

## Development of learning media for physical education (PE) materials on sexually transmitted diseases using google sites

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### Abstract

This study addresses the limited use of interactive digital learning media in teaching sexually transmitted diseases (STDs) within Physical Education, Sports, and Health (PJOK) at the senior high school level, which often leads to low student engagement and insufficient understanding of reproductive health concepts. The study aims to develop Google Sites-based learning media, test its feasibility, and analyze teacher and student responses to its implementation. This research employed a Research and Development (R&D) approach using the ADDIE model, consisting of analysis, design, development, implementation, and evaluation stages. Data were collected through expert validation, teacher assessments, small-scale student trials (12 students), large-scale trials (40 students), teacher responses (37 teachers), as well as pre-test and post-test evaluations involving 44 students with a control group. The results show that the developed learning media achieved a very high level of feasibility, with validation scores of 96% from material experts, 89% from learning experts, and 98% from media experts, all categorized as very good. Student responses were also highly positive, with 90% in the small-scale trial and 94% in the large-scale trial, while teacher responses from PJOK MGMP in public senior high schools in Sambas Regency reached 98%, all within the very good category. In addition, student learning outcomes increased by 28.73% based on pre-test and post-test results. These findings indicate that Google Sites-based learning media is feasible and effective in improving student engagement and understanding of STD materials. This study contributes to the integration of digital technology in PJOK learning and highlights the importance of interactive media in delivering sensitive health topics. Future research is recommended to explore broader implementation and long-term learning impact.

**Keywords:** learning media; sexually transmitted disease material; google sites.

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### INTRODUCTION

Education serves as a fundamental pillar in the development of high-quality human resources, as it plays a strategic role in shaping character, enhancing knowledge, and continuously developing individual skills (Khairiyah & Dewinda, 2022). In Indonesia, education is recognized as a fundamental right of every citizen, while the government is entrusted with the responsibility of administering a national education system oriented toward strengthening moral, spiritual, and intellectual aspects (Nazhifah & Najicha, 2023). In line with the dynamics of societal development and the demands of 21st-century learning, national education policies continue to evolve through the implementation of the Kurikulum Merdeka Indonesia, which emphasizes differentiated learning, competency strengthening, and the integration of digital technology in the learning process (Mulbar, Bernard, & Pesona, 2017).

At the senior high school level, the subject of Physical Education, Sports, and Health (PJOK) is not solely focused on physical activities but also encompasses comprehensive health aspects, including reproductive health education (Mustafa & Dwiyoogo, 2020). One of the essential topics is sexually transmitted diseases (STDs), such as syphilis and HIV/AIDS, which are taught in Phase E and Phase F. This material is of high importance, considering that adolescents are a vulnerable group prone to engaging in risky behaviors related to reproductive health (Mawardika et al., 2025) (Azkiya;, Endarwati;, Yastutik;, & Wijayanti, 2025). Furthermore, the increasing trend of sexually transmitted disease cases across various regions underscores the urgency of school-based educational interventions. Local data from the Sambas District Health Office (2025) indicate a rise in HIV/AIDS cases as well as other sexually transmitted infections, highlighting the need for more effective and contextual learning strategies.

This phenomenon is consistent with reports from the World Health Organization, which emphasize that school-based reproductive health education plays a significant role in improving adolescents' knowledge, attitudes, and preventive behaviors related to sexually transmitted diseases (Margiyati & Kurniawati, 2025). Furthermore, recent studies indicate that learning approaches integrating digital technology and interactive media are more effective in enhancing student engagement and understanding compared to conventional methods (Mayer, 2020; García-Martínez et al., 2023) (Syaparudin;, Rahmat, & Suhairi, 2023). However, the implementation of STD-related learning in schools still faces several challenges, including low student interest in sensitive and theoretical topics, limited availability of innovative learning media, and the continued dominance of lecture-based methods that tend to be less interactive.

However, the implementation of sexually transmitted disease (STD) education in schools faces several challenges. First, students tend to exhibit low interest and motivation in learning materials that are perceived as theoretical and sensitive in nature (Kathleen Pasassung & Octavia, 2026). Second, there is a limitation in learning resources, such as textbooks and innovative instructional media (Yogi Fernando, Popi Andriani, & Hidayani Syam, 2024). Third, the dominance of conventional teaching methods contributes to students' limited understanding of reproductive health concepts (Asmaniyah, 2022). In contrast to outdoor practical learning activities, which are generally more engaging, classroom-based theoretical instruction requires more interactive and contextual approaches to effectively enhance student engagement and comprehension (Mayer, 2020) and (Risma Oktaria & Evi Martha, 2023).

