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Google Sites as a Tool for Chemistry: Exploring the 8E Learning Cycle Approach

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ABSTRACT: The shift towards student-centered learning has heightened the demand for effective learning media in the digital era. Nevertheless, the availability of suitable resources remains limited. The fundamental laws of chemistry involve numerous complex concepts, making learning media essential to support student understanding. This study aims to develop and analyze Google Sites as a learning medium based on the 8E Learning Cycle to enhance the learning process of the fundamental laws of chemistry. The media was developed using the ADDIE model by Dick and Carey, limited to the development stage. Validation was conducted by one media expert and one material expert, while assessments were carried out by five high school chemistry teachers and 11 high school students. Google Sites as learning media developed interactively and compatible, combining the 8E Learning Cycle framework to improve student comperhension.. Validation results showed that media and material experts performed at 95.00% and 85.00%, respectively. The assessment of chemistry teachers was 94.33%, which is included in the very good category. In addition, student responses reached 100%. These findings indicate that the developed Google Sites learning media functions as an effective alternative that is in line with the principles of student-centered learning and supports students in understandingthe fundamental laws of chemistry.

Keywords: google sites, learning cycle 8E, the fundamental laws of chemistry

INTRODUCTION

The digital education era curriculum focuses on student-centered learning. This learning model provides many opportunities for students to learn according to their needs and enhances the learning experience to be more interesting and enjoyable [1]. in this era, teachers act as facilitators, to motivate students' interest in learning and prepare appropriate teaching methods or strategies. The methods in this curriculum are designed to accommodate various student characteristics, ensuring that each student can receive learning that suits their individual needs.

There has been a significant shift in the education system in Indonesia, beginning during the COVID-19 pandemic. This pandemic introduced a new phenomenon in education: the creation of digital or virtual classrooms, which shifted activities initially conducted in person to the online environment. During this period, societal habits began to change, replacing face-to-face interactions with online activities [2]. Online learning involves interactions between teachers and students, facilitating the transfer of knowledge [3]. Implementing online learning cannot be separated from using technology, which helps simplify and enhance the learning process [4, 5]. In this era, the application of student-centered learning has become more emphasized, especially compared to the pre-pandemic period when its implementation was still limited. This era also highlights the significant role of digital tools in education.

The Student-Centered Learning program, implemented alongside the era of digitalization, faces significant challenges in its execution. The most prominent issue is the lack of learning media and methods that support this approach, as printed materials such as books and student worksheets (Lembar Kerja Peserta Didik/LKPD) are no longer widely used. Therefore, it is necessary to utilize media that can achieve optimal learning and educational outcomes while helping to clarify the meaning that

needs to be conveyed in the learning process [6, 7]. The effective use of learning media to support the educational process will ease teachers' instructional tasks and help students better understand the material being taught [8]. Media also helps teachers better deliver lessons to students and makes learning more active and fun [9].

Chemistry has material characteristics that differ from other subjects, and much of it is abstract, making it difficult for students to comprehend [10, 11]. The fundamental laws of chemistry are essential because they form the foundation for subsequent chapters [12]. According to the chemistry teacher at SMA Negeri 1 Kendal, this material is poorly understood by students due to insufficient time for instruction and the abstract nature of the concepts [13]. Reasoning regarding the fundamental laws of chemistry is also prone to misconceptions [12]. It is because, in learning the fundamental laws of chemistry, students tend to memorize the laws without fully understanding the underlying concepts [14]. As a result, students fail to develop critical thinking skills and become bored. A survey conducted by Fajri and Yusmaita [15] at SMAN 1 Batam revealed that, on average, students found the topic of the fundamental laws of chemistry in Grade 10 challenging to understand, leading to a high potential for misconceptions. It aligns with an interview with a chemistry teacher, who stated that while the fundamental laws of chemistry are crucial for students' understanding in Grade 10, students often struggle with grasping the concepts and are hindered by limited instructional time, leaving their understanding incomplete This shows the need for media and learning models that can help student to learn the fundamental laws of chemistry more effectively.

