



Developing Google Sites-Based Learning Media for Grade 8 Informatics Instruction

Nada Safarina^{1,*}, Gusnita Darmawati², Firdaus Annas³, Yulifda Elin Yuspita⁴

^{1,2,3,4}State Islamic University of Sjech M.Djamil Djambek Bukittinggi, Bukittinggi, Indonesia

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Correspondence

E-mail: nadaaudrey81@gmail.com*

A B S T R A C T

Teachers tended to rely on lecture-based instruction and used only the whiteboard and textbooks when explaining the material. As a result, student interaction was limited and conceptual understanding, particularly in Informatics, remained low, which reduced students' engagement in the learning process. This study aimed to develop Google Sites-based learning media for Grade 8 Informatics instruction at SMP Negeri 5 Padang Panjang. The study employed a Research and Development (R&D) approach using the 4D model, which consists of the stages of Define, Design, Develop, and Disseminate. The developed media were evaluated through product testing using Aiken's V for validity, Moment Kappa for practicality, and Hake's G-Score for effectiveness. The results showed that the Google Sites-based learning media achieved an average validity score of 0.84, indicating that it was valid. The practicality test produced an average score of 0.92, which was categorized as very high, while the effectiveness test involving 27 students resulted in an average score of 0.87, also in the very high category. This study contributes by providing Google Sites-based learning media that are valid, practical, and effective, offering an alternative solution for teachers to implement more interactive and efficient learning while supporting students' motivation.

Abstrak

Guru cenderung menggunakan metode ceramah serta hanya memanfaatkan papan tulis dan buku dalam menjelaskan materi. Akibatnya, interaksi siswa masih terbatas dan pemahaman konsep, terutama pada mata pelajaran Informatika, masih rendah sehingga keterlibatan siswa dalam proses pembelajaran belum optimal. Penelitian ini bertujuan untuk mengembangkan media pembelajaran berbasis Google Sites pada mata pelajaran Informatika kelas VIII di SMP Negeri 5 Padang Panjang. Penelitian ini menggunakan pendekatan **Research and Development (R&D)** dengan model **4D** yang terdiri atas tahap **Define, Design, Develop, dan Disseminate**. Media yang dikembangkan dievaluasi melalui uji produk menggunakan **Aiken's V** untuk validitas, **Moment Kappa** untuk praktikalitas, dan **Hake's G-Score** untuk efektivitas. Hasil penelitian menunjukkan bahwa media pembelajaran berbasis Google Sites memperoleh skor validitas rata-rata **0,84** dengan kriteria **valid**. Uji praktikalitas memperoleh skor rata-rata **0,92** dengan kriteria **sangat tinggi**, sedangkan uji efektivitas yang melibatkan **27 siswa** menghasilkan skor rata-rata **0,87** dengan kriteria **sangat tinggi**. Penelitian ini berkontribusi dengan menghadirkan media pembelajaran berbasis Google Sites yang **valid, praktis, dan efektif** sebagai alternatif bagi guru untuk melaksanakan pembelajaran yang lebih interaktif dan efisien serta mendukung motivasi siswa.

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1. Introduction

Education is a deliberate effort to shape learners' character in accordance with social values while also supporting the development of knowledge, communication skills, attitudes, and behavior [1]. In the context of contemporary educational change, efforts to improve educational quality cannot be separated from the use of information and communication technology, which has significantly influenced teaching and learning

processes [2]. The integration of technology has transformed instructional delivery from conventional approaches into learning experiences that are more interactive, effective, and responsive to students' needs in the digital era. Recent studies further indicate that digital media can enrich learning environments and broaden access to instructional resources [28], while well-designed multimedia materials can support deeper understanding and stronger learner engagement [27].

In line with this development, innovation in instructional media has become increasingly important for supporting students' understanding of the subject matter [3]. Teachers are expected not only to master content knowledge but also to utilize and develop instructional media effectively [4]. Instructional media are no longer viewed merely as supplementary teaching aids; rather, they have become an integral part of the instructional process because they can present content in a concise, clear, and efficient manner [5]. However, the use of instructional media by teachers remains less than optimal, which indicates the need for further investigation into effective media use to enhance both the learning process and student outcomes [6].

