



Received : 01 February 2026

Revised : 04 May 2026

Accepted : 30 May 2026

Publish : 30 May 2026

Page : 99 – 112

Development of Google Sites Web Learning Media Integrated Problem Based Learning Model on Hydrocarbon Material

Tira Kania Pardosi¹, Haqqi Annazili Nasution^{1*}¹Bilingual Chemistry Education Study Program, Chemistry Department,

Universitas Negeri Medan, Medan

*Email: haqqiannazili@unimed.ac.id

Abstract: This research aims to develop a Google Sites-based web learning media integrated with the Problem Based Learning (PBL) model on hydrocarbon material for senior high school students. The research was conducted at SMA Negeri 2 Percut Sei Tuan using a Research and Development (R&D) approach with the 4D development model, consisting of Define, Design, Develop, and Disseminate stages. The subjects of the study were 34 students of class XI-E. Data were collected through interviews, validation questionnaires, learning outcome tests (pretest and posttest), and teacher and student response questionnaires. The feasibility of the developed media was assessed by material and media experts based on BSNP standards. The results showed that the Google Sites web learning media integrated with the PBL model was categorized as very feasible, with an average validation score of 3.58 for material aspects and 3.51 for media aspects. The effectiveness of the media was indicated by a significant improvement in students' learning outcomes, with the average pretest score increasing from 36.76 to a posttest score of 87.20 and an N-gain value of 0.79, which falls into the high category. Furthermore, teacher and student responses toward the developed media were very positive, indicating high interest, clarity of material, and ease of use. These findings suggest that Google Sites web learning media integrated with the PBL model is effective in improving students' understanding and learning outcomes in hydrocarbon material and can be used as an innovative alternative learning media in chemistry instruction.

Keywords: Google Sites; Hydrocarbon Material; Problem Based Learning (PBL); Web-Based Learning Media

INTRODUCTION

The purpose of education also serves to trigger, awaken, and refresh the material that has been discussed, so that students mastery of the subject is more stable (Rahman et al., 2022). Various abilities such as cognitive aspects, intuition, and other skills must be honed so that children have the

provisions to compete in the future (Sangaa and Wangdrab, 2023). As a result, the most affected aspect is the decline in their interest in learning (Taruklimbong and Sihotang, 2023). Chemistry learning at the secondary school level still faces various challenges, particularly due to the abstract and microscopic nature of the subject matter, such as in hydrocarbon material. Based on

the results of interviews with chemistry teachers at SMA Negeri 2 Percut Sei Tuan, there are obstacles experienced by students when learning hydrocarbons, namely difficulty understanding abstract hydrocarbon concepts and students having difficulty imagining the concept of hydrocarbons in daily life, especially in nomenclature sub-material, low understanding of students to learn hydrocarbon materials. Students generally view chemistry as a complex science, which is exacerbated by a weak understanding of concepts, especially in hydrocarbon materials (Kartini and Putra., 2022). Several studies indicate that learning that is still dominated by conventional media has not been able to optimally facilitate active student engagement. In practice, teachers still tend to rely on conventional media such as package books and worksheets. As a result, students activeness in learning activities becomes low, which ultimately negatively impacts learning outcomes in chemistry subjects (Kartini and Putra., 2022). teaching chemistry requires teachers to have a variety of skills, ranging from mastery of materials to the ability to convey abstract concepts effectively in the classroom (Nuranisa et al., 2020). Therefore, learning innovation is needed that integrates technology with student-centered learning models.

Technology plays a crucial role in enhancing the quality of education, particularly when it is effectively integrated into the learning process and aligned with the applicable curriculum. As stated in Permendikbud Number 103 of 2014 concerning Learning in Primary and Secondary Education, contemporary learning emphasizes a shift from teacher-centered to student-centered approaches, in which students actively engage throughout the learning (Mardhiyah et al., 2025). The development of educational technology opens up opportunities for the use of web-based learning media, one of which is Google Sites. Various studies show that the development of this kind of learning media has a positive impact: improving learning

outcomes and improving the overall quality of the learning process (Yudha et al., 2023). The use of interesting learning media can increase students learning outcomes (Sastramiharja et al., 2021)

Google Sites is a technology-based platform, namely in the form of a website that functions as a learning medium. Google Sites is a very ideal platform as an interactive learning medium because of its accessible and user-friendly nature. This platform allows the incorporation of various learning support elements ranging from text, video, images, animations, evaluation forms, presentations, to various other multimedia components that create an attractive media appearance. With these diverse features, the learning process can take place more actively and meaningfully, while spurring students motivation to learn (Rizky Mardhiyah et al., 2025). Various studies have reported that the use of Google Sites as a learning media is able to enhance students' learning interest, motivation, and conceptual understanding. This media has proven to be simple to understand and manage by teachers and students, as well as increasing interest and comfort in learning due to the interactive and diverse display of material (Adzkiya and Suryaman., 2021). Based on research (Khasanah and Muflihah., 2021) the use of Google Sites in learning is able to increase students enthusiasm for learning. (Supriyanto et al., 2021) also stated that this platform makes it easier for students to understand the subject matter. In addition, (Culajara, 2022) found that Google Sites media is effective in strengthening students knowledge and skills. In addition to google sites learning media, the use of learning models also has an effect on improving student learning outcomes, one of which is the Problem Based Learning (PBL) model which is able to help students solve a problem that is often found in daily life (Nasution and Hutabarat, 2024).