One of the learning media that can be used to support the implementation of the student centered learning concept is website-based learning media. Websites can be an option because they can make learning activities more interesting and interactive and increase student learning motivation [16]. This idea is in line with the research Styawati, Oktaviani, and Lathifah [17], that websites make it easier for teachers and students to carry out the teaching and learning process. It is also supported by the study by Sevtia et al. [18], that web-based learning media can be accessed and used anywhere and anytime, so that it can help advance the teaching and learning process and apply the principles of student-centered education. Websites also make students feel more enthusiastic and provide them easiness in accessing and understanding the material according to their needs [19].

Google Sites is one of the websites that can be used, because Google Sites has several advantages, including being able to accommodate and display various information in one place, its flexible nature can be accessed on various devices, it does not need to be installed so it saves storage and the display is easy to use [18, 20]. Taufik et al. [21] added that Google Sites is the easiest and simplest way to build web-based learning media for teachers. Google sites also provide various features that can be used to help the learning process, in addition, Google sites can also be combined with various applications provided by Google to create and display interesting materials for students [22].

One of the learning models that can be combined with Google Sites to support the implementation of student centered learning is the Learning Cycle. Learning cycle learning activities have been developed up to the 8E concept [23]. The development of the learning cycle model aims to complement the essence of learning, so that students have the opportunity to optimize their learning process and creative thinking [24, 25]. Ridwan and Rahmawati [23] developed the 8E learning cycle with the 8 following stages (Engage, Explore, E-Search, Elaborate, Exchange, Extend, Evaluate, and Explain). The 8E learning cycle stage is designed to enable students play an active role in learning activities such as demonstrations or discussions [26]. Research by Mahardika et al. [24] get the results that this learning model can improve understanding, reduce misconceptions and can improve students' soft skills. This is in line with research conducted by Fitriyani et al. [27], that the 8E learning cycle can improve students' conceptual understanding and critical thinking skills.

This study focuses on the development of media to increase student activity and conceptual understanding in learning fundamental laws of chemistry. The media developed is Google Sites learning media combined with the Learning Cycle 8E model to help students learn according to their needs and support the implementation of student-centered learning in the curriculum. The hope is that Google Sites based on the 8E learning cycle learning model developed can help students and teachers in learning process of fundamental laws of chemistry.

RESEARCH METHODS

This study applies the Research and Development (R&D) methodology, applying the ADDIE concept with the Dick and Carey approach [28]. The ADDIE model consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. However, this study is limited to the Development stage. The selection of ADDIE concept is based on Nugroho and Grendi [29], that stated ADDIE is suitable for a wide range of instructional product development and allows researchers to collaborate with experts,

ensuring the creation of high-quality educational resources. The research aims to develop chemistry learning media based on Google Sites on the Fundamental Laws of Chemistry material with the Learning Cycle 8E learning model.

Analysis

The analysis phase consisted of several components. First, a performance analysis was conducted to identify and clarify performance issues. Second, a needs analysis was essential to determine the skills or competencies required to improve performance or academic achievement. Third, target audience analysis was conducted to assess the existing knowledge and skills of the learners. Lastly, task and topic analysis was carried out to identify the relevant learning content that can enhance knowledge and skills in alignment with the learning objectives.

Design

The design phase was aimed at developing the product. The steps covered selecting the media and the format, gathering references, creating instruments, and designing the initial product. This phase focused on designing the initial prototype of the Google Sites media, which incorporates the Learning Cycle 8E instructional model.

Development

The development phase involves creating the product according to the structure outlined in the design phase. During this phase, expert validation and product revision are also conducted. This phase aimed to produce a learning media that meets the criteria for high-quality media. Activities in this phase included content development. It covered gathering and developing the necessary information and materials, storyboard development, which creates a schematic representation of all the media components, and courseware development. This stage included producing the learning media components, organizing the material in a web presentation format, and integrating the content into the developed website.

