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ADDIE-Based Google Sites Media Development: Feasibility and Effectiveness Test on Creativity, Innovation, and Entrepreneurship Learning in Vocational Schools

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Abstract

Digital learning media in the subjects of Creativity, Innovation, and Entrepreneurship is still not utilized optimally, which has an impact on the low achievement of student learning outcomes. This research aims to develop google sites-based learning media on business opportunity materials and test its feasibility and effectiveness. The method used is Research and Development (R&D) with the ADDIE model, which was carried out at the State Vocational School 1 Kuala Mandor B, Kubu Raya Regency, with 23 students in grade XI. The research instruments included expert validation sheets and multiple-choice questions. Data analysis was carried out through the calculation of eligibility percentage, normality test, paired sample t-test, and N-Gain. The results showed that the media was in the very feasible category with an assessment percentage of 88.21% from media experts and 88.89% from material experts. There was a significant increase in learning outcomes (Sig. 0.000 < 0.05) with the average score increasing from 55.87 to 86.09. The N-Gain value of 0.7112 was in the high category, which indicates that the media is effective in improving student learning outcomes. Theoretically, this study supports the application of the ADDIE model in the development of google sites-based media. Practically, media can be used as an interactive learning alternative to improve the quality of learning in vocational education.

Keywords: ADDIE; Effectiveness; Google Sites; Vocational School

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INTRODUCTION

The pace of development of information and communication technology (ICT) in the digital era has triggered significant transformations in various sectors of life, including the implementation of education. Technology that originally only functioned as a tool has now transformed into a source of information, a means of collaboration, a medium for communicating ideas, and a virtual experiment vehicle that is able to improve the quality and effectiveness of learning (Ariyati et al., 2025). Therefore, the integration of technology in the field of education is a strategic step to respond to the demands of 21st century learning.

Along with these developments, in Indonesia, the Independent Curriculum emphasizes learning that is flexible, innovative, and oriented to the needs and characteristics of students (Kemendikbud, 2022). This curriculum encourages independent learning as well as the use of technology as an integral part of learning

practices. At the Vocational High School level, the curriculum orientation is directed at the formation of human resources who are competent, adaptive, and ready to face the world of work, continue their studies, and be entrepreneurial (Wahab & Rosnawati, 2021). In this context, the subjects of Creativity, Innovation, and Entrepreneurship are developed with a Project Based Learning (PjBL) approach, where students produce products as learning outputs.

PjBL emphasizes experiential learning that integrates teamwork, problem-solving, and peer assessment to improve students' overall competencies (Lei & Wonjae, 2023). However, the success of its implementation is inseparable from the support of systematic planning, continuous teacher guidance, and structured learning design. Despite presenting challenges, such as time management and adaptation to collaborative work, PjBL has been proven to be able to increase students' engagement and critical thinking skills (Puspita, 2025).

Theoretically, this approach is in line with social constructivism which views the learning process as taking place through social interaction and the use of tools as cognitive mediators (Vygotsky, 1978). Collaborative activities in PjBL reflect the concept of zone of proximal development (ZPD), where students are able to achieve a higher level of understanding through peer and teacher support as scaffolding. Thus, PjBL is not only relevant in learning practice, but also supported by a strong theoretical foundation.

Furthermore, the integration of technology in PjBL strengthens the role of media as psychological tools that support the process of internalizing knowledge. Modern learning media, such as interactive modules, educational videos, and digital platforms, are able to enrich the process of constructing students' knowledge (Kozulin et al., 2003). Thus, PjBL and technology are two elements that complement each other, PjBL encourages active involvement, while technology facilitates access to information and collaboration. Support for this can also be seen from research results that show that PjBL contributes significantly to the learning outcomes of vocational school students (Okta et al., 2020), as well as the use of google sites has the potential to increase learning outcomes (Islanda & Darmawan, 2023).

In relation to learning outcomes, student achievement is the main indicator of learning success which is influenced by various factors, such as learning resources, environment, and school culture (Sudjana, 2020; Yandi et al., 2023). Therefore, the integration of the right learning model accompanied by technological support is the key to improving the quality of learning, especially in vocational education.

However, the factual conditions at the Negeri 1 Kuala Mandor B vocational school show that the implementation of PjBL and the use of technology have not been running optimally. The learning process still tends to focus on lecture methods supported by conventional media such as powerpoints and simple youtube videos. As a result, learning interactivity is low, students are easily saturated, and have difficulty understanding the material and project instructions. In fact, supporting facilities such as internet networks and ownership of digital devices by students are adequate.