Along with the rapid advancement of digital technology, the use of web-based learning media has emerged as an innovative solution to enhance the effectiveness of the learning

process. One promising platform is Google Sites, which enables teachers to develop interactive, flexible, and easily accessible learning media. Several previous studies have demonstrated the high feasibility and effectiveness of Google Sites in educational settings. For instance, Jelantik, Gunawan, & Purwanto, (2024) found that Google Sites-based interactive learning media on healthy lifestyle topics were effective in improving student learning outcomes. Similarly, Porja Daryanto, Sari, and Lusiyono Lucius, (2025) reported that Google Sites-based media for pencak silat materials were feasible and effective in supporting students' understanding of martial arts techniques, as well as assisting teachers in delivering instructional content. Another study by Utami, Cahyadi, & Sari, (2024) also highlighted that the integration of Google Sites in learning contributes positively to student engagement and learning effectiveness, particularly through the use of multimedia and interactive features. In addition, Rahmad, Daryanto, & Cahyadi, (2025) developed a Google Sites-based learning media for football instruction, which demonstrated an increase in student engagement. The use of interactive learning media has also been shown to enhance students' curiosity and interest in the learning content (Suhairi, Asmawi, Tangkudung, Hanif, & Dlis, 2020).

Nevertheless, several research gaps remain in previous studies. First, most studies have primarily focused on sports skills or general health topics, with limited attention given to sexually transmitted diseases (STDs), which involve complex concepts and high levels of sensitivity. Second, the developed media generally rely on external visual sources, such as videos from other platforms, and have not fully optimized independently developed and integrated digital content. Third, there is still a lack of research integrating a deep learning approach in the development of Google Sites-based learning media, particularly within the context of the Merdeka Curriculum at the senior high school level.

Based on the identified problems and research gaps, this study proposes a novel contribution (state of the art) in the form of developing Google Sites-based learning media specifically designed for sexually transmitted diseases (STDs) material for Grade X and XI senior high school students. The media is developed by integrating a deep learning approach that emphasizes the strengthening of conceptual understanding, and is supported by independently designed 3D animation-based visual content to enhance both the attractiveness and clarity of the instructional material.

The integration of digital technology in this learning media is expected to enhance the effectiveness of the learning process, promote active student engagement, and improve understanding of essential and contextual reproductive health material. The use of Google Sites is considered appropriate due to its capability to integrate various multimedia elements, such

as text, images, videos, and interactive assessments, within a single platform that is easily accessible and flexible for use both inside and outside the classroom.

Thus, the development of Google Sites-based learning media not only serves as a technological innovation in education but also acts as a strategic solution to accommodate students' learning needs in a more engaging, interactive, and contextual manner. Furthermore, this media is expected to contribute to improving the quality of learning on sexually transmitted diseases (STDs) and to promote active student participation in the learning process.

## **METHOD**

This study employed a Research and Development (R&D) method aimed at producing a learning media product and evaluating its feasibility and effectiveness. The R&D method is a research approach used to systematically develop and validate educational products (Sugiyono, 2020). The development model applied in this study is the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), which was selected due to its systematic structure and suitability for developing digital-based learning media (Triyanto, Suhairi, & Sari, 2025). The ADDIE model consists of five stages: (1) analysis, which involves identifying needs and user characteristics; (2) design, which includes planning the media and content; (3) development, which focuses on product creation; (4) implementation, which involves testing the use of the product; and (5) evaluation, which includes assessing and revising the product (Sugihartini, & Yudiana, 2018).

This study was conducted at SMA Negeri 3 Tebas, Sambas Regency. The research subjects consisted of a small-scale trial involving 12 students and a large-scale trial involving 40 students, including 6 Grade X students and 6 Grade XI students. In addition, the study also involved 37 teachers who are members of the Physical Education, Sports, and Health (PJOK) Subject Teachers' Forum (MGMP) of public senior high schools across Sambas Regency as user respondents. Product validation was carried out by three experts. The media expert was a university lecturer in the field of Information and Communication Technology (ICT) with at least 10 years of teaching experience in media studies. The learning expert was a PJOK teacher with a minimum of 15 years of teaching experience, who is a certified teacher, a teacher practitioner (Guru Penggerak), and an active member of professional development programs. The material expert was a Civil Servant in the field of Public Health working at a Community Health Center (Puskesmas) in Sambas Regency with more than 10 years of work experience. To examine the effectiveness of the developed learning media, the researcher employed a pre-

test and post-test experimental design involving 44 students, divided into two groups: an experimental group and a control group..

