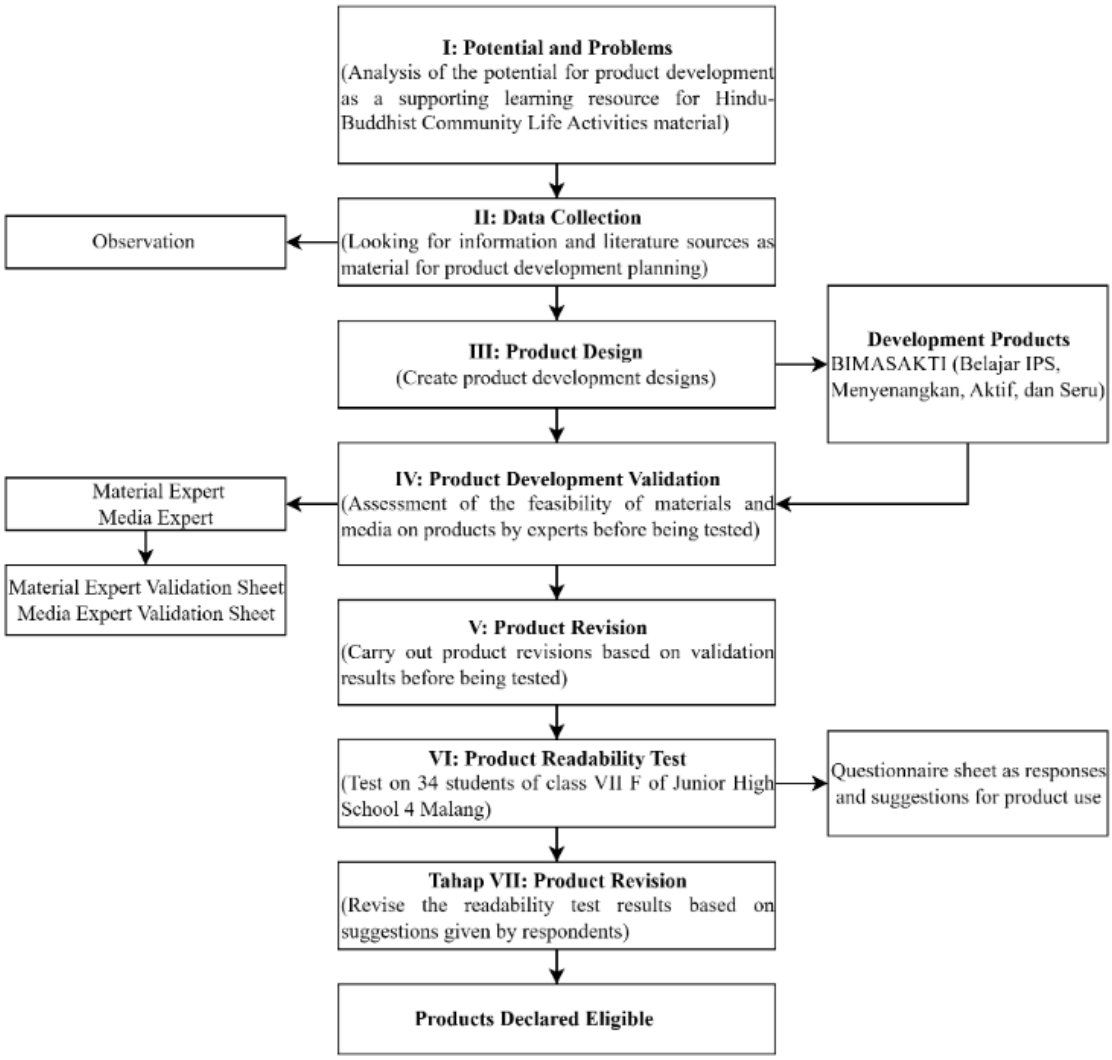


Figure 1. Research and development stage of the Borg & Gall model

After obtaining the quantitative data, Arikunto (2018) states that the data should be analyzed using product feasibility criteria, which assess the suitability of the developed learning media based on expert evaluations. These criteria are categorized as follows: (1) very feasible (81-100%), requiring no revision; (2) feasible (61-80%), requiring partial revision; (3) quite feasible (41-60%), requiring revision and a readability test; (4) not feasible (21-40%), requiring total revision and a re-readability test; and (5) very unfeasible (0-20%), indicating that the

