



Application of Google Sites-Based Learning Media as Alternative Learning Media in Chemistry Education Learning

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Abstract: The need for post-pandemic alternative media development in chemistry learning at school is the goal of this research. This study uses a research and development model. Alternative learning media developed in the form of website-based learning using Google Sites. Two media experts validated the material content, and the media content was validated by two additional media experts. Validation was carried out twice. The results of media validation in this study included the substance of media content, learning design, visual communication, and the use of software by media validators, with percentages of 98.44%, 98.75%, 93.75%, and 97.92%, respectively. The average score of 97.21% falls within the valid category. The results of material validation, based on aspects of content feasibility, pedagogical aspects, language assessment, and graphics, by the material validator, namely 95.83%, 95.83%, 100%, and 100%, with an average score of 97.91%, are included in the valid category. The trial was carried out at MA Hidayatul Marifah with 20 students. The results of teacher and student responses, respectively, were 92.17% and 90.12%, which were included in the good category.

Keywords: chemistry education; google sites-based learning; media learning

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INTRODUCTION

The development of science and technology, which is highly advanced at this time, requires corresponding advancements in the field of education. Technology, communication, and information can enhance student learning and help form students with the skills needed in this era (Yeop et al., 2019). The COVID-19 pandemic has significantly impacted the learning process in schools. The pandemic necessitated the implementation of quarantines by governments and the transition of all educational institutions to distance learning, resulting in significant changes in the field of education worldwide. Therefore, a solution is needed so that education and distance learning can create opportunities and a more personalized approach to teaching in order to be able to improve scientific literacy in students (Bida et al., 2022; Li & Guo, 2021; Muhariyansah et al., 2021; Winata et al., 2017; Zen, 1990).

Kılıç and Saygılı (2022) suggest preparing a curriculum with an interdisciplinary approach that values learner-centred practices, skills, values, and activities. The implementation phase can be done by creating digital content as a learning resource. Learning does not only use computers as offline learning resources but is also developed online through web-based learning (Cahyana et al., 2019). Web-based learning is an online learning medium that can be accessed via the internet, allowing users to learn from anywhere and at any time (Astuti et al., 2020).

Learning media as a means of learning activities are required to be more creative and innovative to suit the current situation. In addition, traditional learning media tend to bore students. To overcome this problem, this research was designed as an educational website that utilizes interactive content to help students acquire learning materials. The use of the web as a learning medium has been widely practiced in various disciplines such as mathematics, physics, biology, and chemistry (Astuti et al., 2020; Cohen et al., 2017; Fatahillah et al., 2020; Haley et al., 2018; Rochmad, 2012; Safrida et al., 2016).

This web-based learning was developed using the Google Sites application. Using Google Sites to create a website is certainly a reasonable choice. The main reason is that all Google services, including Google Sites, are free. With free services, it means that teachers do not incur additional costs to develop learning media (Zhafirah et al., 2020). Google Sites is also an application that is very easy to use. To create a website with Google Sites, teachers do not need special skills; they just need to access <https://sites.google.com> and follow the steps for creating a website through various video tutorials for creating and managing websites with Google Sites, which are widely available at <https://m.youtube.com>. This certainly makes it much easier for teachers to create and manage their websites. The use of web-assisted Google Sites in learning provides students with opportunities to build their knowledge (Özdal et al., 2022).

Chemistry is one of the scientific subjects that studies every aspect of our lives (Jespersen et al., 2012). Characteristics of learning chemistry are facilitated through three levels: macroscopic, microscopic, and symbolic. These characteristics enable brave students to understand chemical concepts. According to Andina et al. (2017), students are expected not only to apprehend chemical concepts, but also to apply them in their lives. Generally, students face difficulties in visualizing the submicroscopic level and relating it to the representative level of chemistry (Hairani & Amini, 2023). Fatah et al. (2021) concluded the results that Development of Web-Based Basic Chemistry Learning Media on the subject of Thermochemistry has produced basic chemistry learning media products for thermochemical topics that are suitable for use by upper, middle and lower group students with validation results from media experts and material experts each getting a score of 5 (very good) in all aspect.

