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The Development Process of "Shapesite": A Google Sites-Based Learning Tool Integrated with *Kayangan Api* Local Wisdom for Polyhedra

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ABSTRACT

Objective: *This research aims to describe the dvelopment stages of "Shapesite". It is a Google site-based learning media that integrates the local wisdom of Kayangan Api to teach flat-sided 3D shapes.* ***Method:*** *This study employed a Research and Development (R&D) framework utilizing the 4D development model (define, design, develop, and disseminate). Data acquisition involved expert validation sheets alongside student responsiveness questionnaires. The quantitative analysis utilized the Aiken's V index to evaluate validity instrument scores and percentage descriptive statistics to determine user practicality.* ***Results:*** *The empirical findings demonstrated that "ShapeSite" successfully fulfilled all four deployment phases. Methodological evaluations revealed outstanding validitsy, evidenced by Aiken's coefficients of 0.875 and 0.925 from media and subject-matter specialists, respectively. Furthermore, the platform achieved an exceptional practicality rate of 92% based on target learner feedback* ***Novelty:*** *This study comprehensively delineates the 4D design phases of a Google Sites-driven mathematics instructional platform, purposefully embedding ethnomathematical elements from local cultural heritage.*

INTRODUCTION

Mathematics is a very crucial subject, as it plays a vital role in almost every field [1]. In addition, mathematics has various practical applications in everyday life [2] and is also taught at all stages of education [3] making it essential for learners to fully master the subject [4]. Despite these challenges, numerous problems persist, one of which is the low level of learner achievement. The PISA scores illustrate this issue, with Indonesia's score of just 359 falling far below the average for OECD member countries and even significantly lower than that of its five neighboring ASEAN nations [5]. This condition is supported by the results of an interview with a mathematics teacher at an MTs in Balen Sub-district, where more than 70% of learners have not passed the minimum proficiency standarts. The data indicates that the state of mathematics education still requires deeper attention and practical solutions that can help optimize the learning process itself.

Suboptimal academic performance often stems from inadequate technological integration [6], detached learning contexts, and restricted access to educational materials. Addressing these deficits requires pedagogical advancements [7], specifically through the design and implementation of digital learning resources [8] through the development of digital learning resources [9].

Learning media are characterized as instruments that can be utilized to enhance the efficacy and productivity of the educational experience [10]. Moreover, educational materials that integrate digital technology facilitate increased involvement in the learning

experience [11]. Consequently, this approach facilitates students' acquisition of knowledge directly [12], enhances the achievement of educational objectives [13], and encourage innovative learning strategies [14]. Numerous digital learning tools are accessible, particularly thru websites.

Websites are online resources that offer users access to a diverse array of information that can be accessed at any given time [15] An abundance of educational resources are accessible via the internet [16]. Google Sites, a web-based application, can be employed to facilitate digital learning. Google Sites is a Google service that incorporates a variety of features, including text and video, within a website [17]. This platform is accessible free of charge and is characterised by ease of management [18]. Consequently, Google Sites can be more readily developed into a learning resource platform.

In practice, website-based learning resources have the capacity to incorporate contextual elements in the form of local wisdom. This method aims to establish a connection between learning and daily life, thereby increasing its significance in the lives of students [19], [20]. Furthermore, the integration of contextual aspects through elements of local wisdom has been demonstrated to facilitate a realistic learning process [21], encourage pupils to explore concepts independently [22], convey values relevant to the local community [23], build a meaningful learning environment for students [24], and serve as a key element in character-building efforts [25]. An exemplary manifestation of regional insight that might be underscored is the local wisdom of Kayangan Api.