product should not be used. This criterion was chosen because it provides a structured approach that is widely used in the evaluation of learning materials, thereby ensuring systematic assessment and necessary improvements. Additionally, a similar feasibility classification has been applied in previous research related to the validation of mobile learning-based educational media by (Fauzia & Sakti, 2017). This ensures that the evaluation remains rigorous and aligned with standardized educational research practices.

RESULTS AND DISCUSSION

The BIMASAKTI research and development uses seven research stages that adopt the Borg & Gall model.

Stage I: Potential and Problem Analysis

The first stage is an analysis of potential and problems, which is part of the pre-field stage. This stage is carried out by observing problems in the learning environment and analyzing the potential to overcome these problems. There was a change in the curriculum from the 2013 Curriculum (K13) to an independent curriculum, which had an impact on changing the content of social studies material in student textbooks. Social studies material in textbooks tends to be abstract, thematic, and general. This condition causes students to find it difficult to understand the learning material. Students' difficulties in learning can be seen in the data on the average value of learning outcomes for grade VII F students at SMP Negeri 4 Malang in the social studies subject, which is quite low. Technology in the twenty-first century is advancing quickly right now. Technology is anticipated to be used in education at the unit level for students to acquire 21st-century abilities, also referred to as 4C skills—creative, critical, collaborative, and communicative thinking.

Stage II: Data Collection

The second stage is data collection by observation and interviews at the research location, namely SMP Negeri 4 Malang. The results show that curriculum changes cause students to experience difficulties in understanding and mastering the material contained in textbooks. This is because the explanation of the material contained in the Merdeka Curriculum edition package book tends to be general, abstract, and non-specific. Moreover, so far, learning at SMP Negeri 4 Malang has been limited to relying on textbooks. This limitation certainly does not facilitate students to learn based on their learning style. Profiling data from teachers shows that 34 students in grade VII F, consisting of 10 male students and 24 female students, have different learning styles, namely, auditory and visual learning styles are dominant. However, learning style alone does not fully determine students' needs. A deeper analysis of students' prior knowledge is required to identify gaps in their understanding, which, if not addressed, may hinder learning progress. The learning style trends in grade VII F are presented in Figure 2.

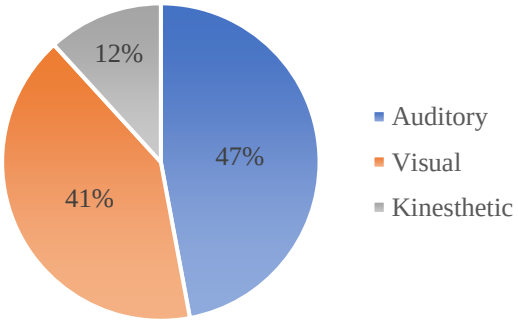


Figure 2. Trends in the learning style of grade VII F students

Grade VII F students who study social studies, especially the material on Community Life Activities in the Hindu-Buddhist Period, often experience difficulties in understanding the material because the scope of this material has complexity in the cognitive domains C2 (understanding) to C4 (analyzing), so that if it is explained classically it will confusing (Ningrum et al., 2021). Media is needed to concretize students' understanding. According to the teacher, students enjoy studying material through technology-based media. However, due to the limitations of teachers in creating and developing media, teachers can only facilitate learning with minimal learning resources, namely textbooks, PowerPoint (PPT), and videos from the YouTube platform. Media that has great potential to be used as a learning resource is Android-based mobile learning (S. Wahyuni et al., 2022; Wahyuningtyas & Yahya, 2021) website, virtual reality, augmented reality (Logayah et al., 2023), and artificial intelligence (Permana & Putri, 2020). The use of Android-based mobile learning has several advantages, namely that users can access learning content practically, the material is presented in various interactive models, and able to increase students' digital independence and literacy (Cahyadi, 2019; D. Wahyuni, 2021; Maurisa & Rahayu, 2021).