In addition, the Problem Based Learning (PBL) model has also been proven effective in improving critical thinking skills, learning independence, active engagement,

and problem-solving abilities through the presentation of contextual problems that are closely related to everyday life. The use of learning models also has an effect on improving student learning outcomes, one of which is the Problem Based Learning (PBL) model which is able to help students solve a problem that is often found in daily life (Nasution & Hutabarat., 2024). The Problem Based Learning model that will be used in hydrocarbon materials to encourage students to solve problems in real, contextual hydrocarbon materials and the use of PBL learning media can increase students independence, because PBL optimizes students thinking skills (Kumalasari et al., 2024)

Nevertheless, reviews of previous studies indicate that the development of Google Sites learning media and the implementation of the Problem Based Learning (PBL) model have largely been conducted separately. The integration of Google Sites as a web-based learning medium with a systematically and contextually designed PBL model for hydrocarbon topics remains limited. In addition, there are still few studies that specifically examine media feasibility, improvements in learning outcomes, as well as teacher and student responses to the use of PBL-integrated Google Sites learning media in senior high school chemistry learning.

There are still several limitations in previous studies. Most research has not optimally integrated web-based learning media with student-centered learning models in a systematic and contextual manner, particularly in abstract topics such as hydrocarbons. In addition, in-depth studies examining media feasibility, practicality of use, teacher and student responses, and improvements in learning outcomes comprehensively are still limited. Therefore, further research is needed to integrate Google Sites with the Problem Based Learning (PBL) model in a cohesive manner while evaluating its effectiveness across these aspects.

Based on these gaps, this study aims to measurable aspects such as product validity, students and teachers responses, and improvements in learning outcomes. Based on these considerations, the study develop the feasibility of web-based learning media using Google Sites integrated with the Problem Based Learning (PBL) model on hydrocarbon material. In addition, it seeks to analyze the improvement in students' learning outcomes after using the developed media and to determine both teacher and student responses toward its implementation. Ultimately, this study is expected to contribute to the development of effective, contextual, and student-centered technology-based innovations in chemistry learning.

LITERATURE REVIEW

Learning is a process in which a person acquires new experiences that are shown through behavioral changes, as a result of interaction with objects in the learning environment (Rahman et al., 2022)

Research and Development (R&D) is a research method that is currently widely adopted in the academic environment to design and evaluate the effectiveness of a product. The main goal is to produce products through a series of processes, namely identifying potential problems, designing products, and developing them as optimal solutions (Waruwu, 2024). The purpose of development research includes two aspects of information, namely: the problem to be solved, and the learning specifications, models, and instruments or devices that will be produced to solve the problem (Okpatrioka, 2023).

The 4D model stands for Define, Design, Develop, and Disseminate. It was introduced in the early 1970s as an extension of the general development stages of the time, namely analysis, design, and evaluation. This model was developed by Sivasailam Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel. The 4D model is a systematic approach to the development of learning tools, designed to produce learning products that are valid, practical, and effective (Rahayu, 2025).

Teaching media is one of the needs in learning to convey the learning material to be taught. Media is also an instrument or tool that has an important role in the teaching and learning process (Fadilah et al., 2023). Learning media are tools that assist the teaching and learning process by making content clearer and helping educational goals to be achieved effectively and efficiently (Nurrita, 2018).

These refer to digital content encompassing a wide range of resources such as websites, social media platforms, films, and games. They also include digital learning materials aligned with the curriculum, designed to support a course or specific topics within it during classroom implementation. In addition, digital tools comprising both hardware and software enable users to carry out activities in a digital environment (Villasmil, 2024). Web-based learning media is seen as a strategic solution to support and facilitate the process of achieving students' educational goals. By utilizing web and internet technology, this media allows the presentation of learning materials in a more flexible, interactive, and adaptive manner to the needs of students (Kumalasari et al., 2024). The use of this media is able to reduce the static classroom atmosphere and make the teaching and learning process more effective, interactive, and interesting, in addition to increasing students' motivation to learn (Panjaitan et al., 2022).

Google Sites has its own characteristics that make it an attractive choice for learning media. Firstly, it is very simple to use and does not require any cost. Secondly, Google Sites allows the integration of various menus and features as needed. Thirdly, it provides online storage capacity of up to 100 MB. Fourthly, easy access from anywhere. The use of this website, in addition to attracting students' attention, also has an impact on improving their learning outcomes (Nuraeni et al., 2023). To access Google Sites, students can use devices such as mobile phones or laptops connected to the internet (Damayanti et al., 2024)

Some of the advantages of Google Sites that researchers have observed are websites that are easily accessible using mobile phones and the internet, can include interesting materials, images and videos, can include examples of questions and practice questions that can be easily accessed by students, this Google Sites can also be used as a medium in the classroom or distance learning.