Product validation was carried out by three types of experts. The media expert was a university lecturer in the field of media or Information and Communication Technology (ICT) with a minimum of 10 years of professional experience. The learning expert was a PJOK teacher with at least 15 years of teaching experience, actively involved in the “Guru Penggerak” program, and holding a professional teaching certification. The material expert was a civil servant in the field of public health working at a community health center (Puskesmas) in Sambas Regency, with more than 10 years of work experience.

The instrument used in this study was a questionnaire based on a five-point Likert scale (Pranatawijaya, Widiatry, Priskila, & Putra, 2019). This instrument was designed to measure the feasibility of the developed learning media as well as user responses to the product. The questionnaires consisted of several types. First, the material expert questionnaire was used to assess the relevance and quality of the instructional content, referring to the evaluation standards of the National Education Standards Agency (Poerwanti, 2018). (2) Second, the learning expert questionnaire was employed to evaluate the alignment of the media with learning outcomes, learning objectives, and instructional principles. This instrument was developed based on the Learning Object Review Instrument (LORI) version 2.0 proposed by Nesbit et.al as cited in Suwandi, Hardini, & Mulyadi, 2023). (3) Third, the media expert questionnaire was used to assess aspects such as visual appearance, interactivity, and the technical quality of the learning media, developed based on the theories of Levie and Lentz, as well as Walker and Hess (Sari; & Susilowibowo, 2017). (4) Finally, the user response questionnaire (students and teachers) was used to determine user satisfaction and perceptions of the Google Sites-based learning media, adapted from (Sanaky, 2009) and Google Material Design Guidelines (Google, 2016).

Data analysis in this study employed a combination of quantitative and qualitative approaches. (1) Quantitative data analysis was obtained from questionnaire assessments conducted by experts and users. The data were analyzed using descriptive quantitative techniques by converting the obtained scores into percentages using the following formula:

$$NP = \frac{R}{SM} \times 100\%$$

Description:

- NP : The percentage score obtained
- R : The raw score achieved
- SM : The ideal maximum score of the test
- 100 : Constant value

The assessment scale used in this study was a five-point Likert scale, consisting of: very good (5), good (4), fair (3), poor (2), and very poor (1). The percentage results were then categorized based on the following criteria:

**Table 1.** Criteria for the Success of Students' Learning Motivation

Percentage	Category
86% - 100%	Very Good
76% - 85%	Good
60% - 75%	Fair
55% - 59%	Poor
≤ 54%	Very Poor

The learning media was considered feasible if it achieved a minimum score within the “good” category ( $\geq 76\%$ ) across all assessment aspects. (2) Qualitative data analysis was derived from interviews, comments, and suggestions provided by experts and users. These data were analyzed descriptively to serve as a basis for revising and improving the developed product.

## RESULT

In the analysis phase, this study was conducted to identify learning needs, existing problems, and the characteristics of students and teachers in Physical Education, Sports, and Health (PJOK) learning, particularly on sexually transmitted diseases (STDs) material at the senior high school level. The results of the analysis indicate that PJOK learning on reproductive health topics is still predominantly delivered through lecture-based methods and conventional teaching media, which are not yet optimal in enhancing student engagement and understanding. In addition, it was found that the use of interactive digital learning media is still very limited among teachers when delivering sensitive topics such as STDs. This condition has contributed to low student interest in learning and insufficient conceptual understanding of reproductive health issues. Teachers also expressed the need for more attractive, easily accessible, and technology-based learning media that align with the characteristics of digital-native students. The analysis of student needs shows that learners have a high level of interest in internet-based media and digital devices, particularly those that are interactive and visually oriented.

However, there is currently a lack of learning media that specifically accommodates these needs in PJOK instruction.

Based on the curriculum analysis, STD material is included in core competencies that require both cognitive understanding and preventive attitudes toward reproductive health. Therefore, there is a need for learning media that can present the material in a systematic, engaging, and easily understandable manner. The findings of this analysis phase serve as the foundation for developing Google Sites-based learning media, which is designed to enhance learning interaction, conceptual understanding, and student engagement in PJOK learning on STD topics.