Web-based instructional media have shown growing potential in supporting learning that is flexible, interactive, and student-centered. Platforms such as Google Sites are widely used because of their accessibility, integration with digital ecosystems, and capacity to present materials multimodally through text, images, videos, and interactive links [7]. This tendency is consistent with the goals of the Merdeka Curriculum, which emphasizes critical thinking, problem-solving, and learner autonomy, particularly in Informatics, a subject that inherently requires case-based inquiry and digital exploration [8].

Previous studies show that although many have reported improved learning interest and easier access through media such as Google Sites, several important limitations remain. Existing research has largely emphasized practicality and attractiveness, but has not sufficiently examined the structured impact of such media on students' critical thinking and conceptual understanding [9], [10]. In many cases, media implementation has also not been accompanied by robust instructional designs such as problem-based learning or project-based learning, meaning that the pedagogical potential of the media has not been fully realized. Additional limitations are evident in teachers' readiness to develop and integrate digital media pedagogically rather than merely technically, as well as in the relatively limited attention given to device accessibility and students' digital literacy [9], [10]. International reviews have also shown that the effectiveness of project-based learning is strongly influenced by implementation design, media support, and the learning outcomes being measured [29], [30]. Therefore, there is a need to develop Google Sites-based instructional media that are not only easily accessible but also pedagogically designed to improve the quality of Informatics learning in a more targeted manner.

Google Sites-based instructional media are particularly relevant for Informatics because many students still struggle to understand the material when instruction relies on monotonous media [11]. One of the main strengths of Google Sites is that it can function as an online learning medium accessible from multiple devices as long as an internet connection is available [12]. Google Sites also enables users to integrate various Google services, such as Google Docs, Sheets, Forms, Slides, Calendar, and YouTube videos, into a single learning environment [8]. In addition, the platform is beginner-friendly because it is

free to use and does not require programming skills [13]. These characteristics suggest that Google Sites has strong potential as an interactive and engaging instructional medium for supporting Informatics learning at SMP Negeri 5 Padang Panjang.

Based on classroom observations and interviews conducted in Grade VIII at SMP Negeri 5 Padang Panjang, several instructional problems were identified, including the dominance of lecture-based teaching, limited media use focused mainly on the whiteboard and textbooks, low student interaction, and insufficient conceptual understanding in Informatics, despite the school's existing facilities such as an ICT laboratory and projectors. These conditions indicate that previous studies have tended to discuss instructional media in general terms, especially in relation to motivation or learning outcomes, but have not specifically developed and implemented Google Sites-based instructional media for Informatics learning in this context, particularly by considering students' limited digital literacy and the lack of interactive classroom engagement. Consequently, a gap exists between the availability of technological facilities and the absence of structured, interactive instructional innovation capable of optimizing Informatics learning. Based on this gap, the novelty of the present study lies in the development of Google Sites-based instructional media designed to create a more interactive, flexible, and learner-responsive Informatics learning environment. The contribution of this study is therefore not limited to offering a practical solution for teachers to use existing technology more effectively, but also includes strengthening the scholarly discussion on digital instructional media innovation and providing empirical reference points for future research on the implementation of web-based instructional media to enhance Informatics learning at the junior secondary level.

This study focuses on the development of Google Sites-based Informatics instructional media to improve conceptual understanding and active participation among Grade VIII students at SMP Negeri 5 Padang Panjang. The developed media include learning materials, videos, and interactive activities designed to support both independent and guided learning [14]. Accordingly, the use of this media is intended to facilitate more effective interaction between teachers and students while creating a learning process that is more active, structured, and technology-enhanced [15].

2. Method

This study employed a Research and Development (R&D) design to develop and evaluate Google Sites-based learning media for Grade 8 Informatics instruction. R&D was selected because it is intended to develop, refine, test, and evaluate the effectiveness of a product, model, method, or strategy. The study adopted the 4-D model, which consists of four stages: Define, Design, Develop, and Disseminate.

2.1. Research Context and Setting

The study was conducted at SMP Negeri 5 Padang Panjang in the context of Grade 8 Informatics learning. The object of the study was Google Sites-based instructional media designed for the Informatics subject.

2.2. Participants

The participants involved in the study consisted of three experts (media and subject-matter experts), one Informatics teacher, and 27 students of SMP Negeri 5 Padang Panjang.

