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# DEVELOPMENT OF STEM DISCOVERY LEARNING-BASED MEDIA ASSISTED BY GOOGLE SITES ON STATISTICS MATERIAL

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## Abstract

Statistics is necessary for students since it provides them with critical abilities for data analysis, decision-making, and the evaluation of information. However, learning statistics is still challenging for students. This study aims to develop learning media based on STEM-Discovery Learning assisted by Google Sites for statistics material, and to test the validity and practicality of the media. This research employs the ADDIE development model, consisting of analysis, design, development, implementation, and evaluation phases. Participants in this study were mathematics teachers and grade VII students of Junior High School in Kudus, Jawa Tengah. The interview guidelines and questionnaires were used as the instruments. The interview results were analyzed by the flow method involving data reduction, data presentation, and conclusions. While the questionnaire results were analyzed by determining the average score and then changing it into qualitative data. With the help of Google Sites, the SMARTISTISKA learning media based on STEM-Discovery Learning was successfully developed on statistical material for junior high school students in the seventh grade. The results of the expert validation evaluation show an average total score of 3.5 for the media, indicating that its validity is considered excellent. Additionally, the mean overall practicality score is 3.39, placing it within the high practicality range. Therefore, this learning media is deemed suitable for use in classroom statistics instruction. This study provides a statistical learning media that integrates STEM and discovery learning assisted by Google Sites. Teachers can utilize or modify this media to increase students' active participation in statistical learning.

**Keywords**: Development; Google-site; learning-media; statistics.

## *Abstrak*

*Statistik diperlukan bagi siswa karena memberikan mereka kemampuan kritis untuk analisis data, pengambilan keputusan, dan evaluasi informasi. Namun demikian, mempelajari statistik masih menjadi tantangan bagi siswa. Penelitian ini bertujuan untuk mengembangkan media pembelajaran berdasarkan STEM-Discovery Learning dengan berbantuan Google Sites untuk materi statistik, dan untuk menguji validitas serta kepraktisan media. Penelitian ini menggunakan model pengembangan ADDIE, yang terdiri dari fase analisis, desain, pengembangan, implementasi, dan evaluasi. Peserta dalam penelitian ini adalah guru matematika dan siswa kelas VII Sekolah Menengah Pertama di Kudus, Jawa Tengah. Pedoman wawancara dan kuesioner digunakan sebagai instrumen. Hasil wawancara dianalisis dengan metode alur yang terdiri dari reduksi data, penyajian data, dan kesimpulan. Sementara hasil kuesioner dianalisis dengan menentukan skor rata-rata dan kemudian mengubahnya menjadi data kualitatif. Dengan bantuan Google Sites, media pembelajaran SMARTISTISKA berbasis STEM-Discovery Learning berhasil dikembangkan pada materi statistika untuk siswa SMP kelas VII. Hasil evaluasi validasi ahli menunjukkan skor total rata-rata 3,5 untuk media, yang menunjukkan bahwa validitasnya sangat baik. Selain itu, skor rata-rata keseluruhan untuk kepraktisan adalah 3,39, yang menempatkannya dalam kategori kepraktisan tinggi. Oleh karena itu, media pembelajaran ini dipandang cocok untuk digunakan dalam pengajaran statistik di kelas. >> Penelitian ini menyediakan media pembelajaran statistik yang mengintegrasikan STEM dan discovery learning dengan berbantuan Google Sites. Guru dapat memanfaatkan atau melakukan modifikasi media ini untuk meningkatkan partisipasi aktif siswa dalam pembelajaran statistik.*

***Kata kunci**: Google sites, media pembelajaran; pengembangan;statistik.*

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## INTRODUCTION

The world is currently experiencing the Fourth Industrial Revolution, characterized by rapid advancements in technology that affect all aspects of life, including education. Rapid technological advancements brought about by the Internet of Things and Industrial Revolution 4.0 have replaced traditional teaching techniques in school with technology-based learning (Romli et al., 2020). Rapid advancements in technology have an impact on education by influencing trends in classroom supplies as educational institutions and teachers embrace new technologies to improve instruction (Dubé & Wen, 2022).