This condition has an impact on the achievement of learning outcomes that are still below the criteria for achieving learning objectives, especially the entrepreneurial element in the subjects of Creativity, Innovation, and

Entrepreneurship. Data shows that student scores on various learning objectives are still in the incomplete category. This indicates a discrepancy between the potential use of technology and learning practices in the classroom. The following is data on the average score of students in each learning objective of the entrepreneurial element in 2025.

Table 1. Average Student Scores Per Learning Objective

No	Learning Objectives	Average Student Score	Description
1	Identifying the basic concepts of entrepreneurship	66	Incomplete
2	Analyzing business opportunities	64	Incomplete
3	Preparing a business plan	65	Incomplete
4	Implementing resource management	72	Incomplete
5	Using technology in entrepreneurship	70	Incomplete
6	Analyzing marketing strategies	69	Incomplete
7	Managing finances	66	Incomplete
8	Applying business ethics and social responsibility	71	Incomplete
9	Identifying and analyzing business risks	66	Incomplete
10	Showing a work attitude according to corporate culture	74	Incomplete

Source: Data on the average score of students in Creativity, Innovation, and Entrepreneurship subjects in 2025

Based on this data, it can be seen that all learning objectives are below the minimum completeness limit set, which is 75, so innovation is needed in the learning process. One of the materials that is quite complex is business opportunities, which requires analytical skills in recognizing opportunities, identifying sources of opportunities, and assessing business feasibility. Without the support of systematic and interactive learning media, students tend to have difficulties in understanding concepts and relating them to real contexts, thus having an impact on learning outcomes.

To overcome these problems, it is necessary to develop digital learning media that is able to support the learning process more effectively and independently. Through digital media, students can learn the material and understand project instructions flexibly without relying entirely on the teacher's explanation. In this case, the role of the teacher shifts to a facilitator who provides clarification and deepening of the material according to the needs of students. The effectiveness of digital media in learning has been proven by various studies, such as the use of PhET media in physics learning which is able to improve learning outcomes and problem-solving skills (Warneri et al., 2024), as well as Moodle-based network infrastructure administration learning which has been proven to improve the understanding and skills of vocational school students (Sumartini et al., 2023).

In the context of learning media development, a systematic framework is needed so that the resulting product is not only visually appealing, but also pedagogically valid and able to improve learning outcomes. One of the widely used models is ADDIE (Analysis, Design, Development, Implementation, Evaluation),

which is a systematic approach that emphasizes a continuous process starting from the needs analysis to the product evaluation stage (Branch, 2009).

In the analysis stage, the developer identifies the learning needs, student characteristics, and gaps between ideal and actual conditions. The design stage focuses on planning the media structure, the preparation of materials, and the learning strategies to be used. Furthermore, the development stage is carried out by realizing the design into a real product to be assessed for feasibility and ready for trial. The implementation stage includes the use of media in learning, while the evaluation stage is carried out to assess the effectiveness of the product as a whole. Theoretically, the ADDIE model is in line with the principles of instructional system design which emphasizes the integration between objectives, materials, methods, and evaluation. Therefore, the use of the ADDIE model is not only technical, but also conceptual in producing structured, feasible, and effective media.

However, the selection of technology-based learning media must still be adjusted to learning objectives, resource availability, and student needs (Jelimbi et al., 2024). In this context, the results of observations at the Negeri 1 Kuala Mandor B vocational school show that both teachers and students have the readiness to adopt technology-based media, especially google sites.

Table 2. Results of Student Digital Literacy Questionnaire (n = 70)

No	Indicator	Number of Students	Percentage (%)
1	Digital technology skills in supporting academic activities	48	68.6%
2	Digital technology makes it easier to collaborate on learning tasks and activities	49	70%

Source: Primary data processed by researchers (2025)

The data shows that most students have good enough technology skills and feel the benefits of technology in supporting learning. However, the readiness of these students has not been fully balanced by the use of technology by teachers.

Table 3. Teachers' Use of Google Sites as Learning Media (n = 24)

No	Category	Number of Teachers	Percentage (%)
1	Have used google sites as a learning medium	13	54.2%
2	Never used google sites as a learning medium	11	45.8%
	Total	24	100%

Source: Primary data processed by researchers (2025)

From this data, it can be seen that the use of google sites as a learning medium by teachers is still limited and after digging deeper, teachers generally only use available resources and have not developed contextual interactive media according to the needs of the subjects they teach. This condition illustrates the need for the development of digital learning media that is more adaptive and relevant.

In this context, digital learning media is understood as a technology-based means used to systematically deliver material to improve student understanding,

motivation, and engagement. One potential platform is google sites, which is known to be flexible, easy to manage, and allows the integration of various learning content without requiring complex technical expertise (Farahani, 2023; Yanto et al., 2023). When compared to other platforms such as the more structured but relatively complex Learning Management System (LMS), google sites offer a balance between ease of use and design flexibility. This advantage allows teachers to independently design digital learning spaces without relying on system administrators, making them more suitable for school contexts with limited resources and technical competence.