Stage III: Product Design

The third stage is product design. Product designs are designed and developed according to user needs and potential ease of operation. Students need learning resources that are contextual and able to facilitate their learning styles, namely, auditory and visual learning styles. To help students grasp the subject matter in a way that best suits their learning styles, the content is provided through videos, podcasts, and illustrated modules. Students may find it simpler to learn by having access to all of the content in BIMASAKTI on a single platform. Figure 3 illustrates the breadth of the content in BIMASAKTI.

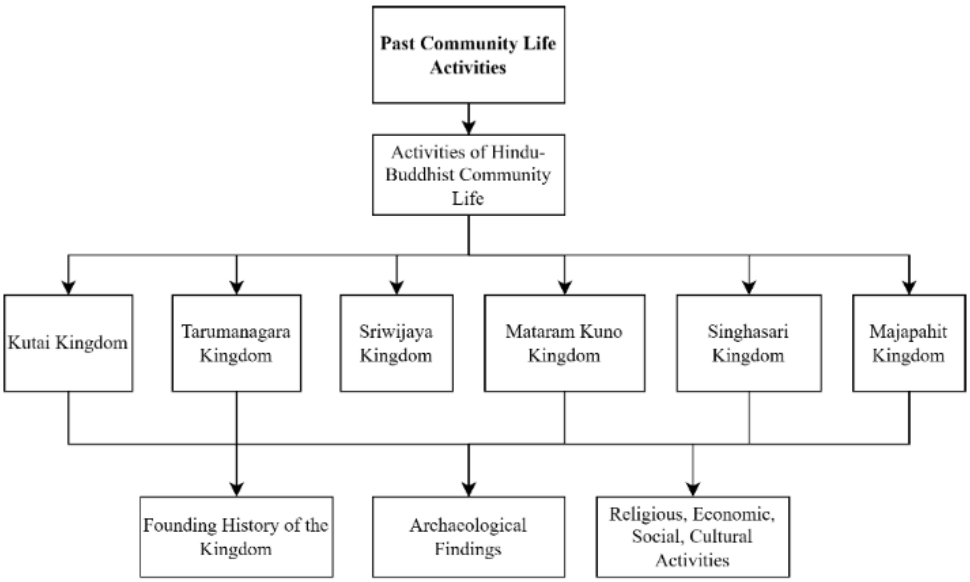


Figure 3. Material concept map

The product is developed and packaged in the form of an Android Package Kit (APK) file. At this stage, a storyboard is created that is adjusted to the development support capacity and can be seen in Figure 4.

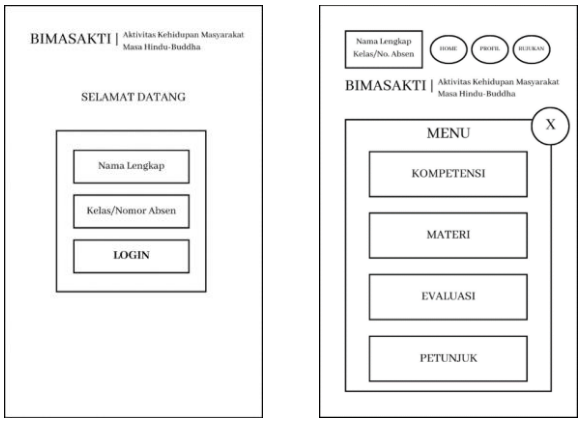


Figure 4. BIMASAKTI mobile learning product storyboard

Then the next step is to execute the design on the Canva platform and Articulate Storyline 3. Once all visual aspects are designed, the next step is to develop the product using Articulate Storyline 3.

Before accessing BIMASAKTI, users must first log in by filling in their identity in the form of full name, roll number, and class. After logging in, users enter to the homepage and can access all of the menus, namely (1) competencies; (2) material on the life activities of Hindu-Buddhist society; (3) evaluation in the form of multiple-choice questions; (4) instructions; (5) developer profile; and (6) reference list. Apart from that, there is also a grade reporting feature

that is connected to the teacher's WhatsApp number. Android smartphones running version 5.0 (Lollipop) or higher and having at least 100 megabytes of storage capacity can utilize BIMASAKTI. Figure 5 displays the BIMASAKTI display.