### *Design Stage*

The product developed in this study is a Google Sites-based learning media for sexually transmitted diseases (STDs). This media was developed using the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation.

In the design stage, the learning media was systematically planned by determining the structure, content layout, and key features to support effective learning. The developed media includes several main features: (1) an interactive learning content page presenting concepts of sexually transmitted diseases (syphilis and HIV/AIDS), (2) self-developed 3D animated videos to clarify abstract concepts, (3) an online-based evaluation quiz, and (4) a responsive and user-friendly navigation system.

### *Development Stage*

The development of this media was designed to support a deep learning approach by emphasizing conceptual understanding and the connection of learning materials to real-life situations. This study involved three expert validators, namely a media expert, a content expert, and a learning expert. The results of the media expert validation in the development of the Google Sites-based learning media for sexually transmitted diseases indicated that the developed product was highly feasible for use in learning.

**Table 2.** Media Expert Validation Results Data

<b>No</b>	<b>Indicator</b>	<b>R</b>	<b>SM</b>	<b>Percentage %</b>	<b>Category</b>
1	Feasibility of the language/textual aspect in the media	15	15	100%	Very Good
2	Feasibility of the media presentation aspect	24	25	96%	Very Good
3	Feasibility of the media's effect on the instructional strategy	34	35	97%	Very Good
4	Overall quality of the media	25	25	100%	Very Good
	Overall Average	98	100	98%	Very Good

The media expert validation results, as presented in Table 1, consist of four assessment aspects. First, the language and writing feasibility aspect obtained a score of 100%, categorized as very good. Second, the media presentation aspect obtained a score of 96%, categorized as very good. Third, the media’s effect on instructional strategy obtained a score of 97%, categorized as very good. Fourth, the overall media quality obtained a score of 100%, categorized as very good. Overall, the average score of media expert validation was 98%, which falls into the very good category.

The results of the material expert validation of the developed Google Sites-based learning media for sexually transmitted diseases are presented as follows.

**Table 3.** Material Expert Validation Results Data

No	Indicator	R	SM	Percentage ( % )	Category
1	Material Quality	15	15	100%	Very Good
2	Effectiveness Level	19	20	95%	Very Good
3	Accuracy of the Material	33	35	94%	Very Good
4	Relevance of the Material	29	30	97%	Very Good
	Overall Average	96	100	96%	Very Good

The validation data, as presented in Table 2, consist of four assessment aspects based on the material expert evaluation. First, the material quality aspect obtained a score of 100%, categorized as very good. Second, the effectiveness level obtained a score of 95%, categorized as very good. Third, the material accuracy obtained a score of 94%, categorized as very good. Fourth, the material relevance obtained a score of 97%, categorized as very good. Overall, the average score of the material expert validation was 96%, which falls into the very good category.

The results of the learning expert validation of the developed Google Sites-based learning media for sexually transmitted diseases are presented as follows.

**Table 4.** Learning Expert Validation Results Data

No	Indicator	R	SM	Percentage %	Category
1	Content Quality	35	40	87%	Very Good
2	Learning Objectives	12	15	80%	Good
3	Activities and Evaluation	22	25	88%	Very Good
4	Motivation	20	20	100%	Very Good
	Overall Average	89	100	89%	Very Good

The learning expert validation data, as presented in Table 3, consist of four assessment aspects. First, the content quality obtained a score of 87%, categorized as very good. Second, the learning objectives obtained a score of 80%, categorized as good. Third, the activities and evaluation aspect obtained a score of 88%, categorized as very good. Fourth, the motivation aspect obtained a score of 100%, categorized as very good. Overall, the average score of the learning expert validation was 89%, which falls into the very good category.

In addition to the validation questionnaire results from the three validators, this study also obtained several suggestions from the media expert, material expert, and learning expert. The suggestions and corresponding improvement actions are presented as follows.