From a pedagogical perspective, google sites not only function as a means of delivering information, but also as a digital learning space that supports the application of constructivist learning. Through a combination of text, video, documents, and interactive activities, this platform allows students to build knowledge actively and meaningfully (Irawan et al., 2023; Napitu et al., 2023; Hartari & Putra, 2025). Moreover, the characteristics of google sites that allow for structured content organization, integration of various learning resources, and flexible access make it potential as a sustainable and directed learning hub in the context of project-based learning.

A number of studies show that google sites have advantages in flexibility, accessibility, and the ability to integrate various learning content in one platform. However, if examined more critically, most studies still position google sites only as a medium for delivering information, so their use tends to be static and does not fully accommodate learning interactions, project activity management, and systematic learning reflection. In addition, the dominance of research that focuses on testing effectiveness without going through the stages of structured media development shows that the aspect of instructional design has not been studied in depth. As a result, the contribution of research to the development of learning practices is still limited to the final results, without providing a comprehensive understanding of the effective media design process.

On the other hand, the integration of google sites with active learning models such as PjBL is still relatively limited, especially in the context of vocational education and materials that require applicability such as business opportunities. In fact, conceptually, PjBL requires media support that is able to manage project flows, provide relevant learning resources, and document student processes and work results in an ongoing manner. In this case, google sites has the potential to meet these needs through page organization features, multimedia integration, and ease of access that supports collaboration and independent learning. Thus, there is a strong match between the characteristics of google sites and the needs of PjBL implementation that have not been optimally utilized in previous research.

Based on these conditions, this study takes a more progressive position by not only utilizing google sites as a medium for delivering information, but as a learning ecosystem that is integrated with the PjBL model. In this study, google sites are designed to function simultaneously as a learning resource, project activity space, and documentation media for the learning process. Based on this synthesis, google sites is defined as a web-based digital learning media that is systematically designed to support project-based learning, facilitate independent learning, and improve

learning outcomes through the integration of multimedia content and contextual interactive activities.

Previous research has shown that google sites and the PjBL model contribute positively to improving learning outcomes. Kusumawati & Prapanca (2023) found that website-based media with the PjBL approach has a significant effect on learning outcomes as well as the cognitive and psychomotor abilities of vocational school students. Similar results were also shown by Jusriati et al., (2021) and Sastromiharjo et al., (2024) both of whom explained that google sites are able to increase student engagement and learning outcomes in various subjects. However, these studies still have limitations, namely that they have not specifically combined google sites with PjBL in business opportunity materials, and tend to only focus on testing effectiveness without going through a systematic media development process in one integrated research framework. In addition, the context of vocational education, especially in the subjects of Creativity, Innovation, and Entrepreneurship, is still relatively underexplored, so the relevance of previous research findings to this context is still limited.

Based on this gap, this research was conducted to design and test google sites-based learning media combined with the PjBL model on business opportunity materials in vocational schools. This research not only assesses effectiveness, but also covers aspects of feasibility and the media development process systematically, so that it is expected to make a more comprehensive contribution both theoretically and practically.

The purpose of this research is to develop, assess, and measure the effectiveness of google sites-based interactive learning media on the learning outcomes of Creativity, Innovation, and Entrepreneurship subjects, especially in business opportunity materials in vocational schools. Theoretically, this research is expected to be able to strengthen the study of google sites-based digital media integration with the PjBL model in the context of vocational education. Practically, this research is expected to be a reference for teachers in developing effective and contextual learning media. Based on this background, the formulation of this research problem is.

(1) How is the process of developing google sites-based learning media combined with the PjBL model in business opportunity materials in vocational schools?
(2) What is the feasibility level of google sites-based learning media based on expert assessment?
(3) How effective is google sites-based learning media in improving student learning outcomes in the subjects of Creativity, Innovation, and Entrepreneurship?

METHODS

This research applies the Research and Development (R&D) method with the aim of developing products in the form of google sites-based learning media while testing the feasibility and effectiveness of its use in learning. According to Sugiyono (2021), the R&D method is a research approach that not only focuses on developing certain products, but also tests its effectiveness so that it is suitable for

use in the context of education. The product produced in this study is in the form of digital learning media that focuses on business opportunity materials in vocational schools.

The development model applied in this study is ADDIE, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation (Ghani & Daud, 2018). This model was chosen on the basis of its stages that are structured, logical, and allow for continuous evaluation and revision at each stage, so as to support the development of quality media and in accordance with learning needs.