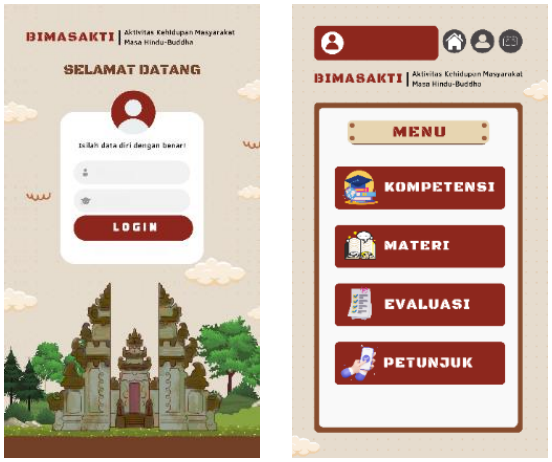


Figure 5. BIMASAKTI display

Stage IV: Product Development Validation

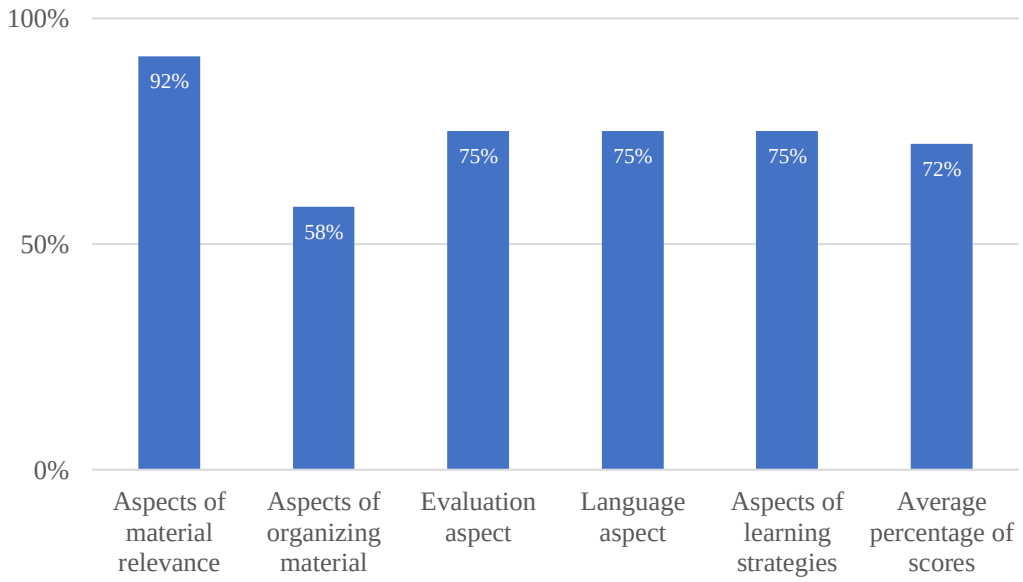


Figure 6. First material validation results

The percentage of validation results for the first material is shown in Figure 6, namely 72.2%. This percentage is included in the "Appropriate" criteria for use with revision, because there are aspects that still do not meet the criteria, namely, aspects of material organization. The material expert validator's recommendations are shown in Table 1.

Table 1. Suggestions and recommendations for improvements from material expert validators

No.	Improvement Suggestions	Follow-up
1.	Add accurate and reliable references, namely the Indonesian National History Book Volume II, as the main reference source.	Have added books as main references according to suggestions from validators
2.	Explore Hindu-Buddhist temples in the Greater Malang area and add documentation to the material.	Have explored the temple and added personal documentation
3.	There was an error in writing the name of the king in one of the materials, specifically the name of King Kudungga from the Kingdom of Kutai, which did not match the Indonesian National History Book Volume II.	Have revised the writing of the name of the king of Kudungga to Kundungga, following the Indonesian National History Book Volume II

Once the material has been revised, the next step is to validate the second material. The results of the second material validation are shown in Figure 7.