Problem Based Learning (PBL) is a learning model in which students are actively involved in solving problems through several stages of scientific methods. Thus, students are not only expected to master knowledge that is relevant to the context of the problem, but also develop skills in solving problems effectively (Syamsidah and Suryani., 2018). The Problem Based Learning Model (PBL) encourages the increase of students' independence because in its application, students' thinking is maximized through an active thinking process (Kumalasari et al., 2024). There are advantages and disadvantages to the Problem Based Learning (PBL) learning model according to Warsono and Hariyanto (Mulyani, 2021), namely:

1. Advantages of the Problem Based Learning (PBL) Model
 - a. Students are trained to face and solve problems, related to material and real situations in daily life
 - b. In the process of group discussions, it can foster a sense of solidarity, togetherness, and cooperation between shivas.
 - c. The relationship between teachers and students becomes closer
 - d. Students are used to conducting experiments or in finding solutions to solve given problems so that their scientific skills improve
2. Disadvantages of the Problem Based Learning (PBL) Model
 - a. Not all teachers have the ability to guide students towards effective problem-solving
 - b. The use of this model takes longer

c. Students learning activities outside the classroom are difficult to be directly supervised by teachers.

Learning outcomes are achievements obtained through the learning process, which is reflected in changes in individual behavior in interacting with their environment (Widyasari et al., 2024). Learning outcomes are a form of assessment given to students after they participate in the learning process, which includes an assessment of aspects of knowledge, attitudes, and skills, and is characterized by behavioral changes in students (Yogi Fernando et al., 2024). In addition, there are external factors that also affect student learning outcomes, one of which is the use of learning media (Astuti et al., 2021)

Carbon has an atomic number of 6 and has a configuration of $2s^2 2p^2$ or $1s^2 2s^2 2p^2$. Carbon elements are group IVA (group 14) and are in period 2 in the periodic table of elements. The element carbon is very close to living things and our daily lives. Hydrocarbons are organic chemical compounds that consist only of carbon atoms (C) and hydrogen atoms (H) (Roni and legiso, 2021). Within each hydrocarbon, there is a carbon chain with hydrogen atoms attached to it. Carbon atoms can bond strongly covalently with fellow carbon atoms. The covalent bonds formed between carbon atoms can form single bonds, double bonds, and triple bonds (Ramli et al., 2022)

METHODS

This study employed a Research and Development (R&D) method using the 4D development model, which consists of the Define, Design, Develop, and Disseminate stages. Data collection techniques included interviews, questionnaires, and tests. Interviews were conducted at the initial stage to identify learning problems and needs. Questionnaires were used for student needs analysis, media and material validation based on BSNP standards, and to determine teacher and student responses to the PBL-integrated Google Sites web learning media. Learning outcome tests in the form of pretests and posttests were used to measure improvements

in students' learning outcomes after the use of the learning media. Validation and response data were analyzed using descriptive quantitative analysis by calculating average scores based on a four-point Likert scale and interpreting them into feasibility and practicality categories. Improvements in student learning outcomes were analyzed using normalized gain (N-gain) to determine the effectiveness of the developed learning media. This research was conducted in a limited trial in one class to observe the improvement of students' learning outcomes.

The data analysis used in this study includes:

1. Feasibility Analysis

Table 1. Likert Scale

Criterion	Score
Very agree	4
Agree	3
Disagree	2
Very Disagree	1

Formula:

$$\bar{x} = \frac{f}{N} \quad (1)$$

Information: \bar{x} = Percentage score

f = Total score of data collection

N = Amount of data

Table 2. Average of Feasibility Criteria

Average	Criterion
$3,4 < \bar{x}$	Very Feasible
$2,8 < \bar{x} \leq 3,4$	Feasible
$2,2 < \bar{x} \leq 2,8$	Less Feasible
$1,6 < \bar{x} \leq 2,2$	Infeasible
$\bar{x} < 1,6$	Very Infeasible

Analisis of Teacher and Student Responses

Formula:

$$\bar{x} = \frac{f}{N} \quad (1)$$

Information: \bar{x} = Percentage score

f = Total score of data collection

N = Amount of data

Table 3. Average of Teacher and Student Response Criteria

Average	Criterion
$3,4 < \bar{x}$	Very Positive
$2,8 < \bar{x} \leq 3,4$	Positive
$2,2 < \bar{x} \leq 2,8$	Less Positive
$1,6 < \bar{x} \leq 2,2$	Inpositive
$\bar{x} < 1,6$	Very Inpositive

3. Analysis of Improvement of Learning Outcomes

Formula:
$$g = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}}$$

Information: S_{post} = Average posttest score
 S_{pre} = Average pretest score
 S_{max} = Maximum score

Table 4. Learning Outcomes Analysis Criteria

Value	Category
$N\text{-gain} \geq 0.7$	High
$0.3 \leq (N\text{-gain}) \leq 0,7$	Keep
$(N\text{-gain}) < 0.3$	Low

RESULT AND DISCUSSION

1. Result

The results of this study include material and media validation, improvements in students' learning outcomes, and findings obtained from teacher and student responses.