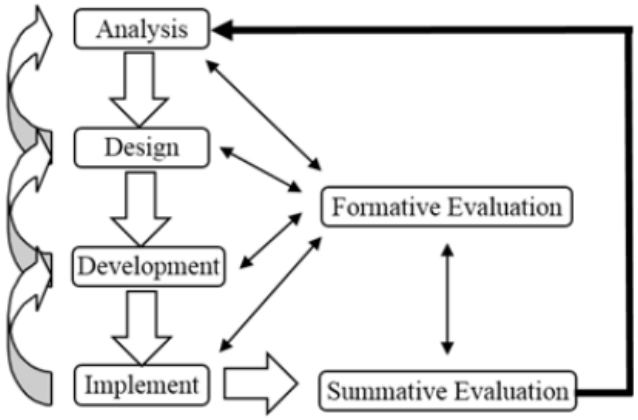

Figure 1. Steps for Research and Development of the ADDIE Model

The research was conducted in the even semester of the ongoing school year at the State Vocational School 1 Kuala Mandor B. The research population was all grade XI students totaling 23 people. The sampling technique applied was saturated sampling, where all populations were used as research samples. This technique was chosen because of the relatively small population, so that all subjects could be reached in the study. However, the use of saturated sampling techniques in a limited population and only one class in one school showed that the characteristics of the sample were specific to the context being studied. Therefore, the findings in this study are not intended for broad generalization, but rather emphasize on contextual understanding of the implementation of the developed learning media.

Before the research was carried out, all respondents had obtained an explanation regarding the purpose and procedure of the research, and expressed their willingness to participate as a research sample. This consent was carried out consciously, by ensuring that the data collected was used solely for research purposes and maintaining the confidentiality of the respondents' identities.

The research procedure is carried out according to the stages in the ADDIE model. The analysis stage is carried out through observation of learning activities and interviews with subject teachers to identify problems, learning needs, and student characteristics. The design stage is carried out by compiling media designs in the form of storyboards, content structures, and integration of the PjBL model into learning media. The development stage is carried out by developing google sites-based learning media according to the design that has been prepared. At this stage, a validation process is also carried out by media experts and material experts to assess the feasibility of the product, as well as a phased trial that includes

individual tests, small group tests, and field tests. The implementation stage is held by applying learning media to all research subjects. Furthermore, the evaluation stage is carried out continuously at each stage to assess and improve the quality of the developed media.

Testing the effectiveness of the product uses a one-group pretest-posttest design, this design provides an opportunity for researchers to compare the conditions before and after treatment in the same group. The implementation of the research was carried out through the provision of pretests before treatment, followed by the application of google sites-based learning media, and ended with a posttest to measure student learning outcomes after being given treatment. The design was chosen because of the limitations of the research conditions that did not allow the use of a control group, so that the research results emphasized more on analyzing changes in one group and were contextual. The following is a chart of the design of this research experiment.

Table 4. Experimental Design

Group	Pretest	Treatment	Posttest
Experiment (media *google sites*)	T1	X	T2

The research instrument consists of expert validation sheets and learning outcome tests. The validation sheet includes validation of media experts and subject matter experts designed using a Likert scale of 1-5. Validation by media experts aims to assess the feasibility of the developed learning media by referring to four aspects, namely general aspects, software engineering, visual engineering, and audio communication. Meanwhile, the validation of subject matter experts is used to assess the feasibility of learning content based on format, content, and language aspects.

The learning outcome test consists of 20 multiple-choice questions designed to refer to learning indicators, namely (1) recognizing the concept of business opportunity, (2) identifying the source of business opportunity, and (3) analyzing business opportunity. This test instrument is a question that has been used by subject teachers and has been tested for validity and reliability in grade XII students before being used on the research subject.

The validity test of the question item was carried out using Pearson Product Moment correlation by comparing the value of r calculated with r of the table at a significance level of 0.05. The value r of the table was determined based on the degree of freedom (df = N-2), with N = 36 then df = 34 and r of the table was obtained of 0.3291. An item is declared valid if r is calculated to be greater than r of the table and the significance value is less than 0.05. Furthermore, the reliability test was carried out using Cronbach's Alpha coefficient, with the criterion that the value of $\alpha > 0.60$ indicates that the instrument has good reliability (Taherdoost, 2016).

Data collection techniques include interviews, expert validation sheets, and learning outcome tests. Interviews are conducted at the stage of one-on-one needs analysis with subject teachers using semi-structured interview guidelines to obtain information related to learning conditions and the need for learning media. The validation sheet is used at the development stage and is filled in by six validators consisting of three media experts and three material experts. Media experts are

lecturers in the field of educational technology, while material experts are lecturers in entrepreneurship and teachers of related subjects. The validation process is carried out by providing google sites-based learning media products and assessment instruments to the validators, who then provide assessments and suggestions for improvement to the developed media. Learning outcome tests are used at the implementation stage in the form of pretest and posttest to all research subjects, with a total of 20 multiple-choice questions and a processing time of 30 minutes.