Kayangan Api has been designated a geopark tourist attraction, thus becoming one of the icons of Bojonegoro Regency. Kayangan Api itself offers a view of an eternal flame that never goes out due to a natural geological phenomenon [26] and is also renowned for various beliefs and legends [27]. In addition, this local wisdom site is frequently the venue for cultural events organised by the local governmen [28]. Kayangan Api is extremely pertinent to one of the curriculum's subjects in mathematics education, namely polyhedra. The temple buildings and Eyang Kriyokusumo's meditation site, among other features at Kayangan Api, have geometric shapes that can be examined in relation to polyhedra. As a result, Kayangan Api can function as a suitable source of local knowledge in Google Sites-based educational materials.

Numerous pertinent studies have been carried out. One such study used Google Sites to create educational materials on the subject of three-dimensional shapes; the findings showed that the materials satisfied the requirements for validity and usefulness while greatly enhancing students' learning outcomes. [29]. Additionally, other research has demonstrated that the creation of web-based educational materials that incorporate aspects of local knowledge has been successful in enhancing students' cultural literacy [30], mathematical critical thinking abilities [31], and learning outcomes [32].

The development model employed in this study is different from the development stages examined in that study, which is an innovative aspect of this research. Therefore, using the four stages of the 4D development model, the goal of this study is to describe the development stages of the "ShapeSite" learning resource on the subject of flat-sided

three-dimensional shapes, which is based on Google Sites and incorporates the local knowledge of Kayangan Api.

RESEARCH METHOD

This study is a R&D study using a 4D model developed by S. Thiagarajan, D. S. Semmel and M. I. Semmel [33]. The study aims to develop the ShapeSite, a Google Sites-based learning resource that incorporates Kayangan Api local wisdom, while ensuring its validity and practical application in all four phases of development: define, design, development and dissemination.

A number of research subjects were involved in this study, which took place between February and May of 2026. These subjects included: 1) two lecturers in information technology education who served as media expert validators; 2) one lecturer in mathematics education and one math teacher who served as content expert validators; and 3) 29 students who served as test subjects for the learning resource and respondents to the student feedback questionnaire.

Three types of questionnaires; a subject-matter expert validation questionnaire, a media expert validation questionnaire, and a student response questionnaire, adapted from earlier research were used as data collection techniques, along with documentation and an interview with one of the math teachers to gather preliminary information for problem identification

A media expert validation form, a subject matter expert validation form, and a student response questionnaire were the research tools utilized. Two phases of data analysis were completed. The media expert and subject matter expert validation forms, which employed a 1–5 Likert scale and Aiken's V index with the following formula, were first examined in order to assess the validity of the learning materials [34]:

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

The following table is then used to interpret the obtained Aiken indext [35].

Table 1. Validity Criteria

Value	Criteria
0,81-1,00	Very Valid
0,61-0,80	Valid
0,41-0,60	Medium Validity
0,21-0,40	Low Validity
0,00-0,20	Invalid

Second, evaluation of the usefulness of educational resources. The following formula was used to process the data from the student response questionnaires, which took the form of a 1–5 Likert scale [36]:

$$\text{Level of practicality} = \frac{\text{total score}}{\text{score maximal}} \times 100\%$$

The following table was used to interpret the practicality scores from the student response questionnaire [37].

Table 2. Practicality Criteria

Score Percentage	Criteria
81%-100%	Highly practical
61%-80%	Practical
41%-60%	Moderately Practical
21%-40%	Less Practical
0-20%	Impartical

RESULTS AND DISCUSSION

Results

The "ShapeSite" educational resource was developed in four stages. The following is a description of these four stages:

1. Define

The first stage of the research is the define phase, which aims to formulate the research concepts and methodology as well as identify various aspects related to the research problem, the circumstances of the students, and their learning.