1. Define Stage

Define stage a needs and problem analysis to identify challenges faced by teachers and students during learning activities, especially difficulties in understanding hydrocarbon materials. Interviews with teachers revealed significant student learning problems, prompting a student needs analysis using questionnaires distributed to 32 Grade XII students, which showed that 62.5% of students struggled with hydrocarbon topics due to a lack of varied learning media. Students expressed a need for interactive, engaging digital learning media that can be accessed independently and anytime. Based on this, the researcher analyzed the curriculum, hydrocarbon concepts, and the Problem-Based Learning

(PBL) model to formulate research objectives. The curriculum supports student-centered, contextual learning, while the hydrocarbon analysis covered key content such as carbon atom identification, structure and nomenclature of alkanes, alkenes, and alkynes, isomers, and combustion effects. Observations indicate that the integrated Google Sites learning media based on the PBL model for hydrocarbon materials is expected to be suitable for enhancing student learning outcomes and will likely receive positive responses from students.

2. Design Stages

This stage starts from the preparation of benchmark reference tests, media selection, format selection, and initial design of activities.

a. Preparation of benchmark reference tests

The researcher made a material and media validation questionnaire in accordance with the BSNP (National Education Standards Agency) standard, which was then validated first by 1 validator who was a lecturer at Chemistry at the State University of Medan. The researcher also made a questionnaire on the responses of teachers and students which had previously been validated by the validator who was a lecturer in Chemistry at the State University of Medan.

b. Media Preparation

To create web learning media, the researcher uses several application programs, including the following:

1. Canva

The cover on the big title of google sites is designed using the canva application. Canva tends to be more visually appealing due to the support of graphic elements such as illustrations, icons, and varied typography.

Figure 1. Cover Design in Canva



2. Microsoft Word

The use of Microsoft Word in the development of the google sites web is when making chemical and mathematical equations written in the google sites web site.

3. YouTube

The use of youtube on google sites web learning media, namely when uploading learning videos, requires a youtube application.

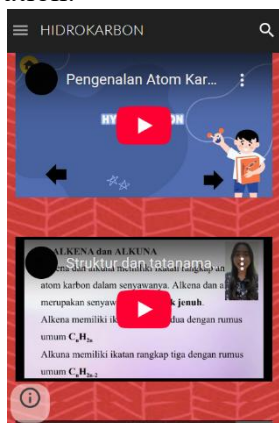


Figure 2. The Use of Youtube on Google Sites

4. Google Form

The use of google forms is used when creating questions on google web sites, so that students can directly access and fill in the answers to questions in google forms in google sites



Figure 3. Gform use in Google Sites

c. Format Selection

The format used is designed to meet criteria that support the clarity of the material and make it easier for users to understand the hydrocarbon material. The aspects that are the basis for the selection of the web format of Google Sites that are developed include:

1. The use of typefaces in the developed google sites web is not excessive; researchers consistently use Times New Roman fonts, with the difference only in the writing of the main title.

2. The choice of cover color on each google sites web subtitle is adjusted to the color of the content in each subtitle so that it is attractive and not boring.

3. Google Sites web provides easy access for users through the web that can be accessed anywhere and anytime.

d. Advance Plan

The researcher makes an initial product or product design. Google Sites web learning media is in accordance with the observations of the defined, and the planning stage (Design) that have been analyzed previously. The initial design of this google sites web is compiled based on the Problem Based Learning learning model. The initial structure of this google sites web starts with the front page, namely the homepage, how to use it as a guide for teachers and students in using google sites, concept maps as an introduction to students' initial understanding, learning objectives, PBL syntax, materials, videos, questions, summaries, bibliographies, glossaries, and development teams.

3. Development Stages

The feasibility testing of the Google Sites web learning media integrated with the Problem Based Learning model on hydrocarbon material was carried out by providing material and media validation sheets that had been previously validated to expert validators in material and media. In development stages also to know the teacher and student respon and increasing student learning outcomes.

1. Material Expert Validation

The material validation instrument sheets were given to 3 material expert validators, namely 2 chemistry lecturers from Universitas Negeri Medan and 1 chemistry teacher at SMA Negeri 2 Percut Sei Tuan. The validation data obtained from the 3 material validators can be seen in **table 5**.

Table 5. Average assessment result of material expert validators

No.	Rating	Average rating			Friendly
		V1	V2	V3	
1.	Content feasibility aspects	3,30	3,38	3,61	3,43
2.	Aspects of presentation eligibility	3,6	3,6	3,8	3,66
3.	Language eligibility aspects	3,7	3,1	4	3,6
4.	Contextual feasibility aspects	3,5	4	3,5	3,66
Average score (\bar{x})					3,58

Based on the average of the results of the assessment of material expert validators from the development of the integrated google sites web learning media on hydrocarbon materials, an average score (\bar{x}) of 3.58 was obtained, so that the integrated google sites web learning media on the Problem Based Learning (PBL) learning model on hydrocarbon materials was declared very feasible.

2. Media Expert Validation

The media validation sheet instrument was given to 3 media expert validators, namely 2 chemistry lecturers at the State University of Medan and 1 chemistry teacher at SMA Negeri 2 Percut Sei Tuan. The results of the validation data obtained from the 3 material validators can be seen in **table 6**

Table 6. Average assessment result of media expert validators

No.	Rating	Average rating			Friendly
		V1	V2	V3	
1.	Aspects of influence on learning strategies	3,6	3,3	4	3,63
2.	Aspects of software engineering	3,2	3,8	4	3,66
3.	Visual and audio display aspects	3,8	3	3	3,26
Average score (\bar{x})					3,51
Validity Criteria					Very feasible

Based on results of media expert validators from the development of the integrated google sites web learning model on hydrocarbon materials, an average score (\bar{x}) of 3.51 was obtained, so that the google sites web learning media integrated with the Problem Based Learning (PBL) learning model on hydrocarbon materials was declared very feasible.