**Table 5.** Validator Suggestions and Follow-up Improvements

<b>No</b>	<b>Validator</b>	<b>Validator Suggestions</b>	<b>Improvement Actions</b>
1	Media Expert	The design appearance is still inconsistent (colors, fonts, and layout).	Standardizing the use of colors, font types, and layout across all Google Sites pages to ensure a more aesthetic and professional appearance.
2	Material Expert	The material does not yet cover all types of sexually transmitted diseases comprehensively.	Adding more comprehensive content (types, causes, symptoms, prevention, and treatment).
		Some scientific terms have not been explained in a simplified manner.	Adding explanations of terms using language that is easy for students to understand.
		The learning references have not been clearly included.	Adding valid and up-to-date references to each learning material.
		The case examples are not yet sufficiently contextual to students' daily lives.	Adding real-life case examples that are relevant to adolescents' daily lives.
3	Learning Expert	The media does not yet fully reflect an active learning approach.	Adding interactive activities such as quizzes, discussions, and reflection.
		The learning evaluation is still limited.	Developing a variety of evaluation questions (multiple choice, fill-in-the-blank, and case study-based questions).
		There is no direct feedback provided on evaluation results.	Adding automatic feedback in quizzes to improve students' understanding.

After making several revisions based on the validators' suggestions regarding the development of the Google Sites-based learning media for sexually transmitted diseases, the study proceeded to the field testing stage, namely the implementation phase.

*Implementation Stage*

After the validation process and revisions based on feedback from the media expert, content expert, and learning expert, the developed learning media was further subjected to user testing. The first field trial was conducted through a small-scale test, with the following results.

**Table 6.** Small-Scale Student User Response Data

No	Indicator	R	SM	Percentage %	Category
1	Appearance	269	300	90%	Very Good
2	Content Presentation	112	120	93%	Very Good
3	Benefits	160	180	89%	Very Good
	Overall Average	541	600	90%	Very Good

The results of the user response test for the Google Sites-based learning media on sexually transmitted diseases were obtained from student users. Responses were collected from 12 students of Grade X and Grade XI. The results showed that the display indicator scored 90% (very good category), the material presentation indicator scored 93% (very good category), and the benefit indicator scored 89% (very good category). The overall average score of the small-scale trial was 90%, which is categorized as very good.

Therefore, the learning media is considered feasible to proceed to a larger-scale group trial. The results of the large-scale trial are presented as follows.

**Table 7.** Large-Scale Student User Response Data

No	Indicator	R	SM	Percentage %	Category
1	Tampilan	928	1000	93%	Sangat Baik
2	Penyajian materi	380	400	95%	Sangat Baik
3	Manfaat	566	600	94%	Sangat Baik
	Rata-rata Keseluruhan	1874	2000	94%	Sangat Baik

The results of the user response test for the Google Sites-based learning media on sexually transmitted diseases, involving 40 students from Grade X and Grade XI, showed that the average student response in the large-scale trial reached 94%, which is categorized as very good.

Considering that the users of the learning media are not only students but also teachers, this study also examined the responses of PJOK teachers. A total of 37 PJOK teachers who are members of the MGMP (Subject Teacher Association) for Senior High Schools across Sambas Regency participated in this study. The data obtained are presented as follows:

**Table 8.** Teacher User Response Data of PJOK at Senior High Schools in Sambas Regency

No	Indicator	R	SM	Percentage %	Category
1	Appearance	906	925	98%	Very Good
2	Content Presentation	370	370	100%	Very Good
3	Benefits	542	555	98%	Very Good
	Overall Average	1818	1850	98%	Very Good

From the data above, it can be concluded that the user responses from 37 PJOK teachers who are members of the MGMP PJOK for public senior high schools in Sambas Regency reached 98%, which is categorized as very good.

To examine the effectiveness of the developed learning media, a pre-test and post-test experimental design was conducted with a control group involving 44 students divided into two groups. Based on the student user data, the following results were obtained.