a. **Problem indentificaton.** According to an interview with a maths teacher in one of the MTs in the Balen sub-district of Bojonegoro, more than 70% of the students' had not achieve the minimum standards. This is due to several factors, such as the lack of integration and innovation in the use of technology in teaching and the lack of relevance of lessons for the daily life of students.
b. **Identification of students' characteristics.** On the basis of data collected from the same interviews, students' were found to have a low level of interest in mathematics. In addition, students tend to prefer digital technologies such as online games, which have grown rapidly in recent years. This situation provides an opportunity to further increase the use of technological innovation in teaching, especially in maths, with the aim of increasing pupils' commitment and interest.
c. **Concept analysis and step development.** Based on the problems identified in the previous stage, the product concept developed consisted of a digital learning resource using Google Sites that incorporated elements of local wisdom. In particular, the element of local wisdom highlighted is Kayangan Api in Bojonegoro, which is relevant to the topic of polyhedra. The learning resource comprises several main pages, such as the home page, local wisdom, learning objectives, content, practice questions, conclusions, and information about the development team.
d. **Formulation of learning objectives.** The learning objectives established in this learning resource are: 1) to understand the definition of a polyhedra; 2) to identify the elements of polyhedra; 3) to identify the different types of polyhedra; 4) to calculate

the surface area and volume of polyhedra; and 5) to solve contextual problems relating to polyhedra.

2. Design

The design stage is the next stage following the define stage. In this stage, a several activities are performed as outlined as follows.

a. **Formulation of testing standards.** In this stage, the elements that should be included in the test instrument are formulated and finalized.

b. **Identify relevant learning resources.** According to the findings of the previous stage, the most relevant learning resources are technology-based resources that are accessible and flexible, incorporate contextual elements, and are complemented by the various elements required for learning. Consequently, the learning resources were developed utilizing a Google Sites-based website, incorporating contextual elements related to the local wisdom of Kayangan Api in Bojonegoro.

c. **Determining the format.** This stage involved determining preliminary formats for the learning tools, the designs and structures of the products, and deciding the software to be employed in designing the visual presentation of the learning tools. The formats that had been developed were then adapted into storyboards. Additionally, the Canva software was employed in developing the design of the elements involved in the creation of the learning tools.

d. **Instructional media storyboard.** A storyboard contains initial sketches of the display of each page in the learning media and also provides a reference for deciding the structure and format of the design. The storyboard is presented in the following images:

Table 3. Learning media

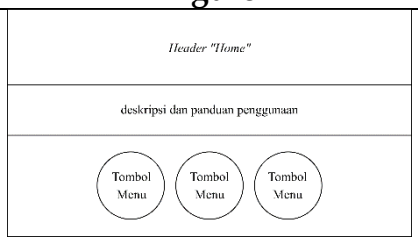
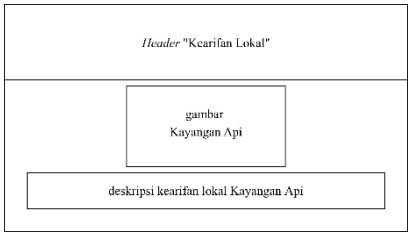
No.	Page	Figure
1	Home	
2	Local wisdom	