To face the challenges of globalization and the rapid development of information technology, an innovative approach in the teaching and learning process is necessary. Science, Technology, Engineering, and Mathematics (STEM) is one of the approaches considered effective in 21st-century learning. It is an approach that integrates science, technology, engineering, and mathematics based on contextual problems, where the learning process aims to develop individuals' abilities to reason, think critically, logically, and systematically, enabling them to face various global competitions (Anita et al., 2021). Teaching and learning that incorporate STEM activities can improve student learning outcomes and encourage the growth of 21st century abilities (Fung et al., 2022; Peters-burton & Stehle, 2019; Sahin et al., 2014).

The use of a STEM approach in teaching and learning can be integrated with certain learning models. Discovery Learning is one of the learning models that can be integrated with the STEM approach (Johan & Rohaeti, 2024; Khotimah et al., 2021, 2023). Learning activities in the Discovery Learning model involve students to the fullest in finding solutions to problems, thus the Discovery Learning model emphasizes the process in student learning. Moreover, discovery learning model had positive impacts on the student learning outcome (Ayuningsih & Muna, 2023; Kamaluddin & Widjajanti, 2019).

The implementation of the learning approach and learning model in the classroom, especially in statistics material requires an effective and efficient learning media. Prior research revealed that learning statistics is challenging for students. Abbiati et al., (2021) found that students often view statistics as a burden, do not grasp its utility, and face difficulties that provoke anxiety and stress. Based on a study of 293, students in general hold a negative perception about learning statistics. Individuals often encounter anxiety and dissatisfaction while engaging in problem-solving (Gopal et al., 2020). Further data suggests that students experience heightened anxiety and reduced confidence in learning statistics (Peiró-Signes et al., 2020).

Google Sites can be a very helpful platform in designing learning media that supports teaching and learning activities. It is one of the learning media that can be used effectively in the learning process (Abdjul, 2023). Google Sites-based interactive learning media are useful for enhancing students' conceptual understanding (Johdi and Ayub, 2024; Martiasari and Ghiyats Ristiana, 2023). The use of Google Sites can help teachers manipulate objects in delivering lessons, which aligns with Piaget's statement that knowledge can arise and increase through interaction with the objects being studied (Aminah et al., 2021).

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Several previous researchers have studied the development of learning media assisted by Google Sites. Widyawati and Rindrayani (2025) have developed learning media based on Google Sites to enhance student' motivation in science. The development of Google Sites-based learning media to improve the student' learning outcome (Fatonah and Isdaryanti, 2024; Putri and Wulandari, 2024) and to support the learning process Putri and Wulandari (2024) has been conducted. Meanwhile, Gumilar et.al (2022) analyzed the need for web-based Google Sites learning media on high school Statistics material. Study on the integration of Google Sites and STEM approach has also been carried out. The E-book based on Google Sites with STEM-PBL has been developed to enhance students'critical thinking skills and mathematical literacy (Aditiyas et al., 2025), and the study on the development of websites utilising STEM principles through Google Sites, to enhance creative thinking skills has been undertaken (Ningrum & Jumadi, 2024). However, the study on the development of learning media assisted by Google Sites based on STEM-discovery learning for statistics material has not been found at Junior High School.

The current study aims to: 1) develop Google Sites-assisted learning media based on STEM Discovery learning for statistics in Junior High School, 2) test the validity and practicality of the Google Sites-assisted learning media develop Google Sites-assisted learning media based on STEM Discovery learning for statistics in Junior High School.

## METHODS

This research is a developmental study using the ADDIE model as ADDIE model is a systematic instructional design framework that provides a dynamic and adaptable guideline for developing effective educational aids (Moradmand et al., 2014).The stages of ADDIE model included analysis, design, development, implementation, and evaluation as presented in Figure 1.