Editorial note: the manuscript does not specify the detailed characteristics of the experts or students.

2.3. *Research Instruments*

Several instruments were used in this study. During the development and evaluation process, data were collected through validation questionnaires, practicality sheets for the teacher and students, and an effectiveness sheet. The validation instrument was used by experts to assess the quality of the product, while the practicality instrument was used to measure the ease of use of the developed media. The effectiveness instrument was used to examine learning outcomes after the implementation of the media. Editorial note: the manuscript does not provide sufficient detail regarding the indicators, number of items, or scale structure of these instruments.

2.4. *Data Collection Procedures*

The study followed the four stages of the 4-D model.

2.4.1. Define

At the Define stage, a needs analysis was conducted through field study and literature study to identify the existing instructional conditions, including the media used by the teacher, student characteristics, and problems in Informatics learning. The outcome of this stage was a formulation of instructional needs and the identification of the main problems to serve as the basis for media development.

2.4.2. Design

At the Design stage, the learning media were planned based on the needs analysis. This stage included the formulation of learning objectives, the selection of materials, interface design, the selection of media format, and the preparation of a storyboard and initial design of the Google Sites-based media. The outcome of this stage was the initial prototype of the instructional media [16].

2.4.3. Develop

At the Develop stage, the initial design was transformed into a usable instructional media product. This stage included the creation of the user interface, the integration of learning materials, and supporting features such as videos and evaluation tasks. The product was then validated by experts and subjected to a limited trial to determine its feasibility and to identify necessary revisions. The outcome of this stage was a revised version of the instructional media that had been improved based on validation and trial results [17].

2.4.4. Disseminate

At the Disseminate stage, the developed and revised media were distributed on a limited basis to students at SMP Negeri 5 Padang Panjang. The outcome of this stage was the implementation of the media in an actual classroom setting. This stage was intended to examine the applicability of the product in a real instructional context before wider use.

2.5. *Product Testing*

2.5.1. Validity Testing

Product validity was assessed to ensure that the developed media met the required quality standards before implementation. In this study, validity testing

was conducted by experts using validation questionnaires. The validity scores were analyzed using Aiken's V, as follows:

$$V = \sum s / [n(c - 1)]$$

where:

$$s = r - l_o$$

l_o = the lowest validity rating

c = the highest validity rating

r = the score given by each rater

n = the number of raters

The criteria for determining validity are shown in Table 1.

Table 1. Validity Criteria

Interval	Category
0.60-1.00	Valid
≤ 0.60	Not Valid

2.5.2. Practicality Testing

Practicality testing was conducted to determine the extent to which the product was easy to use and manageable during implementation. A product was considered practical if it could be used easily and without unnecessary complexity. Practicality was assessed using teacher and student practicality sheets. The practicality data were analyzed using the Moment Kappa formula:

$$\text{momen kappa } (k) = \frac{\rho_o - \rho_e}{1 - \rho_e}$$

Description:

K = Moment Kappa coefficient indicating product practicality

P = the realized proportion, calculated by dividing the total score given by respondents by the maximum possible score

P_e = the unrealized proportion, calculated by subtracting the total obtained score from the maximum score, then dividing it by the maximum score

The resulting Kappa coefficient was interpreted using the practicality categories shown in Table 2.

Table 2. Moment Kappa Decision Categories

Interval	Category
0.81-1.00	Very High
0.61-0.80	High
0.41-0.60	Moderate
0.21-0.40	Low
0.01-0.20	Very Low
≤ 0.00	Not Practical

2.5.3. Effectiveness Testing

Effectiveness testing was conducted to determine how far the use of Google Sites-based instructional media supported learning outcomes. The effectiveness data were analyzed using Richard R. Hake's G-Score, as follows:

$$g = \frac{S_f - S_i}{S_{max} - S_i}$$

where:

G = G-Score

S_f = final score

S_i = initial score

The effectiveness level was interpreted using the criteria in Table 3 [2].

Table 3. G-Score Criteria

G-Score	Criteria
$g > 0.7$	High Effectiveness
$0.3 < g < 0.7$	Moderate Effectiveness
$g < 0.3$	Low Effectiveness

2.5.4. Validity and Reliability

The study addressed product validity through expert judgment using Aiken's V. Editorial note: the manuscript does not report reliability testing for the research instruments; therefore, no reliability statement can be added.