Figure 1. Home

Figure 2. Local Wisdom

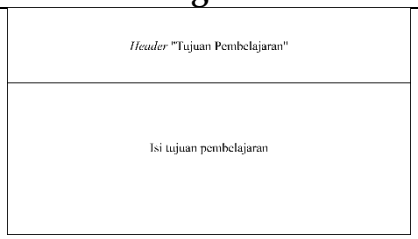
No.	Page	Figure
3	Learning objective	

Figure 3. Learning Objectives

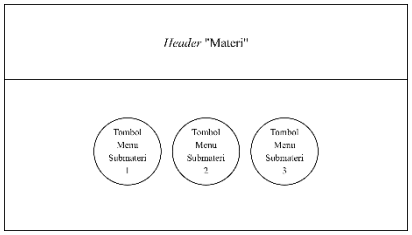
4	Materials	

Figure 4. Instructional Materials

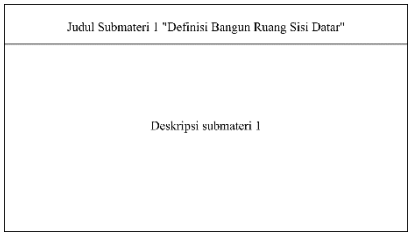


Figure 5. Sub-Topic 1 Menu

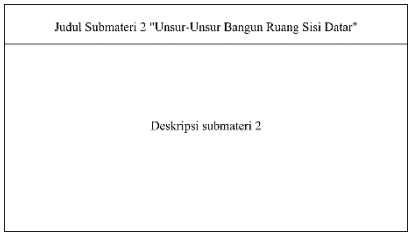


Figure 6. Sub-topic 2 Menu

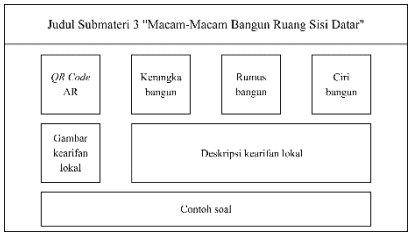


Figure 7. Sub-topic 3 Menu

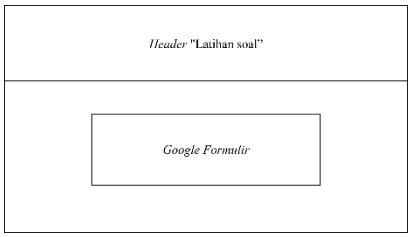
	Assesement	

Figure 8. Assesement Menu

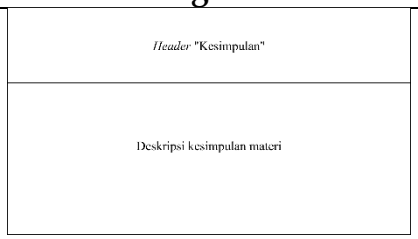
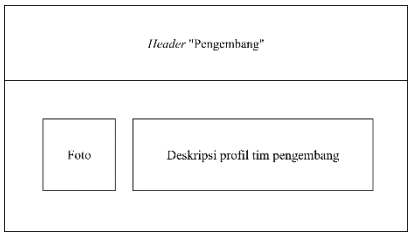
No.	Page	Figure
6	Conclusion	
7	Development team	

Figure 9. Conclusion Menu

Figure 10. Development Menu

3. Development

The following actions were implemented during the development stage:

a. **Determination of the tools.** The instruments are arranged according to a specified format. In this study, three kinds of tools are utilized from previous research, including a validation form conducted by media experts, a validation form carried out by subject matter experts, and a questionnaire to determine students' perceptions.

b. Development of teaching materials

1. Design of learning materials

   The learning resource menu was made using Canva software and organised on Google Sites. The figure in the table following shows how the learning resources are designed.