Yulianti et al. (2021) obtained results showing that website-based ionic liquid learning improves students' competency in every aspect of ionic liquid knowledge and skills, as well as their website knowledge and attitudes. Although not all students can do it independently, the learning can attract the attention of students. Learning should be combined with the lecturer's explanation to reinforce the concept. The implications of this research are expected to be used as recommendations in enriching the Chemical Engineering education curriculum by adding website-based ionic liquid material. Mkrttchian et al. (2019) argue that two things can be identified in modern universities today: the development of distance learning and the digitization of traditional education. They choose their stage of development and show that both lead to the same result - a new quality of education.

The authors conclude that the most effective path to achieving the highest level of development depends on the characteristics of the university, as well as the stage of development of distance learning and the digitization of traditional education. Januarisman and Ghufro (2016) developed web-based learning media for natural science subjects for class VII students. The results of this study indicate that web-based learning media products in science subjects have been declared eligible as learning media based on the validation results from material experts and media experts, with the "good" category. The effectiveness of web-based science learning media is evidenced by the increase in student learning outcomes, as indicated by the data from pretest and posttest evaluation results.

METHODS

The research design employs a research and development (R&D) design, utilizing a Plomp development model that comprises a preliminary investigation phase, a design phase, a realization/construction phase, and a construction phase. Validation, testing, and revision (evaluation, test, and revision), and the implementation phase (Arianatasari & Hakim, 2018), with a development flow chart adapted from Azhar (2016). The following is a description of the activities carried out in each phase: 1) *Preliminary Investigation*. Various analyses were carried out in this phase, specifically focusing on the front end, students, materials, and competencies, by collecting and analyzing related information to plan further activities; 2) *Design*. The design phase aims to design the prototypes and instruments; 3) *Realization/Construction*. The realization/construction phase aims to produce prototypes and instruments as the realization of the designs that have been designed; 4) *Evaluation, Test, and Revision*. The validation, trial, and revision phase (evaluation, test, and revision) aims to obtain an assessment and advice on the prototype that has been constructed. These assessments and suggestions were obtained through Validation and trial activities (Arikunto, 2016). This research is limited to the validation, trial, and revision phases. The implementation phase was not carried out because the purpose of the research was only to develop a valid prototype and review user responses.

The types and sources of data used as data collection devices in this study, namely: 1) Primary Data, including: validation sheets used to determine the validity criteria, user response questionnaires used to determine student and teacher response criteria, chemical literacy tests, and chemical science attitude questionnaires; 2) Secondary Data, including syllabus, implementation plans, lesson plans, books, and related articles.

Literature and field study are the data collection techniques used in this research. A literature study was conducted to gather theoretical information from numerous relevant works, while a field study was conducted to collect data related to the validity and user responses. Assessment data and suggestions related to validity were obtained through validation by a team of validators, which included two media validators and two material validators. The scientific literacy measurement data of students was obtained through a scientific literacy test, which consisted of 20 questions. Validity analysis was carried out on aspects of material substance, learning design, display (visual communication), and software utilization. The percentage obtained is then converted into a qualitative value based on the validity criteria in Table 1. User Response Analysis, User response analysis using a four-choice Likert scale at Table 2 (Rohmad et al., 2013).

Table 1. Percentage of score

Percentage of score (%)	Validity Criteria
75,00-100	Valid
50,00-74,99	Quite Valid
25,00-49,99	Not Valid
0,00-24,99	Invalid

Table 2. Attitude Statement

Attitude Statement	Skor
Agree	4
Quite Agree	3
Not Agree	2
Disagree	1

The formula used to calculate the percentage of user response scores is the one proposed by Yamasari (2010). The percentage obtained is then converted into a qualitative value based on the user response criteria (Yamasari, 2010).