Data analysis techniques include media development analysis, media feasibility, and learning media effectiveness. Development analysis is carried out descriptively with reference to the stages of the ADDIE model. Media feasibility analysis is carried out through two approaches. First, content validity analysis uses Aiken's Coefficient V to determine the level of agreement between validators, which is calculated using the following formula.

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

Aiken's V value is in the range of 0 to 1, and an item is declared valid if it has a coefficient value of ≥ 0.80 (Azwar, 2012). To strengthen the interpretation, the following criteria are used.

Table 5. Aiken's Interpretation Criteria V

Value Range V	Category
0.80 < V ≤ 1.00	Very High
0.60 < V ≤ 0.80	Height
0.40 < V ≤ 0.60	Enough
0.30 < V ≤ 0.40	Low
0.00 < V ≤ 0.20	Very Low

Aiken's V analysis is used to assess the validity of the instrument's contents. Second, percentage analysis is used to determine the overall feasibility level of the product. The feasibility percentage analysis is calculated by the formula.

$$P = \frac{\Sigma \mathrm{X}}{\Sigma \mathrm{Xmaks}} \times 100\%$$

The percentage results are then classified into the feasibility category referring to Riduwan (2018), as presented in the following table 6.

Table 6. Product Eligibility Categories

Percentage (%)	Category
0% - 20%	Not Eligible
21% - 40%	Less Eligible
41% - 60%	Quite Decent
61% - 80%	Eligible
81% - 100%	Very Worth It

The effectiveness analysis was carried out with the help of IBM SPSS software version 26. The normality test used Shapiro Wilk because the number of samples was less than 50, with the criteria of normal distributed data if the significance value was > 0.05. Furthermore, a paired sample t-test was carried out to determine the difference in learning outcomes before and after treatment, with

the criterion that if the significance value (Sig.) < 0.05, there was a significant difference.

To measure the improvement of learning outcomes, the N-Gain calculation is carried out with the formula.

$$g = \frac{\text{posttest} - \text{pretest}}{\text{maksimum} - \text{pretest}}$$

The results of N-Gain are interpreted as follows.

Table 7. N-Gain Interpretation Criteria

Value Range	Category
g ≥ 0,7	Height
0,3 ≤ g < 0,7	Medium
g < 0,3	Low

RESULTS & DISCUSSION

Result

This research produced a product in the form of google site-based learning media on business opportunity materials in class XI of the State Vocational School 1 Kuala Mandor B. The results of the research are presented based on three main aspects, namely: (1) media development, (2) media feasibility, and (3) media effectiveness.

Media Development

Media development is carried out by referring to the stages of the ADDIE model. At the analysis stage, it was found that learning is still conventional and has not utilized digital media optimally. This condition shows the need for media innovation that can increase interactivity and student involvement in learning.

At the design stage, the media is designed by integrating the PjBL model into the learning structure. The design is carried out based on the results of the needs analysis obtained from interviews with subject teachers, so that the media design is adjusted to the characteristics of students and the material demands of business opportunities.

In the development stage, google sites-based learning media is produced that contains components according to the PjBL syntax, namely: (1) basic questions as a starting point for learning that direct students to the main problem, (2) student worksheets that contain systematic steps in completing the project, (3) a project assignment collection link that allows monitoring of the process by teachers and fellow students, and (4) an interactive comment feature that facilitates discussion, feedback, and reflection between students. The media is also equipped with visual elements in the form of images, videos, and audio introductions designed to increase student attraction and engagement. The presentation of google sites-based media with the PjBL approach is in line with previous research that showed that project-based digital media is able to improve learning outcomes as well as the cognitive and psychomotor abilities of vocational school students (Kusumawati & Prapanca, 2023). The visualization and presentation of interesting material also

contributes to improving students' cognitive processes and learning independence (Munawir et al., 2024).

The media developed supports students in managing the project completion process independently without relying entirely on teachers, as well as encouraging interaction and collaboration. Thus, the media not only plays the role of delivering material, but also as a facilitator of project-based learning activities.

At the implementation stage, media was applied to all research subjects, namely 23 students in grade XI. The implementation of learning began with a pretest to measure students' initial abilities, followed by the use of media in project-based learning, and ended with a posttest. During the implementation process, students accessed online media, worked on project worksheets, and participated in discussions through the interactive features available. Teachers acted as facilitators who monitored the progress of the project work and provided direction when needed.

At the evaluation stage, continuous evaluation is carried out through expert validation and gradual trials to improve the media, as well as the evaluation of learning outcomes to assess the effectiveness of the use of media in learning. The results of the media development are shown in the following image.