Table 4. Learning media design

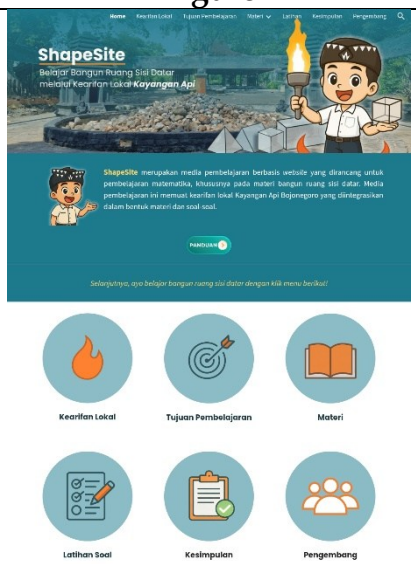
No.	Page	Figure
1	Home	

Figure 11. Homepage Design

2	Local Wisdom	

Figure 12. Local Wisdom Design

3	Learning objectives	

Figure 13. Learning Objectives

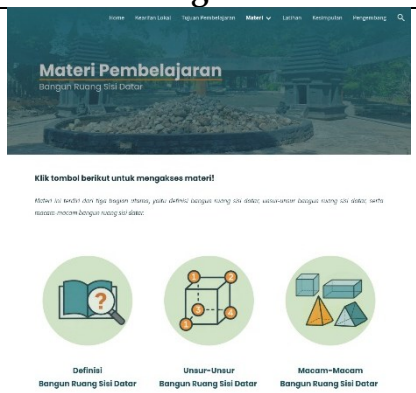
No.	Page	Figure
4	Material	

Figure 14. Materials

Figure 15. Sub-topic Menu 1

Figure 16. Sub-topic Menu 3

No.	Page	Figure

Figure 17. Sub-topic Menu 2

5 Assessement

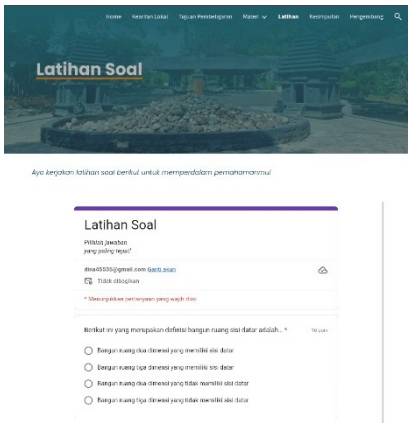


Figure 18. Asessement Menu

6 Conclusion

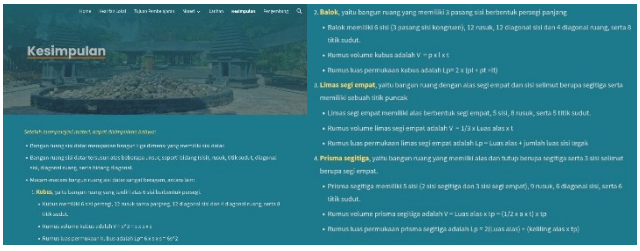


Figure 19. Conclusion page design

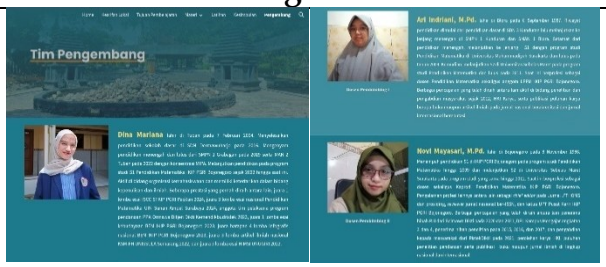
No.	Page	Figure
7	Development Team	

Figure 20. Development Menu

2. Validation and revision of teaching materials
   a. **Media expert validation.** Validation by media experts was performed by supplying validators with a validation form including 10 assertions rated on a 1–5 Likert scale. The assertions on the validation document encompassed several metrics, including layout, visual aesthetics, interactivity, navigation, and accessibility. Results of the validation are shown in the table following:

Table 5. Media Validation Result

Instrument Items	Validator 1	Validator 2	s1	s2	Σs	n(c-1)	V	Criteria
Items 1-10	47	43	37	33	70	80	0,875	Very Valid

The data in the table indicates that the 10 items on the media expert validation sheet achieved an Aiken score of 0.875, satisfying the "very valid" criterion. This confirms that the ‘ShapeSite’ learning resource meets validity standards from a media perspective. These findings align with prior research, where learning media developed with a focus on local wisdom attained a media expert validity score of 0.96, which was classified as high [38].

   b. **Media expert validation.** Media validation was achieved by supplying validators with a validation form including 10 statements rated on a 1–5 Likert scale. The validation document included multiple indications such as curricular alignment, conceptual precision, material efficacy, thoroughness of the content, activities, and evaluation.

Table 6. Media Validation Result

Instrument Items	Validator 1	Validator 2	s1	s2	Σs	n(c-1)	V	Criteria
Item 1-10	46	48	36	38	74	80	0,925	Very Valid

The data shown in the table indicates that the expert validation sheet yielded an Aiken score of 0.925, satisfying the 'very valid' standart. These findings show that the educational tool “ShapeSite” has met the standards of content validity. In additions, they also concur with previous studies evaluating the validity of learning resources based on Google Sites. The subject-matter expert

assessment results in this earlier study showed a score of 95%, categorised as 'very valid' [39].