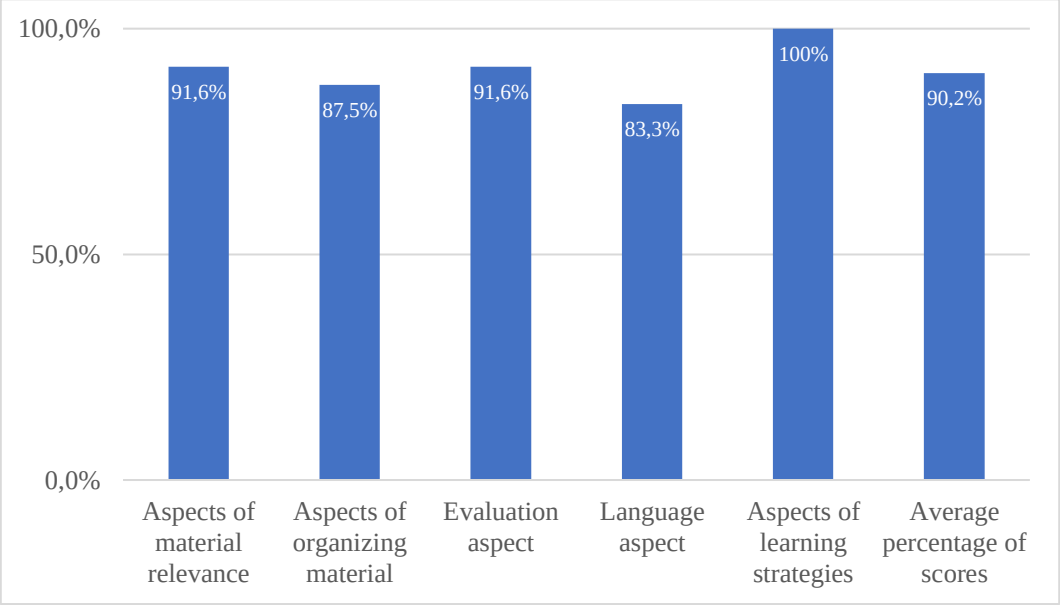


Figure 7. Second material validation results

The percentage of validation results for the second material is listed in Figure 7 (90.2% and appropriate). It indicates that there is no need for revisions and the product is ready for use. It also indicates that the information is contextually and methodically organized. Despite this, the material expert validator offers suggestions to improve the outcomes of the BIMASAKTI development. Table 2 lists the suggestions made by material expert validators.

Table 2. Suggestions and recommendations for improvements from material expert validators

No.	Improvement Suggestions	Follow-up
1.	Correct spelling errors (typos)	Fixed spelling errors (typos)

The next step is media validation to assess the feasibility of the media. The validation results are listed in Figure 8.