Validation and Assessment

The validation and assessment phase included the following steps: consultation with a supervising lecturer, which resulted in the first revision of the product. Next, a discussion with peer reviewers was conducted to gather suggestions and feedback (second revision). The media and content were validated by material and media experts to obtain recommendations for improving the quality of the developed media (third revision). Five chemistry teachers then carried out the assessment. Eleven high school students responded by evaluating the quality and reception of the developed product, ultimately leading to further refinement of the media.

The product assessment instrument

The instruments used include product validation sheets, product assessment sheets using Likert scale questionnaires, and student response sheets using Guttman scale questionnaires. The instrument expert validated the instrument employed to ensure its validity. The content expert validation sheet consists of aspects related to content and the learning model. The validation sheet from media experts included aspects related to usability, organization, and design. The media reviewer assessment sheet included aspects of content, learning model, usability, organization, and design. The student response sheet covers usability, content, organization, design, and the learning model.

TABLE 1. Scoring Rules

Category	Score
Very Good (VG)	**4**
Good (G)	**3**
Fair (F)	**2**
Poor (P)	**1**

TABLE 2. Ideal Assessment Criteria

Score	Category
$x \geq \bar{x} + SBi$	Very Good
$\bar{x} + SBi > x \geq \bar{x}$	Good
$\bar{x} > x \geq \bar{x} - SBi$	Fair
$x < \bar{x} - SBi$	Poor

The data analysis technique for product quality assessment involved converting qualitative assessment data into quantitative data based on the Likert scale, as outlined in TABLE 1. Then, the

overall average for each aspect and each individual assessment aspect was calculated. The scores were subsequently transformed into qualitative values according to the ideal rating categories, as shown in

TABLE **2**.

$$\overline{X} = \frac{\Sigma X}{N} \quad \text{.....(1)}$$

$\bar{x}$ = Average Score
Σx = Total Score
N = Number of Reponses

The technique for analyzing the student response results was applied by converting qualitative data into quantitative data in the form of Guttman scale scores, as shown in

TABLE **3**. The score data was then used to calculate the Ideal percentage of the product as a whole, and for each aspect, the following formula for Idealness was used.

TABLE 3. Guttman Scale Scoring Rules

Category	Score
Yes	1
No	0

$$\text{Idealness} = \frac{\text{Number of "ideal" responses}}{\text{Total number of responses}} \times 100\% \quad \text{.....(2)}$$

RESULT AND DISCUSSION

Analysis

The analysis phase started with a performance analysis conducted through a literature review. The findings indicate that while the curriculum performance is already well-adapted to the digital era, implementing the Student-Centered Learning approach still needs improvement [30]. Second, a needs analysis is conducted through interviews with chemistry teachers and a literature review. The interview results revealed a lack of learning media that can effectively support the Student-Centered Learning model, especially during online and hybrid learning, which has been widely implemented. Additionally, students' comprehension during lessons has declined, as indicated by their decreased engagement in the learning process. This decline in engagement is attributed to the limited availability of interactive learning media and the use of less engaging materials. Learning media is crucial in enhancing students' interest in the subject matter [31, 32]. Furthermore, the limited classroom time for delivering content also challenges ensuring effective learning.

The third step involved a target audience analysis, in which 10th-grade senior high school students were the research subjects. This decision was based on the fact that 10th grade marks the beginning of high school education, where students were still adapting to a new learning environment. Moreover, the curriculum at this level included fundamental concepts that served as the foundation for understanding more advanced topics in the following grades. The fourth step was task and topic analysis, focusing on chemistry as the subject of study. Chemistry is well-known for its unique characteristics, with many abstract and complex concepts for students to grasp [10, 11]. Among these topics, fundamental laws of chemistry have been identified as a challenging area where student engagement and comprehension tend to decline. Findings from literature reviews and teacher interviews indicate that while fundamental chemistry laws are essential for building a strong conceptual foundation in 10th grade, students often struggle with understanding these concepts due to limited instructional time and incomplete comprehension, leading to misconceptions. Furthermore, these fundamental laws serve as prerequisites for more advanced chemistry topics in grades 11 and 12, making them a critical area of focus for improvement.