Nonetheless, the media expert validators offered several recommendations for enhancements, such as adding formulas for a polyhedra's frame, net, and diagonal length to the materials menu. Consequently, the final version of the learning resource following the revisions is as follows:

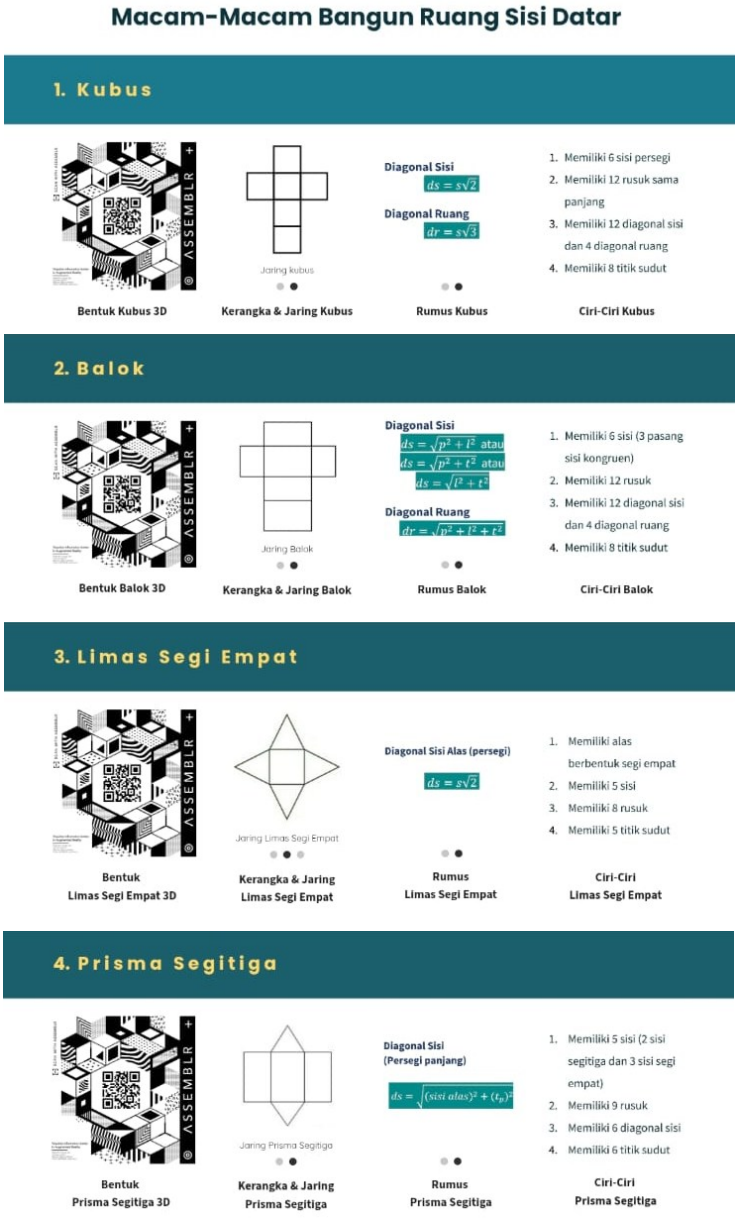


Figure 21. Materia Menu After Revision

3. Product Testing

The product testing was carried out utilising the "ShapeSite" learning resource during classroom lessons focusing on polyhedra. The testing of this learning resource involved 29 students at MTs Islamiyah Unggulan Balen. Following the lessons, students completed a feedback questionnaire to assess the practicality of the learning resource. The practicality scores are presented in the table below:

Table 7. Student Feedback Results

Student	Average Score	Score Maximal	Level of Practicality
1-29	32,21	35	92%

The table shows a 92% practicality rating, classified as 'very practical.' This indicates that the 'ShapeSite' learning resource is well-received by students and highly effective in supporting the learning experience.