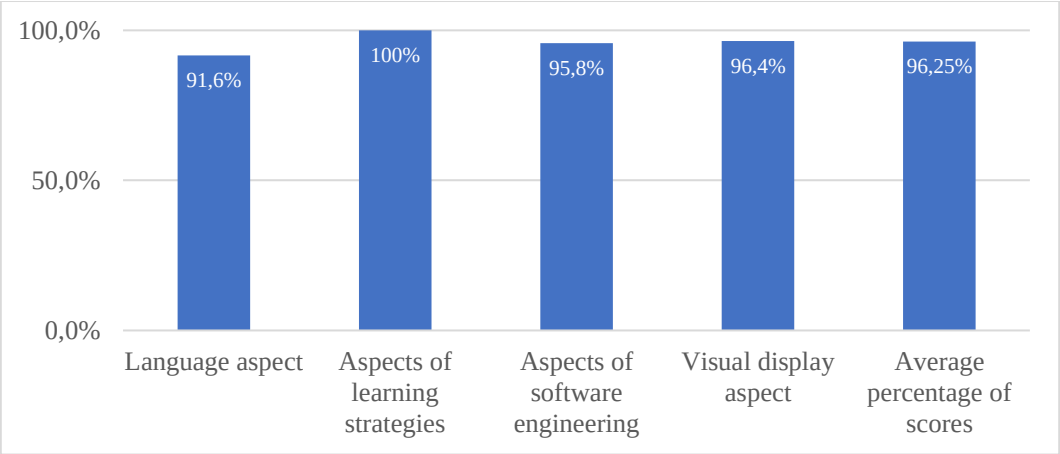


Figure 8. Media validation results

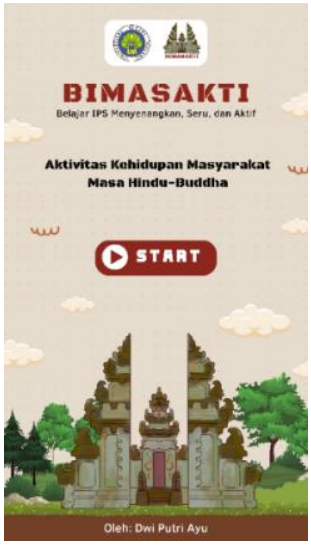
The percentage of media validation results in Figure 12 shows 96.25% and is classified as "appropriate" criteria without revision. The mobile learning product developed by Mardita (2020) is limited to material content in module form only, so it cannot facilitate students with an auditory learning style. Apart from that, Rohmah & Bukhori (2020) also developed learning media with a large product size, so that it could hinder students who have devices with limited specifications. The BIMASAKTI product was developed with a size that is not too large and has a short loading time during operation, thus providing convenience and time efficiency for users (students). With these various advantages, BIMASAKTI can be a stimulant for students to learn easily & independently. However, recommendations and suggestions are still needed to optimize the results, as listed in Table 3.

Table 3. Suggestions and recommendations for improvements from media expert validators

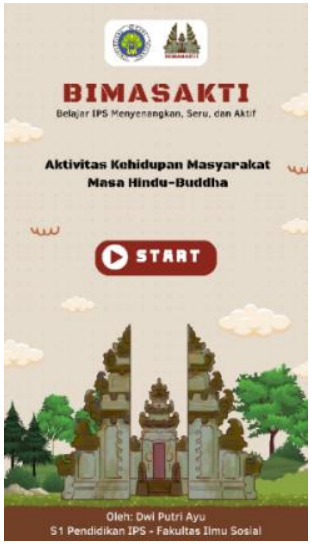
No.	Improvement Suggestions	Follow-up
1.	Can be optimized with video tutorials (screencast video)	Have added a tutorial for using mobile learning in the form of a video screencast
2.	Given the name of the institution from which the media developer originates	Has added the name of the institution from which the media developer originates

Stage V: Product Revision

The fifth stage is to revise the product based on the recommendations and suggestions provided by the validator to optimize the results of the BIMASAKTI product. The product revisions are shown in Figures 9 and 10.



Before revised



After revised

Description: Added the name of the institution/institution of origin of the media developer at the bottom.

Figure 9. Revised BIMASAKTI product home page

Before revised

After revised

Description: Added video tutorial (screencast video) for using BIMASAKTI to make it more optimal, where previously there were only instructions for use in written form.

Figure 10. Revised the BIMASAKTI product instructions section

Stage VI: Product Readability Test

The sixth stage was implemented in two meetings on 34 students of grade VII F of SMP Negeri 4 Malang. It is well known that students responded to BIMASAKTI by expressing a great desire to study Hinduism and Buddhism. Students' comments, which demonstrate their enthusiasm and active participation in discussions and autonomous material discovery utilizing BIMASAKTI, demonstrate how learning sessions become more enjoyable, thrilling, and

dynamic. After using BIMASAKTI, students are also able to correctly describe the life activities of the Hindu-Buddhist society. The results are displayed in Table 4.

Table 4. Recapitulation of the product readability test result

No.	Aspect	Score
1.	Language	351
2.	Application components	373
3.	Display organization	469
4.	Presentation of material	715
5.	Whole aspects	457
Total score		2.365
Percentage		87%
Eligibility Criteria		Very Appropriate

Table 4 indicates that the product achieved an overall readability score of 87%, classified as "Very Appropriate." However, while the high readability score reflects the product's effectiveness, further refinement is still needed. Student feedback provided valuable insights for optimizing BIMASAKTI's readability and overall usability.