3. Result and Discussion

3.1. Result

This study produced Google Sites-based instructional media for Grade 8 Informatics at SMP Negeri 5 Padang Panjang through the 4D development model, consisting of the Define, Design, Develop, and Disseminate stages. The results are presented according to the development process and the outcomes of product evaluation.

3.1.1. Define Stage

At the define stage, initial analysis, concept analysis, and learning objective analysis were conducted. Classroom observations and interviews with the Informatics teacher revealed that instructional media use was still limited and monotonous, resulting in low student interest and insufficient understanding of computer-related concepts. Although the school had supporting facilities, learning was still dominated by conventional explanation. Therefore, technology-based learning media accessible through Android devices and laptops were considered necessary to support more flexible and engaging Informatics learning. The learning objectives were then formulated to ensure that the developed media would align with the expected learning outcomes.

3.1.2. Design Stage

The design stage focused on preparing the initial structure of the Google Sites-based learning media [18]. At this stage, the navigation system was designed to allow students to access materials and features systematically and intuitively. The main navigation structure is presented in Figure 1, which shows the organization of the main menu and its supporting pages.

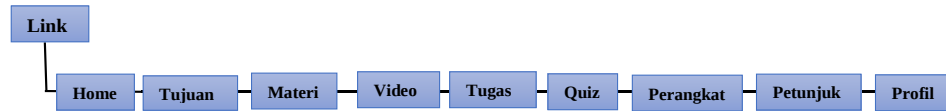


Figure 1. Main Navigation

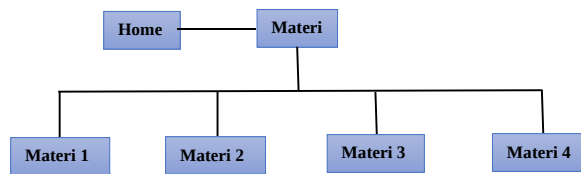


Figure 2. Course Navigation

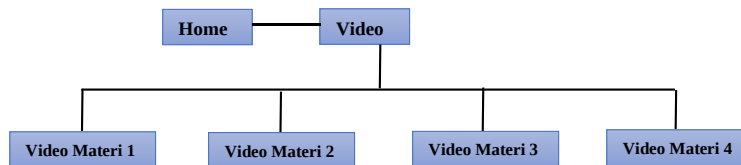


Figure 3. Video Navigation

In addition, a storyboard was developed to visualize the instructional flow, media structure, and user interaction. As shown in Table 2, the storyboard consisted of nine scenes, including the main menu, learning objectives, materials, videos, tasks, quizzes, learning devices, usage instructions, and developer profile. This storyboard served as the main guide for product development and ensured that the learning media followed a coherent instructional sequence [19]

Table 2. Storyboard

Scene	Description
1	Main page containing the school logo, media title, and menus for materials, videos, tasks, quizzes, learning devices, usage instructions, and profile
2	Learning objectives page
3	Materials page containing four learning materials
4	Video page containing four supporting videos
5	Task page containing four tasks
6	Quiz page containing four quizzes
7	Learning devices page containing four teaching modules
8	Usage instructions page
9	Developer profile page

3.1.3. Develop Stage

At the Develop stage, the initial design was realized into a usable product by integrating learning materials, multimedia elements, and interactive features.

The product included a cover page, main menu, materials page, videos, tasks, quizzes, learning devices, usage instructions, and profile page.

The cover page was designed to provide an attractive initial display and a clear identity for the media, as shown in Figure 6. The main menu presented access to all learning components in a simple and intuitive interface (Figure 7). The materials page displayed the content systematically and contextually so that students could understand the topics more easily (Figure 8). In addition, the video page functioned as supporting media to clarify the explanation of concepts (Figure 9), while the quiz page was developed as an interactive evaluation feature to measure student understanding (Figure 11). These components indicate that the product was designed not only as a digital container of content but also as an integrated learning environment.