3. Improved Student Learning Outcomes

The next stage that is carried out after the google sites web learning media is integrated with the Problem Based Learning (PBL) learning model on hydrocarbon materials is declared feasible by media expert validators and material expert validators is to implement google sites web by teaching using google sites web that has been developed in class XI-E SMA Negeri 2 Percut Sei Tuan. The pretest and posttest were given to 34 students in class XI-E. There are 20 pretest and posttest questions in the form of multiple choices. The improvement of student learning outcomes from pretest and posttest instruments will be presented and can be seen in **table 7**

Table 7. Student Learning Outcome Improvement Data

Instruments	Red	N-gain	Categories
Pretest	36,76	0,79	height
Posttest	87,20		

There was an increase in students' learning outcomes after being taught using the Google Sites web learning media. The improvement in students' learning outcomes can also be seen in Figure 4

Figure can be presented as follow:

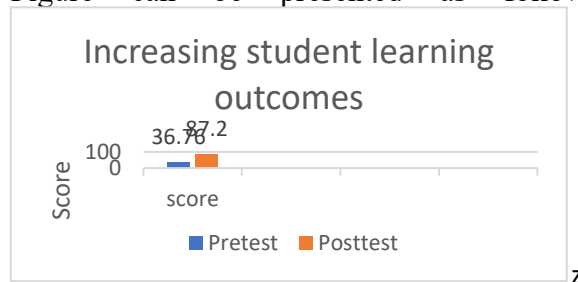


Figure 4. Student Learning Outcome Improvement Data Graph

4. Teacher and Student Respon

The last stage after the google sites web is developed and has been taught to students is the provision of teacher response questionnaires and student responses that have previously been validated by validators to find out how teachers and students respond to google sites web learning media integrated with the Problem Based Learning (PBL) learning model on hydrocarbon materials.

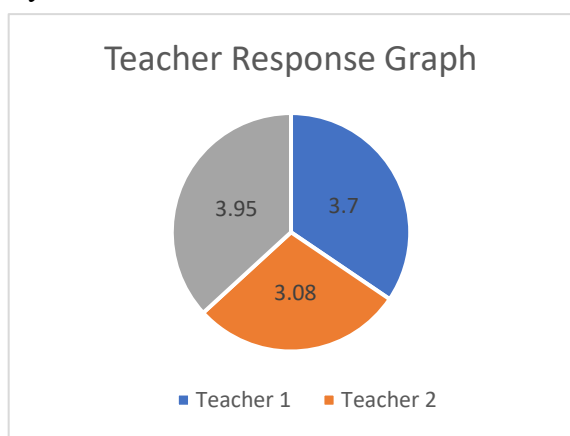


Figure 5. Teacher Response Graph

Based on the average of teacher response assessments from the development of integrated google sites web learning media on the Problem Based Learning (PBL) learning model on hydrocarbon materials, an average score (\bar{x}) of 3.57 was obtained so that the teacher's response from the development of the integrated google sites web learning media on the Problem Based Learning (PBL) learning model on hydrocarbon materials was declared very positive

Table 8. Students Response Assesments

No.	Indicator	Average
1.	Interest	3,60
2.	Material	3,49
3.	Language	3,65
Average score (\bar{x})		3,58
Categories		Very Positive

Based on the average table of student response assesments from the

development of google web learning media google sites web learning integrated Problem Based Learning (PBL) learning model on hydrocarbon materials, an average score (\bar{x}) was obtained of 3.58. So that the response of students from the development of Google Sites web learning media integrated with the Problem Based Learning (PBL) learning model on hydrocarbon materials was stated to be very positive.

4. Disseminate Stage

The dissemination stage is intended to introduce and share the developed product so that a broader audience can benefit from it. In the 4D development model, this stage typically involves wide-scale distribution and implementation. However, in this study, the dissemination phase was carried out on a limited scale due to time limitations and the scope of the research. The dissemination of the Google Sites web-based learning media, which was integrated with the Problem-Based Learning (PBL) model for hydrocarbon material, was conducted through several activities, such as limited implementation, digital publication, and sharing to teachers.

2. Discussion

The product produced from this study is a google sites web learning media integrated with the Problem Based Learning (PBL) learning model on hydrocarbon materials. This research is motivated by the lack of variety in learning media, especially in hydrocarbon materials.

Based on the average results of the assessment of material expert validators from the development of the integrated google sites web learning media on hydrocarbon materials, an average score (\bar{x}) of 3.58 was obtained, so that the integrated google sites web learning media on the Problem Based Learning (PBL) learning model on hydrocarbon materials was declared very feasible.

Based on results of media expert validators from the development of the integrated google sites web learning model on hydrocarbon materials, an average score

(\bar{x}) of 3.51 was obtained, so that the google sites web learning media integrated with the Problem Based Learning (PBL) learning model on hydrocarbon materials was declared very feasible.