Table 5. Suggestions and recommendations for improvement from the product readability test

No.	Recommendations and Suggestions
1.	Questions can be developed at a level form (1, 2, 3) according to the level of difficulty.
2.	It can be added with game features.

Stage VII: Final Product Revision

The seventh stage is the revision of the final BIMASAKTI product based on the suggestions, criticisms, and recommendations that have been provided. This improvement aims to make BIMASAKTI a more effective learning resource by allowing students to explore information independently and hone their logical thinking skills. This aligns with constructivist learning theory, which emphasizes students' freedom to acquire skills, information, and technology in order to actively participate, reflect, and develop their own ideas (Sugrah, 2020). Suparlan, (2019) also emphasizes that students should be given the freedom to build knowledge through various learning activities, such as experiments and discussions. However, challenges in the implementation of independent learning still exist, as stated by Lolang et al. (2023), who mentioned that an overly open learning approach can increase cognitive load, especially for students with still low independent learning skills. Therefore, although BIMASAKTI offers learning flexibility, guidance and supporting strategies are still needed to make learning more effective.

In the context of more effective learning strategies, the learning experiences provided by BIMASAKTI can be linked to Edgar Dale's theory, which emphasizes the importance of direct experiences in enhancing student understanding. According to Dale, learning media play an important role in providing meaningful learning experiences, ranging from the most concrete to the most abstract (Pambudi, 2018; Rohani, 2019). This principle is also supported by the

research of Dewi & Muhibbin (2024), which shows that the integration of visual and audio elements can enhance students' understanding if designed with consideration of their cognitive capacity. However, the effectiveness of learning media is highly dependent on the quality of its design and components. Excessive use of multimedia elements can actually distract students and reduce the effectiveness of learning (Rahayu, et al., 2024). Therefore, BIMASAKTI needs to be equipped with an adaptation mechanism that can adjust the complexity level of the material according to the students' abilities so as not to overload their cognitive capacity.

In its implementation, BIMASAKTI not only offers the freedom to explore information but also provides a richer multisensory learning experience. When used in learning activities, the five senses of students are activated through provided image-based modules, audio (podcasts), and videos. Thus, the use of BIMASAKTI as a learning resource not only enriches students' learning experiences but also helps them record and understand the knowledge they have acquired more deeply. This shows that the combination of adaptive learning strategies and the use of media appropriate to students' cognitive capacities can create a more effective learning environment and support the enhancement of their understanding.

CONCLUSION

Based on the findings of this research, BIMASAKTI shows potential as an additional learning resource. Its advantages include (1) a diverse format for presenting materials, such as illustrated modules, podcasts, and videos; (2) optimized file sizes to enhance time efficiency in learning; (3) minimal storage requirements; (4) responsive menu navigation with short loading times; (5) text readability adjustment features (zoom in/zoom out); and (6) a grading report feature connected to the teacher's WhatsApp number. These features are designed to accommodate various student learning styles. However, this research has several limitations. Although BIMASAKTI offers technical advantages and ease of use, further research is needed to empirically assess its impact on learning outcomes. This study has not yet thoroughly analyzed how these features contribute to student engagement, understanding, or material retention. Moreover, the effectiveness of BIMASAKTI for various student groups, such as those with limited digital literacy or special educational needs, has not yet been explored. Future research should include controlled experimental studies to evaluate the pedagogical effectiveness and ease of use in various classroom environments. To enhance its functionality, further development can focus on integrating adaptive learning mechanisms, such as interactive assessments tailored to students' progress. Instead of just adding game features, the next iteration could explore gamification strategies designed to enhance student learning motivation and critical thinking. Additionally, further distribution strategies, including accessibility through the Google Play Store, need to be considered to expand its reach and ease of use. By addressing these aspects, BIMASAKTI can develop into a more effective and inclusive educational tool. Future studies should aim to refine their pedagogical framework and validate

its effectiveness through empirical data, so that it can meet the diverse learning needs of students.

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