The conclusion drawn from the analysis phase was the necessity of developing an online learning media or e-learning platform to facilitate and enhance the teaching and learning process for both teachers and students [17]. Online learning media offer numerous advantages, primarily by providing access to all learning materials without restrictions on time and location, allowing students to engage with the content anytime and anywhere [33]. According to Sari [34], removing spatial and temporal limitations through integrating adequate online media enables teachers to manage classes from any location while also delivering engaging learning experiences. It aligns with the current educational

landscape in Indonesia, where online and hybrid learning models are being widely implemented. Therefore, developing an online learning platform is proposed to support teachers and students in achieving effective and flexible learning outcomes.

Design

The design stage contains several stages. The first stage is media selection, where the product developed will be in the form of a website using Google Sites. Google Sites was chosen because it has many advantages including free, easy to access, easy to create, large capacity, has many features, and can be accessed anytime anywhere [35, 36]. Furthermore, according to research conducted by Sevtia et al. [18], online learning media based on Google Sites helped students understand the material independently and was flexible, as it could be accessed on any device. Nugroho and Grendi [29] also argued that Google Sites-based learning media is suitable for use as an educational tool that facilitates student learning in an online/remote learning environment with a Student-Centered Learning orientation. Therefore, Google Sites was selected for the fundamental laws of chemistry material. The media was subsequently developed based on the Learning Cycle 8E instructional model to assist students in comprehending the material presented on the Google Sites platform. The Learning Cycle model was chosen because it enhances understanding, reduces misconceptions, and fosters the development of students' soft skills. This learning model also encourages students to actively engage with technology to improve their skills [24]. Research by Mustakim [8] shows that students feel helped by the existence of online learning media during online and hybrid learning, in addition, research conducted by Fitriyani et al. [27] shows that the 8E learning cycle learning model helps students understand the concepts of the material being studied and improves critical thinking skills [37].

The second stage is the format design, which includes determining the content of the learning media to be developed based on the Learning Cycle 8E framework. As a result, it was decided that the media would include a homepage, competency standards, basic competencies and learning outcomes, learning materials, assignments, discussion forums, and bibliographies. The third stage is the collection of reference materials to be included in the Google Sites platform. These references include chemistry textbooks that are in line with the current curriculum, university textbooks, and credible online sources.

The fourth stage was the development of assessment instruments for evaluating the Google Sites-based learning media. These instruments are designed based on the journal article "A Hierarchical Model to Evaluate the Quality of Web-Based E-Learning Systems" by Muhammad et al., published on May 15, 2020 [38], and Website Quailty Asessment Criteria [39]. The final stage was the design phase, which involved creating a prototype or initial design of the Google Sites-based learning media. The prototype was then reviewed and discussed with the supervising lecturer for feedback and refinement.

Development

The development phase was executed by creating a product that was in accordance with the prototype. The product is developed on the Google Sites platform, incorporating the Learning Cycle 8E instructional model for the core topic of the fundamental laws of chemistry, which includes the law of conservation of mass, the law of definite proportions, the law of multiple proportions, the law of combining volumes, and Avogadro's hypothesis. The Development phase was conducted in multiple stages, which encompass:

a. *Content development*: This phase involves creating content to be included on the website.The content, as shown in FIGURE 1, includes formulas, GIFs, and educational videos that would be integrated into the website.