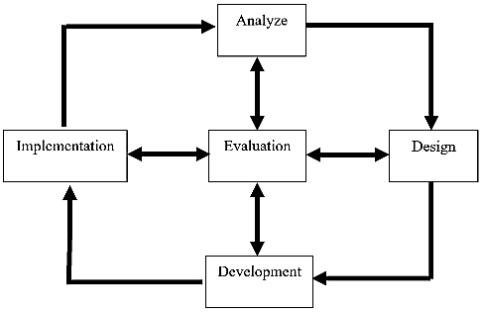


Figure 1. ADDIE Model (Seel et al., 2017)

At the analysis stage, a needs analysis for module development and a curriculum analysis were conducted. The curriculum analysis was carried out by reviewing the current curriculum at the school, namely the Merdeka curriculum, which included an analysis of learning achievements and learning objectives. Based on the results of the analysis phase, a storyboard was designed in the design phase to serve as the foundation for the subsequent media development stage. The development stage is the phase in creating and developing learning media according to the specifications and stages that have been designed in the storyboard. During the implementation phase, the learning media is tested on students to determine whether it is practical to use. At the evaluation stage, a reflection is made from the beginning of the development phase to the implementation phase. From that reflection, it will be identified whether the learning media needs to be improved again or not.

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Subject in this study were 10 seventh grade students and three teachers who teach statistics at a public high school in Kudus, Central Java, who were selected using purposive sampling techniques. The data collected by interview and questionnaires. Interview was conducted in the initial stage, to analyze the needs for the development of learning media. It was given to two seventh-grade math teachers for problem analysis and needs analysis, which can serve as the basis for the researcher to develop learning media. Meanwhile, the questionnaire was used to test the validity and practicality of the media. The validity questionnaire involved construction, technical, material, and language aspects. Meanwhile, the practicality questionnaire consisted of technical, language, material, and benefit aspects.

The questionnaire used is a closed questionnaire where respondents answer questions by selecting one answer according to the predetermined scale. Each answer to the questions on the questionnaire uses scores based on the Likert scale. The answer choices from the questionnaire are as follows: 4 = Very good, 3 = Good, 2 = Fair, 1 = Poor. In the questionnaire, there were also suggestions that can be used for improving the learning media. All the instruments used in this study have undergone the content validation process, making them suitable for use.

In the development of learning media assisted by Google Sites, there are two types of data, namely qualitative data and quantitative data. Qualitative data includes written data from interviews with teachers during the analysis stage and media validation results in the form of expert suggestions. Meanwhile, quantitative data includes the results from the validity questionnaire and the media practicality questionnaire. The qualitative data were analyzed using the flow method which includes data reduction, data presentation, and conclusions (Miles et al., 2014). While the the quantitative data were analyzed to obtain the meaning of each score given by determining the average score and then changing it into qualitative data. The answer scores from the questionnaire were then analyzed using data analysis techniques that were interpreted with a 4-choice range scale (Alwan et al., 2017).

## RESULTS AND DISCUSSION

The development of learning media in this research was carried out using the ADDIE model, which consists of the stages of analysis, design, development, implementation, and evaluation.

### Analysis

At this stage, a needs analysis and curriculum analysis were conducted. Based on the results of interviews with teachers during the needs analysis, it can be seen that teachers have been using learning media for almost all mathematics subjects, with digital media being the most frequently used. The digital platforms frequently used to create these media are Google Classroom, Canva, Quizziz, and Power Point. In addition, teachers have already used cooperative learning models and the Contextual Teaching Learning (CTL) approach. During the learning with this model, the enthusiasm and collaboration of the students were good. However, students still encounter difficulties in learning statistical concepts.

The interview results also show that teachers have never implemented mathematics learning based on STEM-Discovery Learning. Additionally,

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STEM-Discovery Learning-based mathematics learning media assisted by Google Sites have not yet been developed or used in mathematics learning for statistics material. The results of the needs analysis indicate that STEM-Discovery Learning-based mathematics learning media assisted by Google Sites for secondary school statistics need to be developed.

Next, in the analysis stage, a curriculum analysis was also conducted. The curriculum used at the school is the Merdeka Curriculum. The content in the STEM-based Discovery Learning mathematics teaching media using Google Sites for statistics needs to be adjusted to this curriculum. In the Merdeka Curriculum, the learning outcomes used in the media are: "At the end of phase D, students can formulate questions, collect, present, and analyze data to answer the questions. They can use bar charts and pie charts to present and interpret data. They can take samples that represent a population to obtain data related to them and their environment. They can determine and interpret the mean, median, mode, and range of the data to solve problems (including comparing a data point against its group)".