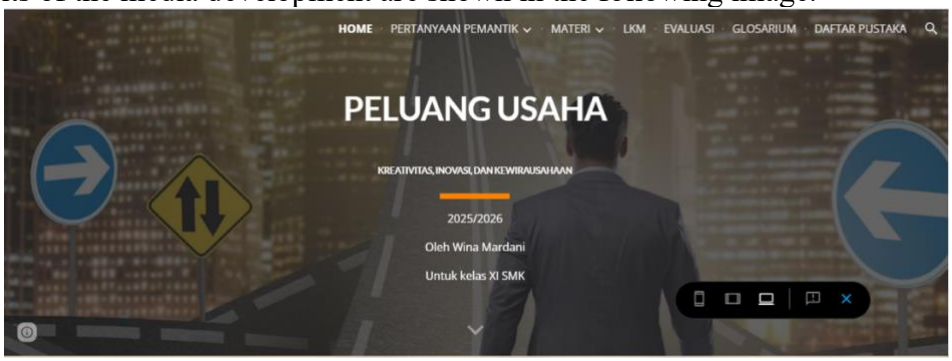

Figure 2. Google Sites home page view

The home page displays the main navigation that contains access to learning materials, project worksheets, and other interactive features. In addition, there is an introduction to learning in the form of material titles, brief descriptions, and supporting visual elements that aim to attract attention and motivate students to start learning.

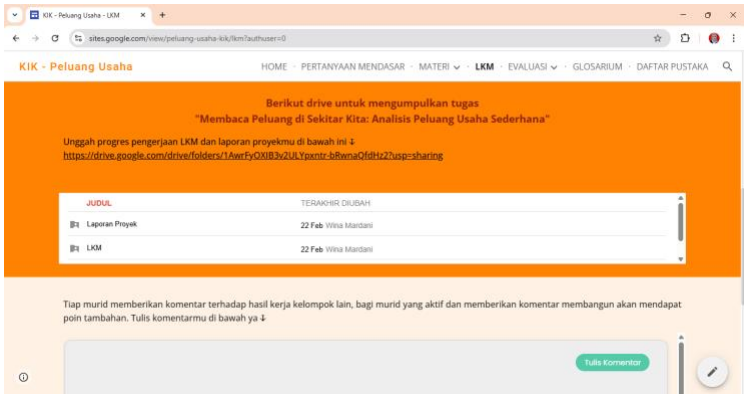

Figure 3. Student Worksheet page view

The student worksheet page is the core of project-based learning activities. On this page, the steps of working on the project are presented systematically, starting from identifying business ideas, analyzing opportunities, to compiling project results. The student worksheet is provided in the form of a document that can be downloaded so that it can be studied in more detail and used flexibly during the work process. This page is also equipped with instructions for use, target work time, and integrated task collection links.

Thus, the student worksheet page not only acts as a guide, but also as a control medium as well as a reflection on the student learning process. Overall, the media developed shows a clear integration between technology and the PjBL model, so that it is able to support project-based learning in a structured and meaningful manner.

Media Eligibility

The feasibility of learning media is analyzed through validation of media experts and material experts, as well as gradual trials on students. The results of instrument validation using Aiken's V are shown in the following table.

Table 8. Validation Sheet Instrument Validity Test Results Using Aiken's V

Validation Results	V Value	Category
Media Expert Validation Sheet	0.85	Very high
Material Expert Validation Sheet	0.86	Very high

Based on table 8, the value of Aiken's V is in the very high category (≥ 0.80), which indicates a strong agreement between validators, so that the instrument is declared feasible to be used to assess learning media.

The results of the assessment by media experts are shown in the following table.

Table 9. Recapitulation of Media Expert Validation Results by Aspect

Aspect	Total Score	Maximum Score	Percentage	Category
General (2 indicators)	27	30	90%	Very Decent
Soft engineering (5 indicators)	69	75	92%	Very Worth
Visual Engineering (5 indicators)	65	75	86.67%	Very Decent
Audio communication (1 indicator)	11	15	73.33%	Eligible
Total	**172**	**195**	**88,21%**	**Very Decent**

The data shows that the media has very good quality in terms of technical and visual, although the audio communication aspect still needs improvement. Overall, the media feasibility rate reached 88.21% with the category of very feasible.

Furthermore, the results of validation by subject matter experts are presented in the following table.

Table 10. Recapitulation of Material Expert Validation Results by Aspect

Aspect	Total Score	Maximum Score	Percentage	Category
Format (2 indicators)	27	30	90%	Very Decent
Contents (4 indicators)	52	60	86.67%	Very Decent
Language (3 indicators)	41	45	91.11%	Very Decent
Total	**120**	**135**	**88,89%**	**Very Decent**

Based on table 10, all aspects of material assessment were in the very feasible category with a percentage of 88.89%, showing that the media content was in harmony with the learning objectives and was easy for students to understand.