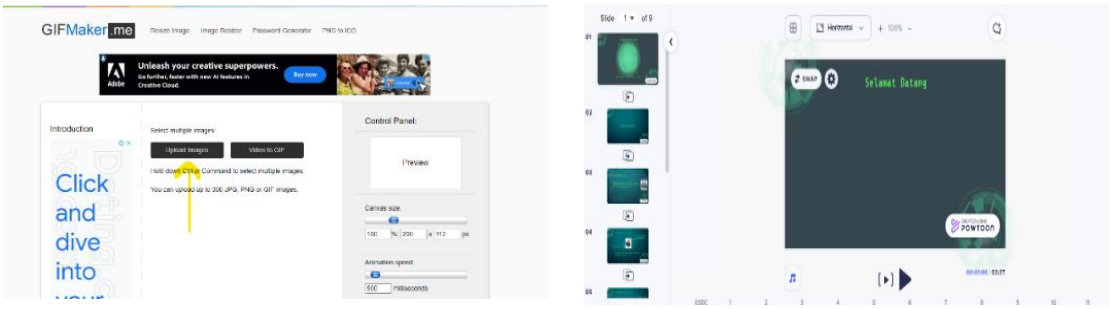

FIGURE 1. Content development of google sites with the 8e learning cycle approach

b. *Storyboard Development,* A schematic diagram was created to illustrate the placement of components within the product, based on the Content Development model of the Learning Cycle 8E. Each aspect of the website corresponded to a specific stage in the Learning Cycle 8E. The purpose of this schematic was to ensure that the content is organized systematically, allowing for a structured flow that ensures no elements are overlooked during the development process.

c. *Courseware development,* The components of the Google Sites platform, based on the Learning Cycle 8E model, were realized by organizing the sequence of content into a web presentation format and integrating the content into the created website. It was done by creating pages on the website using the address https://sites.google.com/. The page creation followed the guidelines outlined in the storyboard development and format design. At this stage, content and media were added and embedded using “text boxes.” Theme customization was done by selecting from the available "themes" or tailoring them according to the specific needs. In the theme settings, elements such as the logo, header, font, and theme colors were adjusted to suit the website design. The addition of pages and subpages was managed through the “Pages” section within Google Sites. Other content insertion could be done as needed via the right-side sidebar of the Google Sites page. The development process, as shown in FIGURE 2, included these steps. The final step of this phase was the website publication by clicking the “Publish” button at the top right corner of the page. The outcome of this publication represents the initial product before undergoing validation, evaluation, and revision.

d. *The initial Google Sites media product,* which covers the fundamental laws of chemistry and was based on the Learning Cycle 8E instructional model, was subsequently consulted with the supervising lecturer for the first round of revisions. Upon receiving approval and completing the necessary revisions, the product moved to the validation and evaluation stages.

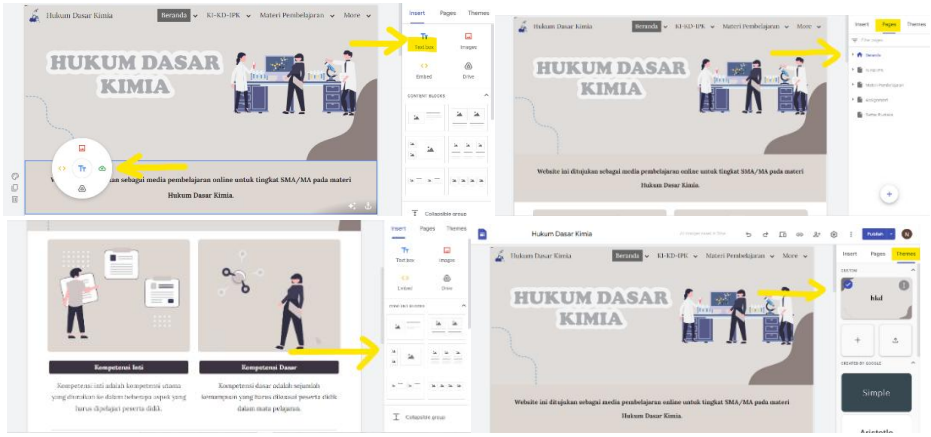

FIGURE 2. Development of Google Sites with the 8e learning cycle approach

Result Google Sites

FIGURE 3. The Google Sites display on various devices

The developed Google Sites learning media, which incorporates the Learning Cycle 8E model on the fundamental laws of chemistry, includes the following sections: Homepage, competency standards, fundamental competencies and learning outcomes, Assignments, Learning Material, and Bibliography.