The National Education Standards Agency (BSNP) identifies four key feasibility elements that should be considered: the suitability of the material content, the appropriateness of how the material is presented, the quality of language use, and the suitability of the visual or graphic presentation (Asrory et al., 2022). The level of validity of the web-based Google Sites learning media, as assessed by both material experts and media experts, was classified as very valid with a validity percentage of 95% (Hidayat et al., 2025).

According to the *Kamus Besar Bahasa Indonesia* (KBBI), a response is defined as a form of reaction, reply, or answer to something (Saputra, 2019).

Average score (\bar{x}) of 3.57 was obtained so that the teacher's response from the development of the integrated google sites web learning media on the Problem Based Learning (PBL) learning model on hydrocarbon materials was declared very positive.

An average score (\bar{x}) was obtained of 3.58. So that the response of students from the development of Google Sites web learning media integrated with the Problem Based Learning (PBL) learning model on hydrocarbon materials was stated to be very positive.

Based on previous research, the use of Google Sites learning media received a very positive response from teachers. The percentage of responses from male and female students regarding the modern, digital learning media based on the G-Sites website was tested on a limited basis, the results showed a positive response, as the percentage exceeded the minimum threshold (Yuliananda and Sakti., 2022). Students' responses to the developed interactive multimedia learning media based on the Google Sites web indicated a

positive reaction from the students (Said et al., 2023). The analysis of the teacher response questionnaires showed that the average scores for the assessed aspects met the requirements and were in the very good or very positive category (Darnawati et al., 2025). Teachers also gave positive evaluations of the Google Sites-based learning media, indicating a high level of acceptance in terms of content quality, visual design, and ease of use (Nuraeni et al., 2025).

The result obtained from the pretest analysis was 36.76 which is relatively low. However, after learning was carried out using the developed google sites web site, the average student score increased to 87.20. Based on the pretest and posttest scores, an N-gain value of 0.79 was obtained, which indicates an increase in student learning outcomes in the high category.

Based on the improvement in learning outcomes and the response questionnaires filled out by the students, it was found that the increase in learning outcomes occurred because of the increased student interest in the Google Sites media, the media used was attractive and varied, and there were group discussion activities in the PBL syntax. Based on the results of research (Suswati, 2021), it shows that student learning outcomes whose material was taught through the application of PBL are higher compared to the application of the conventional model, so it can be concluded that the implementation of the Problem Based Learning (PBL) instructional model can improve student learning outcomes, especially in the subject of Chemistry. Google Sites has a positive effect on students' interest in learning, with an increase in the percentage of mastery of learning outcomes of 23% (Sari, 2023). The use of Google Sites media has been proven to significantly improve students' understanding and learning outcomes. This is seen from the consistent increase in the class average scores (Septiana et al., 2025). The use of Google Sites has a positive

relationship with learning outcomes (Hidayatillah et al., 2022).

CONCLUSION

Google Sites web learning media integrated with the Problem Based Learning (PBL) learning model on hydrocarbon materials was declared very feasible with an average score of materi validation is 3.58 and an average score of media validation is 3.51. Improvement of chemistry learning outcomes of students who are taught with google sites web learning media integrated with the Problem Based Learning (PBL) learning model on hydrocarbon materials is categorized as high with an N-gain value of 0.79. The response of teachers and students to the integrated google sites web learning media of the Problem Based Learning (PBL) learning model on hydrocarbon materials was very positive with the average teacher response assessment of 3.57 and the average assessment of student response was 3.58. For teachers, it is better to apply google sites web learning media integrated with the Problem Based Learning (PBL) learning model on hydrocarbon materials and google sites web with learning modes and other approaches to improve student learning outcomes. For students it is recommended that they first read the instructions for using the google sites web to be studied in order to be able to use learning media to the fullest.

ACKNOWLEDGEMENT

Authors would like to express sincere gratitude to Universitas Negeri Medan for the academic support and facilities provided throughout the research process. Appreciation to SMA Negeri 2 Percut Sei Tuan for granting permission and support during the data collection phase of this research. Special thanks go to thesis advisor, for the insightful guidance, suggestions, and constructive feedback provided throughout the study.

REFERENCE

Adzkiya, D. S., & Suryaman, M. (2021). Penggunaan Media Pembelajaran Google Site dalam Pembelajaran

Bahasa Inggris Kelas V SD. *Educate : Jurnal Teknologi Pendidikan*, 6(2), 20.

Asrory, A. F., Zamani, A. F., & Daroini, S. (2022). Studi kelayakan buku ajar bahasa Arab berdasarkan standar BSNP. *Tarbiyatuna: Jurnal Pendidikan Ilmiah*, 7(2), 103-116.

Astiti, N. D., Mahadewi, L. P. P., & Suarjana, I. M. (2021). Faktor yang mempengaruhi hasil belajar IPA. *Mimbar Ilmu*, 26(2), 193-203.

Culajara, C. J. (2022). Maximizing the Use of Google Sites in Delivering Instruction in Physical Education Classes. *Physical Education and Sports: Studies and Research*, 1(2), 79-90.

Damayanti, A., Wahyuni, E. A., Ahied, M., Rakhmawan, A., & Fikriyah, A. (2024). Pengembangan Media Google Sites Berbasis Model Problem Based Learning untuk Meningkatkan Motivasi Belajar Peserta Didik pada Materi Bumi dan Tata Surya. In *Jurnal Natural Science Educational Research* (Vol. 7, Issue 2).