Figure 4. Desain Cover

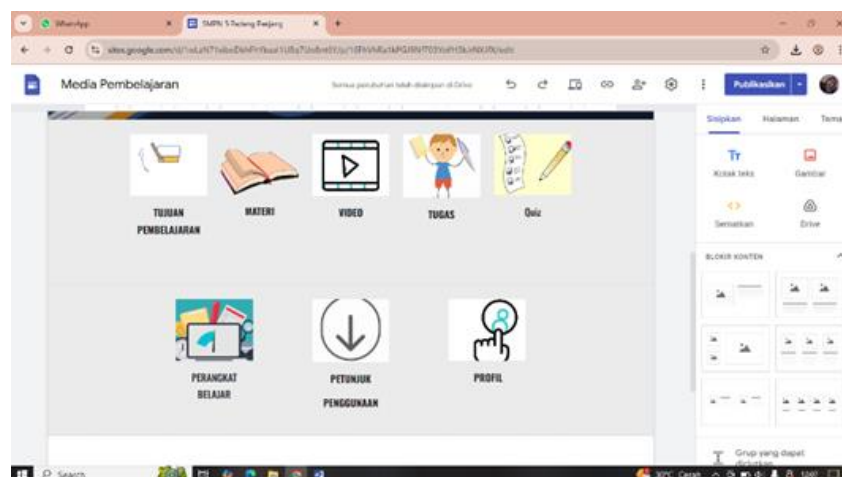


Figure 4. Main Menu Desain

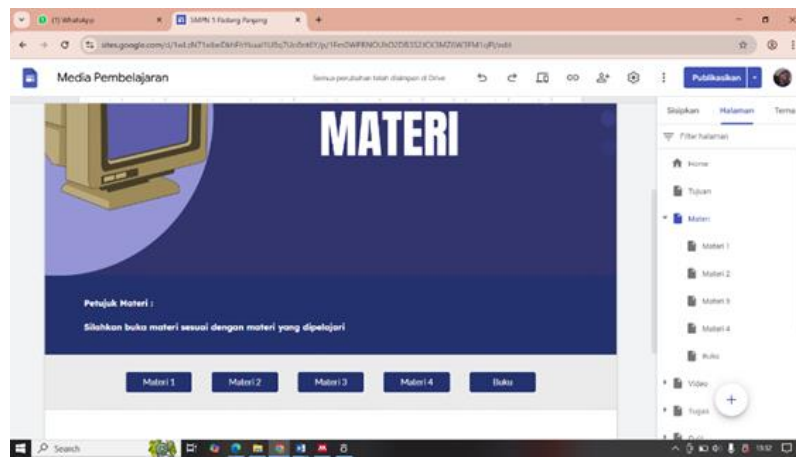


Figure 5. Course Desain UI

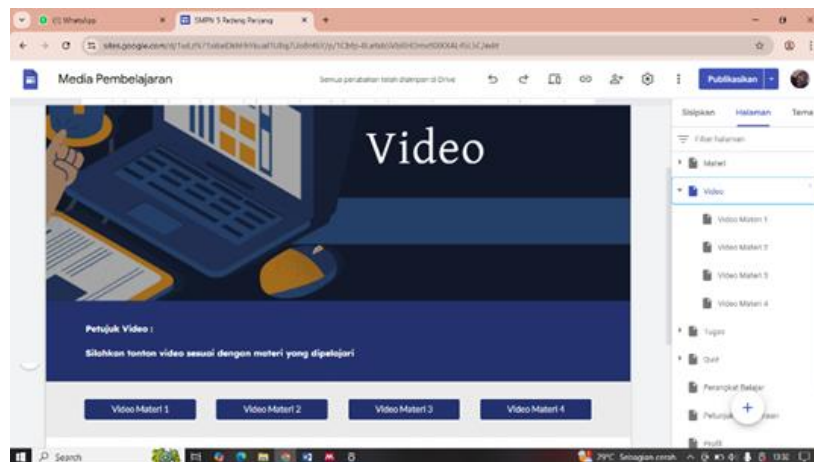


Figure 6. Video Desain UI

3.1.4. Disseminate Stage

At the disseminate stage, the developed media were implemented on a limited basis for Grade 8 Informatics learning at SMP Negeri 5 Padang Panjang. This stage represented the initial application of the media in an actual classroom setting

3.2. Product Testing Results

3.2.1. Validity Results

The validity test covered the aspects of content, language, and design of the developed product. Validation was conducted by three computer science lecturers using Aiken's V. The results are presented in Table 3. Irman Efendi, S.Pd., M.Kom. gave a score of 0.95, Rohaniatul Husna, S.Pd., M.Kom. gave 0.88, and Hari Antoni Musril, S.Kom., M.Kom. gave 0.70. The total score was 2.53, with an average of 0.84, which placed the product in the valid category.