The media was developed based on the outcomes of the Development stage after several revisions. The website's interface can be accessed on various devices, as shown in FIGURE 3. The Homepage provided several pieces of information about the content included on the website, and it also features a discussion column that allows students to engage in anonymous discussions. The competency standards, fundamental competencies and learning outcomes section is where students can view the competencies they are expected to learn and achieve after studying the material available on the Google Sites platform. The Learning Material section contains the content students will study, including real-life applications, fundamental laws, essential formulas, and the history of the fundamental laws of chemistry. The Assignments section includes LKPD (Student Worksheet), practice questions, and a grade list. The Bibliography section provides a list of references used in developing the Google Sites platform.

The Learning Cycle 8E instructional model was implicitly and explicitly implemented in Google Sites. The explicit application of the Learning Cycle 8E was visible across all aspects, including the LKPD (Student Worksheet), within the Google Sites platform, as illustrated in FIGURE 4. It is an implicit breakdown of each phase of the Learning Cycle 8E [26] as implemented in the developed media.

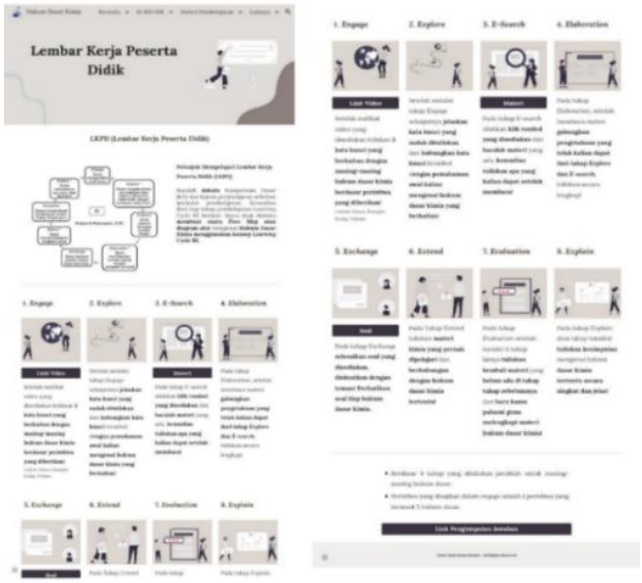

FIGURE 4. Student Worksheet with the 8e learning cycle approach

a. Engage. This stage is implemented in the “Examples in Daily Life” section, which presents real events related to the material. For example, the law of conservation of mass is illustrated through the phenomenon of iron rusting, a common event that students may experience in everyday life. The goal is to help students build an initial understanding of the law being studied. The Engage stage is also integrated into the Student Worksheet.

FIGURE 5. Examples In Real Life in the Google Sites with the 8e learning cycle approach

b. Explore, implemented in learning materials and examples of reactions. Examples of reactions are equipped with images so that students better understand the processes that occur, for example in the HCl reaction in Avogadro's hypothesis in FIGURE 6.This stage is also inserted in the LKPD. The goal is for students to remember the initial concepts learned at this stage.