Darnawati, D., Daud, F., & Arsyad, M. (2025). Pengembangan E-Modul Berbasis Google Sites untuk Meningkatkan Hasil Belajar Fisika Peserta Didik SMAN 19 Bone. *Jurnal Pendidikan dan Profesi Keguruan*, 4(2), 101-107.

Fadilah, A., Nurzakiah, K. R., Kanya, N. A., Hidayat, S. P., & Setiawan, U. (2023). Pengertian media, tujuan, fungsi, manfaat dan urgensi media pembelajaran. *Journal of Student Research*, 1(2), 01-17.

Hidayat, D. H., Okmarisa, H., Ardiansyah, A., & Afrianis, N. (2023). Pengembangan Media Pembelajaran Berbasis Web Google Sites Menggunakan Pendekatan Stream (Science, Technology, Religion, Engineering, Art, And Mathematics)

- Pada Materi Kimia of Scientific Engineering and Applied Hijau. Konfigurasi: Jurnal Science (IJSEAS), 5, 395–400. Pendidikan Kimia dan Terapan, 9(1), 10-25.
- Hidayatillah, W., Wisudaningsih, E. T., & Pratama, L. D. (2022). Kepraktisan media pembelajaran interaktif berbasis google sites berorientasi pada hasil belajar dan minat belajar siswa. *Laplace: Jurnal Pendidikan Matematika*, 5(1), 93-104.
- Kartini, K. S., & Putra, I. N. T. A. (2022). Kebutuhan Pengembangan Media Pembelajaran Berbasis Android pada Materi Hidrokarbon. *Jurnal Edutech Undiksha*, 10(1), 117-125.
- Khasanah, R., & Muflihah, S. M. (2021). Online Learning Management Using Google Sites on Relations and Functions in Pandemic Conditions. *Journal of Education and Learning Mathematics Research (JELMaR)*, 2(1), 68–76.
- Kumalasari, M. R., Yuliani, H., & Azizah, N. (2024). Pengaruh Google Sites Berbasis Problem Based Learning (PBL) Terhadap Kemandirian Belajar Siswa Pada Materi Fluida Statis. *Jurnal Penelitian Pembelajaran Fisika*, 15(2), 145–152.
- Mulyani, Y. (2021). Metode Problem Based Learning Pada Pembelajaran Ekonomi Materi Ketenagakerjaan. *Science, Engineering, Education, and Development Studies (SEEDS): Conference Series*, 5(1).
- Mardhiyah, R. (2025). Pengembangan Media Pembelajaran Interaktif Menggunakan Google Sites Berorientasi Chemo-Entrepreneurship pada Materi Hidrokarbon: Penelitian. *Jurnal Pengabdian Masyarakat dan Riset Pendidikan*, 3(4), 4933-4942. Pujjiono, W., Hendriana, Y., & Partimawati. (2015). Learning Media Introduction of Plant Species Based on Multimedia. *International Journal of Scientific Engineering and Applied Science (IJSEAS)*, 5, 395–400.
- Nasution, H. A., & Hutabarat, V. E. (2024). Efektivitas Penggunaan Modul Kimia Higher Order Thinking Skill Berbasis Problem Based Learning pada Materi Reaksi Redoks untuk Meningkatkan Hasil Belajar Peserta Didik. 9(2). 97–102
- Nuraeni, Z., Dewi, N. K., & Indraswati, D. (2023). Pengembangan Media Pembelajaran Berbasis Web. *Journal of Classroom Action Research*. (5): 279–284.
- Nuranisa, N., Irhasyuarna, Y., & Iriani, R. (2020). Pengaruh Penggunaan Aplikasi Chemscketch Dengan Metode Resitasi Terhadap Hasil Belajar Pada Materi Hidrokarbon. *Jcae (Journal Of Chemistry And Education)*, 4(1), 24-33.
- Nurrita, T. (2018). Pengembangan media pembelajaran untuk meningkatkan hasil belajar siswa. *MISYKAT: Jurnal Ilmu-ilmu Al-Quran Hadits Syari'ah dan Tarbiyah*, 3(1), 171-210.
- Okpatrioka. (2023). Research And Development (R&D) Penelitian Yang Inovatif Dalam Pendidikan. *Jurnal Pendidikan, Bahasa Dan Budaya*, 1.
- Panjaitan, D. J., Ridwan, M., & Aprilia, R. (2022). Pengembangan media pembelajaran berbasis website untuk meningkatkan motivasi belajar siswa pada masa pandemi Covid-19. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11(2), 1524
- Rahayu, A. (2025). Metode penelitian dan pengembangan (R&D): Pengertian, jenis dan tahapan. *DIAJAR: Jurnal Pendidikan Dan Pembelajaran*, 4(3), 459-470.
- Rahman, A. R. B., Sabhayati Asri Munandar, Andi Fitriani, Yuyun Karlina, & Yumriani. (2022). Pengertian pendidikan. ilmu pendidikan. dan unsur-unsur pendidikan. *Al-Urwatul*