**Table 9.** Pre-Test and Post-Test Results

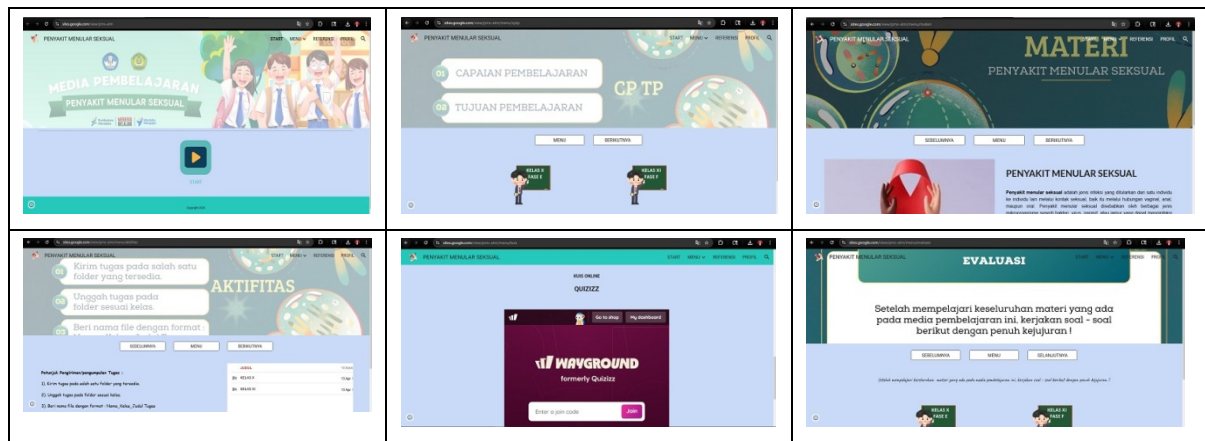
Groups	Pretest	Posttest	Changes (%)
Respondents	59,63%	88,36%	28,73%

There was an increase in students' knowledge of 28.73% based on the results of the pre-test and post-test. Therefore, it can be concluded that the Google Sites-based learning media for sexually transmitted diseases is categorized as effective and suitable for use as a learning medium.

### *Evaluation Stage*

The evaluation results indicate that the Google Sites-based learning media received positive responses from users. Students stated that the media interface was attractive, the learning materials were easy to understand, and the access was practical. In addition, the media was considered helpful in improving their understanding of sexually transmitted disease (STD) materials. Furthermore, the integration of images, videos, and interactive links within Google Sites was found to enhance learning flexibility, as it can be accessed anytime and anywhere. The product had also undergone evaluation and revision in collaboration with validators during the third stage (development).

Overall, the evaluation results show that the Google Sites-based learning media for sexually transmitted diseases is feasible to be used as a learning medium and is capable of supporting a more interactive, effective, and innovative learning process. The final appearance of the product is presented as follows.



**Figure 1.** Screenshots of the Final Product of the Google Sites-Based Learning Media Development for Sexually Transmitted Diseases Material. (Source: Personal Documentation)

## DISCUSSION

The results of the study indicate that the Google Sites-based learning media on sexually transmitted diseases (STDs), developed using the ADDIE model, demonstrated a very high level of feasibility and received positive responses from users. The high validation score from media experts (98%) indicates that the learning media fulfilled the principles of visual communication design, readability, and interactivity. The maximum scores achieved in the language and media quality aspects suggest that the information presented was consistent with the principles of message clarity in digital learning environments. This finding is in line with the Multimedia Learning Theory, which states that the effective integration of text, images, and animations can enhance students' cognitive understanding by optimizing both visual and verbal memory processes simultaneously (Mayer, 2020) (Hardika, Suhairi, Maksum, Suhartini, & Permana, 2024). Furthermore, the high score in the aspect of the media's effect on instructional strategy indicates that the learning media is not only visually engaging but also capable of supporting a more effective, structured, and learner-centered instructional process (Puspitarini & Hanif, 2019).

From the material perspective, the expert validation result of 96% indicates that the developed content possesses very high quality, accuracy, and relevance to the intended learning outcomes. The high scores in the aspects of material quality (100%) and material relevance (97%) confirm that the presented sexually transmitted diseases (STDs) content is aligned with students' learning needs and the applicable curriculum. The accuracy of material presentation is particularly crucial, especially for reproductive health topics, which are sensitive in nature and require correct understanding to prevent misconceptions. This finding is supported by

reports from the World Health Organization, which emphasize that scientifically based and appropriately delivered reproductive health education can improve adolescents' awareness and preventive behaviors (Nurhanifah & Maharani Putri, 2025) (Putri, Maryati, & Solehati, 2025). Thus, the developed media not only fulfills pedagogical requirements but also contributes to enhancing students' health literacy.

The learning expert validation result of 89% also indicates that the developed media meets the principles of effective instructional design. The high score in the motivation aspect (100%) demonstrates that the media is capable of increasing students' learning interest through interactive and contextual presentation. However, the score in the learning objectives aspect (80%), which is still categorized as good, indicates the need for further improvement in aligning learning objectives, activities, and assessments presented in the media. Theoretically, the alignment between objectives, activities, and assessment is a fundamental principle of constructivist instructional design, which emphasizes the relationship between what is learned and how the learning process takes place (Biggs; & Tang, 2011), (Yusuf, Yanti, & Nafi, 2026). herefore, although the media has been categorized as very good, optimization of this aspect may further enhance the overall quality of learning.