The results of the needs analysis indicated that STEM-Discovery Learning-based learning media assisted by Google Sites for seventh-grade junior high school statistics material need to be developed. The analysis result supported the previous finding' study that it is needed to develop learning media based on the science literacy (Fadlah et al., 2024), and mobile learning media based on Problem Based Learning (Yarmi et al., 2024).

**Design**

Upon assessing the media development requirements, the researcher commenced the creation of the preliminary design draft for the media to be produced. The researcher utilised the Canva platform to produce designs for the media header, media logo, and the main page layout. Moreover, the researchers crafted the content of each media menu, specifically customised to the statistical material for seventh-grade junior high school students.

The outcome of the design step is the formulation of a storyboard, which acts as the foundation for the development of the learning media. At this step, the menus or content to be incorporated into the learning media are devised.

**Development**

In this stage, the media development was carried out according to the previously designed layout, using Google Sites. The content development for the media encompasses the creation of the media logo and the design of the main menu page. Meanwhile, the development process of each part of the media is carried out using the Canva platform. Figure 2 shows the appearance of the developed media logo. In the media logo design, there is the word " SMARTISTIKA which is the name of the developed media. The word " SMARTISTIKA " itself is a combination of the words "SMART" and "Statistics." The hope is that the developed learning media can enhance thinking intelligence (SMART) through statistical learning that has been meticulously designed within the media. In addition, the logo also contains other components, each with its own distinct meaning.

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Figure 2. Media Logo

A light bulb with a human brain in the center means that when students operate the SMARTISTIKA media, it is expected to generate many ideas and creativity, critical thinking, and enhance students' cognitive abilities. The last component is an image of a collection of orange circles forming a diagram. The image represents the statistical material presented in the media "SMARTISTIKA." The main page display of the developed SMARTISTIKA media is presented in the Figure 3.


Figure 3. Main Media Page

On the main page of the media, there are two important components: the media header and the media main menu. The media header displays the media name, the media slogan or tagline, and some information related to SMARTISTIKA media. The researcher added a tagline and a little information related to the media. Related to the slogan under the media name, namely SMARTISTIKA, the slogan has its own meaning. The slogan "Revolutioning Education: Pathway to Smart and Fun Math Learning" means that SMARTISTIKA media is a form of educational revolution that is expected to be one way for fun mathematics learning and increase intelligence for users, namely students. Then, under the slogan there is also information stating that SMARTISTIKA media is a mathematics learning media that discusses statistical material. Then, for the main media menu, there are seven options: media usage instructions, introductory learning video, initial understanding check, STEM components, Student Worksheet, Formative Assessment, and Creator Profile.

The display of the media usage instructions menu that has been developed is presented in Figure 4. The media usage instructions need to be understood by students first before accessing the other menus available in the SMARTISTIKA media.


Figure 4. Media Usage Instruction

Then, in the media usage instructions, there is also a Statistics Learning Roadmap with SMARTISTIKA as shown in Figure 5.

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Figure 5. Statistics Learning Roadmap

The roadmap provides information to media users regarding the steps for using the media. At the very bottom of the page, there is a "HOME" button with a house icon. The button will be available on every page of each main menu in the SMARTISTIKA media. The function of that button is to return to the main page of the media.

The next main menu developed is the Learning Introduction Video as shown in Figure 6.

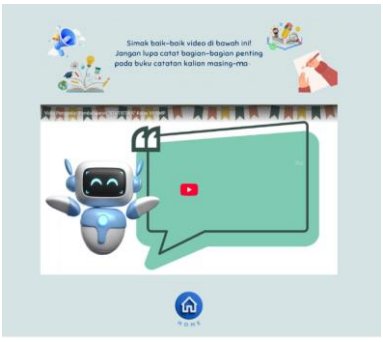


Figure 6. Learning Introduction Video

The Learning Introduction Video is presented in the form of a YouTube video with a duration of 15 minutes and 28 seconds, which users can click on directly without opening the YouTube platform first. As for the content, the material inside includes introductory content that discusses statistics in general. This introductory learning video contains introductory materials or general materials related to statistics. The scope of the material is a) The difference between "statistics" and "statistics" (reviewed in terms of definition). b) Definition of "data" and "datum". c) Classification of data based on the nature and method of obtaining data. d) Four stages in converting data into usable information. The introductory learning video is presented in the form of a narrated power point, where the video design and editing process is assisted by the Canva platform. Then, the video file is uploaded to YouTube and the YouTube link is linked to the Google Sites introductory learning video page.