After being declared feasible by experts, the media is tested in stages. The results of the trial are shown in the following table.

Table 11. Recapitulation of Learning Media Trial Results

Trial Stage	Media Aspect (11)	Media Content Aspect (7)	Language Aspect (2)	Total Score	Average Score (%)	Kategori
Individual (3 persons)	149	92	26	267	89.00%	Very Eligible
Small groups (10 people)	501	327	94	922	92.20%	Very Decent
Field test (23 people)	1.120	731	216	2067	89.87%	Very Eligible

The results of the trial showed that the media was in the very feasible category at all stages, which indicated a high level of acceptance by students both on a limited and wide scale. Overall, google sites-based learning media was declared very feasible to use.

Media Effectiveness

The effectiveness of learning media was analyzed based on student learning outcomes after the implementation of google sites-based media. The analysis was carried out in stages, including testing the quality of the instruments, prerequisite tests, and testing to improve learning outcomes.

The results of the validity test of the question items showed that all 20 question items had a correlation value greater than the r of the table (0.3291) and a significance value of less than 0.05. Therefore, all question items were declared valid based on the Pearson Product Moment correlation. This shows that the instrument is able to measure the construct of business opportunity analysis ability appropriately. Furthermore, the results of the reliability test are presented in table 12.

Table 12. Reliability Statisitc

Cronbach's Alpha	N of Items
.905	20

Cronbach's Alpha value of 0.905 indicates high reliability so that the instrument has good internal consistency. After being declared valid and reliable, the analysis is continued with a normality test of the pretest and posttest data.

Normality Test

The normality test is performed to ascertain whether the data is normally distributed as a prerequisite for parametric analysis. The test results are shown in table 13.

Table 13. Normality Test Results

	Statistic	df	Sig.
Pretest	.937	23	.154
Posttest	.921	23	.069

Based on table 13, the significance value (Sig.) in the pretest (0.154) and posttest (0.069) data is greater than 0.05, so that the data is normally distributed and meets the requirements of parametric statistical analysis. Therefore, the test is continued with a paired sample t-test.

Paired T-Test

The results of the paired sample t-test are presented in tables 14 and 15.

Table 14. Paired Sample Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	55.87	23	18.929	3.947
	Posttest	86.09	23	11.074	2.309

Based on table 14, the average pretest of 55.87 increased to 86.09 in the posttest, which shows an increase in learning outcomes after the use of learning media.

Table 15. Paired Sample Test

		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pretest - Posttest	-30.217	15.036	3.135	-36.720	-23.715	-9.638	22	0.000

Based on table 15, a significance value of 0.000 (< 0.05) indicates a significant difference between the value before and after treatment. Therefore, the use of google sites-based media has a significant effect on improving student learning outcomes.

To determine the level of improvement in learning outcomes comprehensively, the N-Gain calculation was performed.

N-Gain Test

The results of the N-Gain calculation are presented in table 16.

Table 16. N-Gain Test Results

	N	Minimum	Maximum	Mean	Std. Deviation	Description
N-Gain Score	23	.33	1.00	.7112	.22521	High
N-Gain Percent Score	23	33.33	100.00	71.1246	.22.52122	High

Based on table 16, the average N-Gain value of 0.7112 (71.12%) belongs to the high category, which indicates that the improvement in learning outcomes is not only statistically significant, but also has a strong practical impact on learning.

Overall, the results of the analysis show that google sites-based learning media has proven to be effective in improving student learning outcomes in business opportunity materials.

Discussion

The findings of the study show that the google sites-based learning media developed not only meets eligibility standards, but is also proven to be effective in improving student learning outcomes. This is shown by the results of the paired sample t-test with a significance value of 0.000 (< 0.05) showing a significant difference between pretest and posttest scores. In addition, the N-Gain value of 0.7112 which is included in the high category reinforces that the increase in learning outcomes is statistically significant while having a strong practical impact. Thus, the media developed is able to help students understand the concept of business opportunities more effectively than the previous condition.

This effectiveness is inseparable from the characteristics of learning design integrated in the media. The media not only acts as a material presenter, but also as a learning space that accommodates the PjBL model through key components such as basic questions, project worksheets, and collaborative features in the form of comments and assignment collection links. This structure encourages active student involvement in exploratory, directed, and experiential learning. The increase in the average pretest score (55.87) to posttest (86.09) indicates that the active involvement contributes to strengthening concept understanding. This finding is in line with Kusumawati & Prapanca (2023), but this study provides reinforcement that the integration of PjBL in the google sites platform is also effective in the context of entrepreneurial learning in vocational schools.