Table 3. Validity Test Results

Validator	Score
Irman Efendi, S.Pd., M.Kom.	0.95
Rohaniatul Husna, S.Pd., M.Kom.	0.88
Hari Antoni Musril, S.Kom., M.Kom.	0.70
Total	2.53
Average	0.84

Criterion	Valid
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3.2.2. Practicality Results

The practicality test was conducted to determine whether the developed Google Sites-based media were easy to use in Informatics learning. Based on the practicality test administered to the Informatics teacher, Sisca Murya, S.Kom., the average Moment Kappa score was 0.92, which was categorized as very practical. This result indicates that the media were feasible and convenient to use in classroom instruction.

Table 4. Practicality Test Result

Evaluator	Practicality Score	Category
Sisca Murya, S.Kom	0.92	Very Practical

3.2.3. Effectiveness Results

The effectiveness test was conducted to examine whether the developed media supported students' understanding of the provided Informatics materials. Based on the effectiveness test administered to 27 students, the average G-Score was 0.87, which fell into the high category. This result indicates that the Google Sites-based learning media were highly effective in supporting classroom learning. Detailed results for each student are presented in Table 5

Table 5. Effectiveness Test Results

Student	Before (Si)	After (Sf)	g Score
Farlan Anza P	24	94	0.92
Azrina Afrida	30	92	0.88
Pangalila Yusuf	32	86	0.86
Febrian Dirgantara	24	94	0.92
Aufa Qarruunada	40	90	0.80
Muhammad Fadhil	40	92	0.83
Sofiya	34	92	0.87
Mahesa Al Fathir	30	88	0.82
Talita Hasna Salli	30	96	0.94
M. Dimas Prasetyo	30	96	0.94
M. Azzam Asyufi	28	94	0.92
Barnes Aditia	22	98	0.98
Rahmania Aisya	34	92	0.88
Nazayla Syafira	30	88	0.82
Hawra Nafsya Nafasa	24	92	0.88
Antonio Andescko Bakil	22	88	0.84
Yuri Chariss Putri	26	90	0.86
Rani Ramadhani	30	90	0.86
Billa Afriliyantika	28	88	0.83
Ravel Saputra	30	90	0.88
Indah Putri	48	90	0.80
Arif Saifullah	22	88	0.84
Tsalitsa Risty Fathia	26	90	0.86
Nathasya Amelia Putri	22	90	0.88
Naufal Zaky Ramadhan	24	96	0.95
Jumaidil	24	90	0.87
Fransiska Meicha	34	88	0.82

Overall Average	0.87
Category	High

3.3. Discussion

The findings of this study indicate that the developed Google Sites-based learning media for Informatics met the criteria of being valid, practical, and effective [14]. These results suggest that the product was not only appropriate in terms of content and media quality, but also feasible for classroom use and capable of supporting student learning. In particular, the positive evaluation results imply that the media were aligned with the instructional needs of Grade 8 students and were suitable for facilitating a more structured and interactive learning process.

The validity and practicality of the media appear to be closely related to several design characteristics, including the simple interface, clear navigation system, and the structured presentation of content through menus such as learning objectives, materials, videos, tasks, quizzes, learning devices, instructions, and profile [20]. These characteristics enabled students to access the content more independently and reduced technical barriers during implementation. In addition, the integration of various forms of digital content within a single platform increased the accessibility and instructional relevance of the media for Informatics learning [21]. This finding is consistent with research showing that digital learning environments become more effective when multimedia elements are organized coherently and support learners' cognitive processing [27]. It also supports broader evidence that digital media can enrich learning environments and expand instructional access when designed in ways that respond to learner needs [28].