In the SMARTISTIKA media, an initial understanding check menu as shown in Figure 7 has also been developed, where this menu contains three important components that need to be considered, namely the instructions for completion and two buttons below it.


Figure 7. Understanding Check Menu

The instructions must be understood first before taking the quiz available in the initial understanding check menu. To complete the quiz, users can press the button located below the instructions. The quiz consists of 10 matching questions between clues and answers. The questions were taken from the introductory learning video. The initial understanding check quiz was created with the help of the Word-Wall platform.

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The display of the STEM component menu in the developed media is presented in Figure 8. The STEM component menu page contains STEM aspects which are the basis for compiling the content of statistical material learning activities in SMARTISTIKA media.


Figure 8. STEM Component Menu

Through this menu, media users can learn about the STEM components in the developed media. If the STEM components have been read and understood, users can press the Home button to return to the main page and proceed to the next menu.

The developed SMARTISTIKA media also includes a menu page for the Student Worksheet presented in Figure 9.


Figure 9. Student Worksheet Menu

On the student worksheet menu page, there is a header instruction that must be read by the user before completing the worksheet. In Figure 9, below the header, there are two different worksheet cover images. Both images serve as buttons leading to the Worksheet-1 and Worksheet-2 pages. Worksheet-1 is a worksheet that discusses statistical material specifically on data presentation. The worksheet on that page is in the form of a flipbook, which was created using the Heyzine Flipbook platform. Users only need to press the arrow located in the bottom right corner to scroll to the next page. Below the flipbook, there are three buttons: a green button, a red button, and a blue button. For the green button labelled Worksheet-1, Presentation of data, if clicked, the media will switch out to the Heyzine Flipbook site page. This button is created as an alternative if the flipbook on the Worksheet 1 page takes a long time to load/appear or if there is hanging and so on. As for the red button, which is the back button, it is designed to return to the main worksheet page (Figure 9). Then, for the blue button, which is the Home button, it functions to return to the main media page.

Worksheet-2 is a worksheet that discusses statistical material specifically on the topics of mean, median, and mode. The components found on the Worksheet-2 page are the same as the components on the Worksheet 1 page. The students' learning activities are presented in each worksheet through the steps of the discovery learning model, namely stimulation, problem-oriented, data collecting, data processing, verification, and generalization. Figure 10 is an example of student activities in the stimulation and problem-oriented steps in the worksheet.

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Figure 10. Student Activities

The formative assessment menu as shown in Figure 11, was developed using the SMARTISTIKA media with wizer.me, consisting of five questions related to data presentation, reading data in diagrams, mean, median, and mode.


Figure 11. Formative Assessment Menu

## Implementation

The implementation phase in the research was carried out by conducting a limited media trial on students. The media was tested on 10 seventh-grade students at one of the Junior High Schools in Kudus over five meetings. After the trial was conducted, the students filled out a student response questionnaire as an assessment of the practicality of the media used.

## Evaluation

At this stage, an evaluation is carried out from the results of the experts review and the practicality questionnaire on the SMARTISTIKA media to identify whether the learning media needs to be improved or not. If necessary, the learning media can go through a process of improvement to produce more perfect media.

## Expert Evaluation

An expert evaluation was conducted to determine the validity of the media after the SMARTISTIKA Media was developed. The aspects of media evaluation include construction, technical, material, and language. The media that has been developed can be declared feasible or very feasible if the results of the expert validation assessment are included in the good or very good category.

The results of the media assessment by two experts are presented in Table 1.