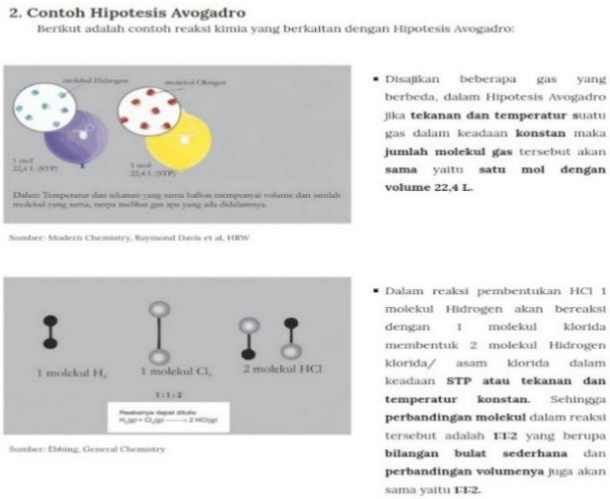

FIGURE 6. Materials in the Google Sites with the 8e learning cycle approach

c. E-Search implemented in the developed website. The website provides learning materials and videos to provide students about the material that being studied. The media is also give many sources in one place so that students can find materials that are still in accordance with the context. This approach was intended to ensure that students focus on the relevant content, promoting a more organized and effective learning experience.
d. Elaborate. This stage is provided in the Student Worksheet, where students are encouraged to reflect on their thoughts after watching the video, engaging with real-world examples, and reading the material. This stage serves as a tool for teachers to monitor student understanding and ensure that there are no misconceptions. By reflecting on the material, students can strengthen their understanding of the concept, and teachers can assess how far students' understanding has developed.
e. Exchange. This phase was provided in the discussion column (Figure 7) and the Student Worksheet. Students were encouraged to exchange ideas and engage in discussions about the questions provided.

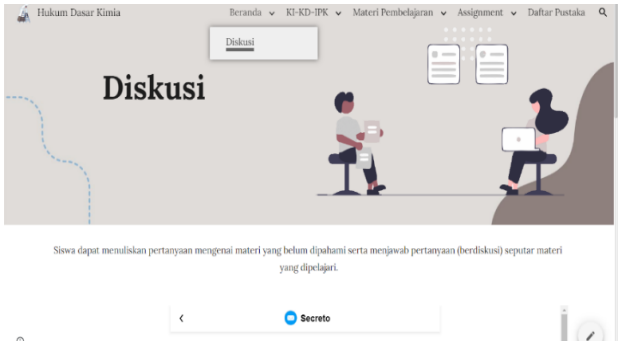

FIGURE 7. Discussion Column in the Google Sites with the 8e learning cycle approach

f. Extend. This phase is integrated into the LKPD (Student Worksheet). The purpose of this stage was to help students understand the importance of the fundamental laws of chemistry and the connect the material being studied and related concepts.
g. Evaluation. This phase was was integrated into the discussion column (Figure 7) and the Student Worksheet to facilitate the exchange of information. This stage was also incorporated into the quiz section on important formulas, helping students apply their conceptual understanding.

h. Explain. This phase was integrated into the Student Worksheet. It was also included in the practice questions to assess students' understanding of the fundamental laws of chemistry that have been studied. This allows students and teachers to gauge levels of understanding and identify areas that may require further repetition or review.

Validations, Assessment, And Responses From Student

The Google Sites product, based on the Learning Cycle 8E instructional model, was validated by one subject matter expert and one media expert. The media was then assessed by five reviewers (high school chemistry teachers) and received feedback from 11 high school (SMA/MA) students. The validation results from the subject matter expert on the aspects of content and instructional model were categorized as VERY GOOD, with the overall content scoring 17 and an idealness percentage of 85.00%. Similarly, the media expert's usability, configuration, and design validation results also fell into the Very Good category, with the media scoring 38 and achieving an idealness percentage of 95.00%. The assessment results from five chemistry teacher reviewers on the aspects of content, instructional model, usability, configuration, and design yielded an average score of 56.6 and an idealness percentage of 94.33%, which falls into the Very Good category.

Furthermore, student responses from 11 seniot high school students regarding content, instructional model, usability, configuration, and design reached 100% idealness across all aspects. These findings indicate that the Learning Cycle 8E-based learning media effectively enhances students' understanding of the fundamental laws of chemistry. Additionally, students actively engaged in the learning process while using the media. The validation, assessment, and student response results are presented in Table 4. The developed media can be accessed at https://sites.google.com/guru.sma.belajar.id/hukum-dasar-kimia/.