The present findings are also in line with previous studies reporting that web-based learning media can improve student engagement and learning motivation because they are interactive and easily accessible. Previous studies have shown that the use of Google Sites can increase learning interest and provide a more flexible learning experience than conventional approaches [22]. Thus, the present study strengthens earlier findings that digital media play an important role in supporting instructional effectiveness [23]. At the same time, this study extends previous work by focusing specifically on junior secondary Informatics learning, a context that requires conceptual understanding, digital exploration, and learner interaction. In this regard, the findings are also compatible with international reviews showing that the effectiveness of technology-supported learning depends not only on media attractiveness, but also on instructional design and the nature of the targeted learning outcomes [29], [30].

This study contributes to the field by developing Google Sites-based instructional media specifically designed for Informatics at the junior secondary level. The contribution lies not only in the production of a media product that can be directly used in classroom instruction [24], but also in offering an alternative instructional strategy that helps teachers create learning experiences that are more interactive, systematic, and technology-based. In addition, the study enriches the discussion on digital instructional media development in basic and secondary education [15]. From a pedagogical perspective, the findings suggest that web-based media can support more active and learner-responsive classroom practice when the

platform is designed around instructional goals, student needs, and usability considerations.

Nevertheless, this study has several limitations. One major limitation concerns accessibility, as not all students had stable internet access to use the media optimally. Another limitation lies in the variation of digital literacy skills among students and teachers in using the available features [25]. These limitations indicate that the successful implementation of web-based instructional media requires not only a well-developed product, but also adequate infrastructure and user readiness. This finding is consistent with broader concerns in the literature that the educational value of digital media depends heavily on contextual factors such as technological access, implementation conditions, and users' digital competence [28]. Therefore, future studies should focus on developing more adaptive and inclusive media and examining their implementation across broader contexts and more diverse learner groups [26].

4. Conclusion

This study achieved its objective by developing Google Sites-based learning media for Grade 8 Informatics at SMP Negeri 5 Padang Panjang that met the criteria of being valid, practical, **and** effective. The findings indicate that the developed media were able to support the learning process and facilitate the achievement of instructional objectives more optimally.

The main contribution of this study lies in the development of a digital learning medium specifically designed for junior secondary Informatics instruction. In scholarly terms, the study contributes to the growing body of work on digital instructional media in the context of Informatics learning at the SMP level. In practical and pedagogical terms, the developed media offer teachers an alternative technology-based instructional strategy for creating learning experiences that are more interactive, structured, and responsive to students' needs.

Overall, the findings suggest that Google Sites-based learning media can serve as a relevant instructional innovation for supporting contemporary classroom practice. Editorial note: if the manuscript already includes explicit study limitations and future research directions in the Discussion section, they should be briefly aligned and restated here in one concise sentence.

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Declarations

Author Contribution Statement

The first author was responsible for the conceptualization and design of the study, data collection, data analysis and interpretation, and the initial drafting of the manuscript. The second author contributed to data analysis, validation of the research findings, and critical revision of the intellectual content of the manuscript. The third author provided research supervision, methodological input, and conducted the final review and revision of the manuscript. All authors have read, reviewed, and approved the final version of the manuscript for publication.

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Data Availability Statement

The data generated and/or analyzed during this research are not publicly available. The datasets and supporting research materials are available from the corresponding author upon reasonable request. Data access requests will be considered in accordance with applicable research ethics, data confidentiality, and proprietary rights.

Declaration of Interests Statement

The authors declare that there are no conflicts of interest, either financial or non-financial, that may have influenced the study design, data collection and analysis, interpretation of results, preparation of the manuscript, or decision to publish this study.

AI Use Statement

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[3] The authors did not use generative AI or AI-assisted tools in the writing, editing, or preparation of this manuscript.

Additional Information

Correspondence and requests for materials should be addressed to: [nadaaudrey81@gmail.com, gusnitadarmawati@iainbukittinggi.ac.id, firdaus.annas@uinbukittinggi.ac.id, yulifdaelin@iainbukittinggi.ac.id].

List the ORCID iD for each author (if available) using the full URL format. ORCID ensures unambiguous author identification and accurate attribution of scholarly work.

[Nada Safarina], <https://orcid.org/0009-0003-9298-9628>

[Gusnita Darmawati], <https://orcid.org/0009-0008-8001-618X>

[Firdaus Annas], <https://orcid.org/0009-0007-5585-1100>

[Yulifda Eliyuspita], <https://orcid.org/my-orcid?orcid=0009-0003-7901-2505>

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