Table 1. Expert Validation Result

| Evaluation Aspects | Number of Items | Total Average Score |
|---|---|---|
| Construction | 14 | 3,45 |
| Technical | 6 | 3,5 |
| Material | 11 | 3,65 |
| Language | 3 | 3,3 |

The expert validation evaluation results indicate an average total score of 3.5 for the media assessment, categorising its validity as very good. The SMARTISTIKA Learning Media, grounded in STEM-Discovery Learning and facilitated by Google Sites, is deemed very feasible according to expert evaluation. The experts' recommendations for the assessment of this media are: 1) Certain font sizes should be marginally enlarged. 2) In the directives for the initial understanding check and formative assessment menus, presented as continuous text, it would be advisable to eliminate the continuous

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format, as users encounter difficulties in reading and comprehending it. 3) In LKPD 2, the duration of the task, initially set at 1 lesson hour (40 minutes), should be revised to 2 lesson hours (2x40 minutes) due to the involvement of a measuring procedure in the learning activity. In the current study, researchers utilised certain revision points from the expert evaluation as enhancement resources.

This result was supported by the previous research findings, the developed media is a highly feasible qualification according to material and media experts (Fatonah & Isdaryanti, 2024). Badu et al. (2021) in their research also found that multimedia-based learning media developed is feasible to be implemented based on the expert review result. The evaluation by experts confirmed the validity of Learning Media Applications for Information and Communication Technology subjects as a learning aid for junior high schools (Murtiyasa & Rahmawati, 2021). These results also were supported by the study that found before being tested, the media was validated by a media expert validator with a result of 86% in the "very good" category and a material expert with an assessment result of 94% in the "very good" category so that "VR Math" was declared valid (Buchori & Osman, 2023). Meanwhile, Wulanningtyas et al. (2023) mentioned that validity through evaluations by experts in the field and media experts, achieving scores of 82 and 73.5, respectively, classified as very good and good. The teaching module based on technology was also declared valid based on assessments from material experts with an average score of 87% and assessments from media experts with an average score of 83% (Nesri & Kristanto, 2020).

**Media Practicality Assessment**

The assessment of media practicality was conducted through limited media trials in small groups. The subjects of the trial in this assessment were 10 seventh grade students of junior high schools in Kudus. The media that has been developed can be declared feasible or very feasible if the results of the media practicality assessment are included in the good or very good category. The results of the media practicality test for students are presented in the Table 2.

Table 2. Media Practicality Result

| Aspect | Total Score | Average Score |
|---|---|---|
| Technical | 237 | 3,386 |
| Language | 69 | 3,45 |
| Material | 32 | 3,2 |
| Benefit | 171 | 3,42 |
| **Total** | **509** | **3.39** |

Based on Table 2, the mean overall practicality score of the media is 3.393, categorising it inside the very good practicality range. The SMARTIS-TIKA Learning Media, grounded in STEM-Discovery Learning and facili-tated by Google Sites, is deemed highly practical according to the outcomes of the small classroom try-out.

This result is consistent with the previous result Rahmatsyah and Dwiningsih (2021) that show their interactive learning media satisfies the strict practical requirements; each criterion's score is more than 81%. Azmi et al. (2022) in their study revealed the student worksheet that has been developed for students in secondary school is very practical. The current study also supported the previous one Kurnia Awala et al. (2024) that mentioned the ISpring Suite-based interactive multimedia with corrective feedback is valid, practical, and effective in enhancing student's

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conceptual understanding. Furthermore, the practicality of media demonstrates its ease of application (Fatahillah et al., 2020). The practitioner validation results in the feasibility test of the PBL-STEM Module indicated that the average score of the results is in the "good" category, with an average of 3.5 (Setyaningsih et al., 2022). Hence, the current research result supported the previous results.

## CONCLUSION AND SUGGESTION

Based on the result and discussion, it can be concluded that the SMARTISTISKA learning media, grounded in STEM-Discovery Learning and assisted by Google Sites, was effectively developed for seventh-grade junior high school. The expert evaluation yielded a validation score of 3.5 for the media. While the media's average overall practicality score is 3.393. Both scores fall into the excellent category, so the mathematics learning media based on STEM-Discovery Learning assisted by Google Sites for seventh-grade junior high school statistics material can be declared very feasible. The significant findings of the study offer a statistical learning resource that combines STEM-discovery learning assisted by Google Sites. This media can be used or altered by teachers to encourage more active engagement from their students in statistical learning.

For the further research, it is needed to test the effectiveness of this valid and practical module on the students'mathematical literacy and achievement

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