TABLE 4. Validation by subject material and media experts, assessment by reviewers (chemistry teachers), and responses from high school students

Validator/Assessor	Aspect	Criteria	Σ Score	Total	Idealness	Category
Material Expert	Content	3	11	17	85,00%	Very Good
	Learning Model	2	6			
Media Expert	Usefulness	2	8			
	Configuration	4	16	38	95,00%	Very Good
	Design	4	14			
Chemistry Teachers	Content	3	58			
	Learning Model	2	37			
	Usefulness	2	37	283	94,33%	Very Good
	Configuration	4	75			
	Design	4	76			
Students	Usabiliity	2	22			
	Content	1	11			
	Configuration	2	22	99	100%	Very Good
	Desgin	3	33			
	Leaning Model	1	11			

Previous research on learning media development in chemistry education was presented in Table 5. This development does not include student assessment, because it is limited to validation by subject matter and media experts. Based on the literature review, expert validation, and student feedback, it can be concluded that the Google Sites developed in this study function as an interactive and compatible alternative learning media for basic chemical laws. The developed Google Sites are integrated with interactive discussion links and combine various multimedia elements, including video, animation, GIF, and audio, which support students in understanding the material.

The study conducted by Agusti et al. [40] developed an e-module for the topic of bufferSolutions. The developed electronic media demonstrated excellent outcomes and incorporated theLearning Cycle concept. However, the media lacked digital discussion platforms, and audiovisual animations.Mardani and Azra [41] developed a learning medium in the form of a game called Chemistry Backgammon (Chemmon). The developed media received highly positive evaluations and validity ratings from experts and chemistry teachers. However, several limitations were identified, including its print-based format, students' unfamiliarity with the game, and the lengthy time required to complete it. Additionally, printed media are less effective in supporting digital-era and pandemic-era learning, which emphasizes Student-Centered Learning (SCL), where teachers and students interact online [3].

Andani and Yulian [42] conducted a study on the development of learning media for the fundamental laws of chemistry in the form of an e-book. The developed media received a very positive response from students. However, the product was not equipped with instructional videos, discussion pages, and interactive links to convey responses and opinions. Learning media that facilitate effective and efficient discussions and feedback without limitations of place and time are very important in the digital era. Sotikno et al. [43] developed Android-based learning media for the fundamental laws of chemistry. While the media met interactive criteria, it was designed as an Android application, which may not be compatible with certain device specifications. This development does not include student assessment, because it is limited to validation by subject matter and media experts. Based on the literature review, expert validation, and student feedback, it can be concluded that the Google Sites developed in this study function as an interactive and compatible alternative learning media for basic chemical laws. The developed Google Sites are integrated with interactive discussion links and combine various multimedia elements, including video, animation, GIF, and audio, which support students in understanding the material.

TABLE 5. Comparison with previous research

Media Type	Interactive	Compatible	Fundamental Laws of Chemistry	Learning Cycle 8E	Result		Reference
					Teacher	Student	
Websites	Yes	Yes	Yes	Yes	Very Good	Very Good	*This Work*
E-modul	Yes	Yes	No	Yes	Very Good	Very Good	[40]
Games	No	No	Yes	No	Very Good	-	[41]
E-Book	Yes	Yes	Yes	No	-	Very Good	[42]
Android Apllication	Yes	No	Yes	No	Very Good	Good	[43]

CONCLUSION

The research and development conducted have successfully developed an interactive Google Sites media based the Learning Cycle 8E model for teaching the fundamental laws of chemistry. The developed Google Sites incorporates instructional materials aligned with the Learning Cycle 8E model, emphasizing students' cognitive knowledge development and reducing misconceptions. The product received excellent validation from subject matter experts and media experts. Teacher evaluations also indicated that the media is highly suitable for use in learning. Furthermore, student responses demonstrated excellent ratings across all assessment aspects of the developed media. Therefore, it can be concluded that the developed media can serve as an alternative learning resource to support students and teachers in teaching and learning the fundamental laws of chemistry.

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