From the perspective of learning theory, the effectiveness of this media can be explained through a cognitive approach that emphasizes the importance of active information processing by students. The presentation of structured material in google sites helps organize information so as to facilitate the understanding of concepts and reduce cognitive burden (Abdurakhman & Rusli, 2015). However, the findings of this study are stronger when viewed from the perspective of Vygotsky's social constructivism which emphasizes that the learning process occurs through

social interaction and collaboration. The comment feature and project activities in the media provide space for students to discuss, exchange ideas, and build understanding together. Thus, the improvement of learning outcomes is not only determined by access to the material, but also by the process of negotiating meaning in social interaction (Pinilih et al., 2024).

In addition, visual and multimedia design aspects also contribute to the effectiveness of media. The combination of text, images, videos, and audio in media not only serves as a sweetener or increases appeal, but as a strategy to strengthen the representation of concepts in a multimodal manner. This is supported by the validation results of media experts who place the categories as very feasible in the aspects of software engineering (92%) and visual engineering (86.67%). However, when compared to the research of Munawir et al., (2024), the role of visualization in this study is more dominant in increasing attention and learning engagement, while its impact on long-term retention has not been identified in depth. This shows that there are opportunities for further development related to the sustainability of student understanding.

When linked to previous research, these results are in line with the findings of Nisa & Susilob (2025) which showed that digital media improves learning outcomes. However, this study adds that more significant improvements occur when digital media is combined with the PjBL model, rather than just used as a tool for delivering materials. Globally, Raothao et al., (2023) emphasized the flexibility of google sites in online learning, but the findings of this study show that flexibility alone is not enough, effectiveness increases when accompanied by interactive design and project-based tasks to have an optimal impact. Meanwhile, Tarigan et al., (2023) and Pinilih et al., (2024) highlight increased learning engagement, and these findings expand on this by showing that such engagement directly contributes to the improvement of measurable learning outcomes.

Another advantage of this media lies in the existence of a direct feedback mechanism through interactive features. The comment feature allows students to get a quick response to the results of their work, so that they can make continuous improvements during the learning process. Muzaki et al., (2024) stated that digital feedback plays an important role in improving understanding, and in the context of this study, this function is strengthened through the integration of reflection and collaborative interaction that is not only evaluative but also constructive.

The practical implications of these findings show that the use of PjBL-based google sites can be an alternative learning strategy that is relevant in vocational education. This media not only supports the achievement of learning outcomes, but also develops critical thinking, collaboration, and learning independence. In the context of vocational education, these findings indicate that the integration of learning technology is in line with the needs of the world of work that demands digital literacy and problem-solving skills. This is in line with Yunus et al., (2021) and strengthened by Almulla (2020) who stated that technology-assisted project-based learning is able to increase engagement and higher-level thinking skills.

However, this study has limitations that need to be considered. The use of a one-group pretest-posttest design without a control group causes an increase in learning outcomes that cannot be fully attributed only to the use of media, as there are no comparisons with other learning methods. In addition, the relatively short

duration of implementation has not allowed for the analysis of the long-term impact on knowledge retention and consistency of learning outcomes. These limitations suggest that the findings are preliminary and still need to be further tested in a more robust experimental design.

Based on this, further research is recommended to use quasi-experimental or true experimental designs with control groups to increase inferential validity. In addition, comparative studies with various digital learning platforms need to be conducted to determine the relative effectiveness of google sites compared to other media. Qualitative research can also be developed to delve deeper into the learning experience of students and teachers, especially related to the dynamics of interaction, motivation, and constraints in the use of google sites-based media. Thus, the development of digital learning media not only emphasizes the achievement of learning outcomes, but also the quality of comprehensive learning experiences in vocational education.

CONCLUSION

Based on the research carried out, the development of google sites-based learning media on business opportunity materials in the subject of Creativity, Innovation, and Entrepreneurship with the ADDIE model produced products that meet the eligibility criteria, as evidenced by expert validation and consistent gradual trials showing very feasible categories, so that they are suitable for use as an alternative learning in vocational education. This media has also been proven to be effective in improving student learning outcomes, shown through a paired sample t-test which shows a significant difference between pretest and posttest results, strengthened by the N-Gain value in the high category, so that the use of media provides a statistically and practically strong increase in learning outcomes.

The main contribution of the research lies in the integration of google sites with the PjBL model which functions as an interactive learning space to support active engagement, collaboration, and student independence. These findings show that the effectiveness of digital media is determined not only by technology, but also by pedagogically integrated learning designs. However, these findings are contextual because they were conducted on limited subjects without control groups so caution is needed in drawing generalizations, and further research is suggested to test the effectiveness of media in a broader context with a stronger experimental design.

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