User responses, both from teachers and students, showed very positive results, with percentages of 98% and 90%, respectively. The high teacher response on the content presentation aspect (100%) indicates that the media is highly effective in explaining complex and sensitive topics such as sexually transmitted diseases (STDs). This suggests that digital-based learning media can serve as a solution to the limitations of conventional teaching methods, which are often less effective in delivering reproductive health education. Meanwhile, the high student response in the content presentation aspect (93%) indicates that the media effectively enhances students' understanding of the concepts being taught. These findings are consistent with previous studies reporting that web-based learning media can significantly improve students' motivation, engagement, and learning outcomes (Safitri et al., 2022) (Marzani, Kartikowati, & Gimin, 2023).

The main advantage of the developed media lies in the integration of independently designed 3D animations and interactive features that support a deep learning approach. The use of 3D animation has been shown to be effective in helping students understand abstract concepts in a more concrete and visual manner. Theoretically, dynamic visualization can reduce cognitive load and facilitate the elaboration of information in long-term memory (Sweller, 2011 as cited in Höffler; & Leutner, 2025). In addition, the deep learning approach implemented in this media encourages students not only to memorize information but also to

develop a deeper conceptual understanding and relate it to real-life contexts (Syahab, Bahriyanto, & 3, 2025), (Cahyadi, Suhairi, Herdika, Porja, & Rahmat, 2025). This is in line with the view that meaningful learning occurs when learners are able to integrate new knowledge with their existing cognitive structures or prior experiences (Ausubel, 2000, as cited in Novak, 2010).

Compared to previous studies, this research demonstrates a significant novelty. Most prior studies have focused on developing Google Sites-based learning media for general sports or health topics and still rely heavily on external video content. In contrast, this study develops learning media specifically focused on sexually transmitted diseases (STDs) by integrating independently designed 3D animations that are directly embedded within the Google Sites platform. In addition, the application of a deep learning approach within the Merdeka Curriculum framework adds further value that distinguishes this study from previous research. Thus, the developed media is not only technologically innovative but also pedagogically relevant (Suhairi, Effendi, & Rajidin, 2022). However, this study has several limitations. The relatively small number of student participants may affect the generalizability of the findings. Furthermore, this research has not examined the long-term impact of media use on students' behavioral changes related to reproductive health. Therefore, future research is recommended to involve a larger sample size and to investigate the long-term effectiveness of the media. Overall, the findings indicate that the developed Google Sites-based learning media is feasible and effective as an innovative alternative for teaching sexually transmitted disease material at the senior high school level.

## **CONCLUSIONS**

Based on the results and discussion of this study, it can be concluded that the development of a Google Sites-based learning media for sexually transmitted diseases (STDs) using the ADDIE model successfully produced a product that is highly feasible and effective for use in Physical Education, Sports, and Health (PJOK) learning at the senior high school level. The high level of feasibility is indicated by the validation results from media experts (98%), material experts (96%), and learning experts (89%), all of which fall into the very good category. This indicates that the developed media has comprehensively met the aspects of content quality, instructional design, and technical quality. In addition, user responses from both teachers (98%) and students (90%) demonstrate a very high level of acceptance. The media is perceived as effective in increasing students' interest, motivation, and ease of understanding of sexually transmitted disease materials, which are often considered complex

and sensitive. The integration of interactive features, 3D animations, and context-based content presentation has been shown to support a deep learning approach that emphasizes conceptual understanding and real-life relevance.

The implications of this study suggest that web-based learning media such as Google Sites can serve as an innovative solution to improve the quality of learning, particularly in reproductive health education. This media provides an alternative for teachers to deliver learning content in a more engaging, systematic, and accessible way, thereby potentially improving student learning outcomes and health literacy. However, this study has limitations, including the relatively small number of participants and the absence of an investigation into long-term behavioral changes in students. Therefore, future research is recommended to conduct broader-scale trials and develop more interactive and adaptive features. In addition, teachers are encouraged to utilize and further develop similar media to support innovative and technology-relevant learning practices.

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