4. Dissemination

The development of this learning resource has reached its final stage: dissemination. This process involved introducing the 'ShapeSite' resource beyond the primary pilot school. Implementation took place at State Junior High School 1 Ngasem with 32 students. This location was chosen for its relevance to the subject matter, as the school is situated within the same Ngasem Sub-district where the highlighted local wisdom originates.

Discussion

The "ShapeSite" learning resource was developed using the 4D model, which encompasses the define, design, develop, and disseminate stages. This model was selected based on research identifying it as a highly suitable framework for creating learning resources [40], aligning it with the development of this Google Sites-based tool.

The define stage involved several key activities: identifying problems, analyzing student characteristics, conducting concept analysis, outlining steps, and establishing learning objectives. This stage revealed that the primary issue was poor student performance, highlighted by the fact that over 70% of students failed to achieve the minimum passing grade. This problem stems from a gap between course content and students' daily experiences, combined with a lack of digital technology integration in classrooms. Since modern students naturally prefer digital environments, developing contextual learning materials rooted in local wisdom becomes crucial. To address this, we developed a systematic strategy based on a series of core research activities.

The design phase comprised four key procedures: formulating evaluation metrics through targeted assessment criteria, sourcing localized web-based digital assets, establishing the structural layout, and drafting the product storyboard. Subsequently, the development phase advanced the project by finalizing the adapted instrument and fabricating the learning resources. Expert evaluation yielded robust content and media validity, with Aiken's V coefficients of 0.925 and 0.875, respectively, thereby satisfying the 'highly valid' threshold. Furthermore, empirical data from pilot testing demonstrated strong field usability; student feedback questionnaires generated a 92% practicality score, confirming the pedagogical efficacy and readiness of the materials for classroom deployment.

The final stage, dissemination, involved distributing the 'ShapeSite' learning resource to non-pilot schools to boost adoption and ensure long-term sustainability. This

phase is essential for transforming the experimental media into an active instructional tool that optimizes classroom practice.

Overall, these four sequential development phases form an interconnected framework, with each stage directly influencing the next. Collectively, they converge toward a single objective: delivering a Google Sites-based learning resource infused with Kayangan Api local wisdom. This systematic approach ensures that the product not only meets empirical validity and practicality standards but is also successfully implemented to improve pedagogical outcomes across multiple institutions [41].

The findings of this study align with prior research validating the practicality, validity, and efficacy of Google Sites-based mathematics resources [42]. Nevertheless, those investigations largely overlooked contextual integrations, such as local wisdom. Conversely, while existing literature demonstrates the viability of culturally rooted web-based learning tools [43]. their application remains scarce within mathematics education. This critical gap underscores the primary novelty of the present study.

Furthermore, this research offers broader implications for the design and deployment of localized digital learning environments. This aligns with empirical evidence indicating that such contextualized media can promote the achievement of learning objectives [13], enrich student knowledge [12] and provide more meaningful learning experiences [44], Crucially, these integrated resources have been shown to build conceptual understanding and spatial skills [45], thereby improving overall student learning outcomes [29].

CONCLUSION

Fundamental Finding: the development of the “ShapeSite” learning resource was carried out in four stages of the 4D development model, comprising define, design, develop, and disseminate. Implications: This research has implications for the development of website-based learning resources incorporating local wisdom, with a broader scope of study, whether in terms of the content included in the resource, elements of local wisdom, variety of material, or other innovations. **Implication:** this research has implications for the development of website-based learning resources incorporating local wisdom, with a broader scope of study, whether in terms of the content included in the resource, elements of local wisdom, variety of material, or other innovations. **Limitation:** the limitations of this study lie in the restricted scope of the material, specifically polyhedra, and the fact that the dissemination phase involved only one school. **Future Research:** future research should involve more schools and stakeholders in the dissemination phase to ensure long-term sustainability and a broader impact. Additionally, subsequent studies could explore a wider variety of cultural elements to integrate into other mathematics educations.

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