- Wutsqa: *Kajian Pendidikan Islam*. 2(1). 1–8.
- Ramli, M., Saridewi, N., Budhi, T., Suhendar, A. (2022). *Kimia untuk SMA*. Jakarta. Kebudristek.
- Rizky Mardhiyah, Yusnidar, & Afrida. (2025). Pengembangan Media Pembelajaran Interaktif Menggunakan Google Sites Berorientasi Chemo-Entrepreneurship pada Materi Hidrokarbon. *Jurnal Pengabdian Masyarakat Dan Riset Pendidikan*, 3(4), 4933–4942.
- Roni, K. A., Martini, S., & Legiso, L. (2021). Analisis Adsorben Arang Aktif Sekam Padi dan Kulit Pisang Kepok untuk Pengolahan Air Sungai Gasing, Talang Kelapa, Kabupaten Banyuasin Sumatera Selatan. *Jurnal konversi*, 10(2), 13-18.
- Said, A. R., Iriansyah, H. S., & Huzaefah, O. (2023). Pengembangan media pembelajaran multimedia interaktif berbasis WEB Google Sites untuk meningkatkan motivasi belajar siswa SMPN I Teluknaga Tangerang. *Jurnal Citizenship Virtues*, 3(2), 544-558.
- Sanga, L. D., & Wangdra, Y. (2023, September). Pendidikan adalah faktor penentu daya saing bangsa. In *Prosiding Seminar Nasional Ilmu Sosial Dan Teknologi (SNISTEK)* (Vol. 5, pp. 84-90).
- Saputra, H. N. (2019). Analisis respon guru dan siswa terhadap penerapan model siklus belajar hipotesis deduktif dalam pembelajaran kimia. *PEDAGOGIK: Jurnal Pendidikan*, 6(2), 278-299.
- Sari, T. I. (2023, May). Pemanfaatan Media Pembelajaran Interaktif Google Sites Dalam Meningkatkan Minat Belajar Analisis Kimia Dasar di SMKN 1 Panjatan. In *Prosiding Dewantara Seminar Nasional Pendidikan* (Vol. 1, No. 02).
- Septiana, D. S., Azizah, H. N., Putri, R. N. A., Sumarni, G. N., & Nugraha, R. G. (2025). Implementasi Media Website Berbasis Google Site Untuk Meningkatkan Pemahaman Siswa Kelas IV SDN Conggeang I Pada Materi Profesi Masyarakat Berdasarkan Bentang Alam. *Didaktik: Jurnal Ilmiah PGSD STKIP Subang*, 11(04), 213-228.
- Sastramiharja, U. S., Nathanael, L., Permata Sari, R. W., & Kusriani, F. (2021). Pengaruh Penggunaan Media Video Terhadap Motivasi Belajar Peserta Didik. *EDUTECH*, 20(1), 72–86.
- Supriyanto, N., Faisal, M., Aji, B. P., & Putri, H. (2021). The Use Of Google Sites Media In Learning At Madrasah Ibtidaiyah Ma'arif Labschool Sintang During The Covid-19 Pandemic. *IJGIE (International Journal of Graduate of Islamic Education)*, 2(2), 93-105.
- Suswati, U. (2021). Penerapan problem based learning (PBL) meningkatkan hasil belajar kimia. *TEACHING: Jurnal Inovasi Keguruan Dan Ilmu Pendidikan*, 1(3), 127-136.
- Syamsidah dan Hamidah Suryani. (2018). *Model Problem Based Learning (PBL)*.
- Taruklimbong, E. S. W., & Sihotang, H. (2023). Peluang dan tantangan penggunaan AI (Artificial Intelligence) dalam pembelajaran kimia. *Jurnal Pendidikan Tambusai*, 7(3), 26745-26757.
- Villasmil, L. (2024). The effects of influencing factors on upper secondary school teachers' use of digital learning resources for teaching. *Computers and Education Open*, 7, 100210.
- Widyasari, D., Miyono, N., & Saputro, S. A. (2024). *Peningkatan Hasil Belajar melalui Model Pembelajaran Problem Based Learning*.

- Waruwu, M. (2024). Metode Penelitian dan Pengembangan (R&D): Konsep, Jenis, Tahapan dan Kelebihan. *Jurnal Ilmiah Profesi Pendidikan*, 9(2), 1220–1230.
- Yudha, S., Nurfajriani, N., & Silaban, R. (2023). Analisis Kebutuhan Guru Terhadap Pengembangan Media Pembelajaran Kimia Berbasis Android. *Jurnal Warta Desa (JWD)*, 5(1), 42–47.
- Sinaga, M., Situmorang, M., & Hutabarat, W., (2019). Implementation of Innovative Learning Material to Improve Students Competence on Chemistry. *Indian J of Pharmaceutical Education and Research*, 53(1):28-41.
- Yogi, Popi Andriani, & Hidayani Syam. (2024). Pentingnya Motivasi Belajar Dalam Meningkatkan Hasil Belajar Siswa. *ALFIHRIS: Jurnal Inspirasi Pendidikan*, 2(3), 61–68.
- Yuliananda, Q. P., & Sakti, N. C. (2022). Pengembangan Media Pembelajaran Berbasis Website dalam Bentuk Google Sites untuk Peserta Didik Kelas XI IPS. *Jurnal Pendidikan Ekonomi (JURKAMI)*, 7(2), 15-28.