Table 3. User Response

Percentage (%)	User response criteria
75,00-100	Very good
50,00-74,99	Good
25,00-49,99	Not Good
0,00-24,99	Bad

RESULT AND DISCUSSION

The results of the R&D research carried out are products in the form of WEB-based Learning Media using Google Sites on valid Class X SMA/MA Equivalent Chemical Bonding Materials. Material experts and media experts carried out validation. The product has been tested on a limited basis on 20 MA Hidayatul Ma'rifiyah Pkl students. Kerinci and SMAN 1 Pkl. Kerinci. The trial results have been applied at MA Hidayatul Ma'rifah. The following is a description of the results of the activities carried out in each phase: Preliminary Investigation. Various analyses were carried out in this phase, including the front end, students, materials, and competencies, by collecting and analyzing related information to plan further activities. The following explains each analysis conducted.

The results of the front-end analysis, conducted through interviews with two teachers, distributing questionnaires to students, and reviewing the literature, concluded that the use of WEB-based media, specifically Google Sites, which has not been applied in learning, is expected to greatly assist students in learning chemistry as an additional learning material. Independent, especially in the process of teaching and learning activities the new normal system is very dependent on the use of IT, which can be shared/published on the school's e-learning system, which will provide opportunities for students to improve learning outcomes by fulfilling various kinds of learning styles of students with different abilities, motivated in learning activities, as well as adding references to teaching materials other than printed teaching materials, and so on.

The results of the pre-research questionnaire data showed that, regarding chemical bonding materials, as many as 82.8% of students felt that the material was challenging to understand because it contained abstract concepts and included a lot of theory that needed to be comprehended. Therefore, through this Web-Based Learning Media Using Google Sites, the material is presented in a simple, easy-to-understand, and systematic way, progressing from simple to complex questions. Students are guided to solve them, making it easier for them to answer and find knowledge about the material independently. The results of the analysis showed that the chemical bonding material contained in the basic competencies of 3.5, 4.5, 3.6, 4.6, 3.7, and 4.7 in the chemistry lesson syllabus. Where the subject matter of chemical bonds is to be loaded onto an interactive medium, which is developed only from the basic competencies of 3.5 and 4.5, will then be compiled into learning media. The competencies expected to be realized through this learning after the analysis is complete are those of attitudes, knowledge, and skills.

The results of activities in the design phase include tools and materials in various forms, such as text, images, audio, video, animation, Flash, links, and software related to the prototype. Additionally, a review of relevant literature related to the instrument was conducted. Outline or outline against a prototype that systematically contains content according to the characteristics of web-based learning media—instruments, validation sheets by media and material validators, as well as response questionnaires by users.

The realization/construction phase aims to produce prototypes and instruments as the realization of the designs that have been designed. The prototype design includes the title of the learning media, basic

competencies, and learning objectives: how to use media, learning media materials, animated pictures, and videos. The results of the assessment instrument preparation consist of an expert assessment instrument, validated by a material expert and a media expert, as well as a user response questionnaire (for teachers and students), each accompanied by a grid design.

Validation was carried out twice. The second validation was carried out based on the suggestions derived from the results of the first validation. Media expert validation was carried out on aspects of content substance, learning design, visual communication, and software utilization. The validation carried out on the substance of the media content in the 1st validation yielded 8.38%, which was categorized as "fairly valid." After improvement, the results in the 2nd validation were 98.44%, categorized as "valid." The validation of the learning design aspect yielded the first validation result, which was 95%, classified as "valid." After improvements were made to the second validation, the result was 98.75% which was classified in the valid category". The results of the validation on the visual communication aspect in the first validation were 71.88% which was included in the "fairly valid" category. The validation results on the aspect of software utilization in the first validation are 95.83% which are included in the "valid" category after repairs are made, the second validation results are 99.92% which are included in the "valid" category. The graph of the validation results, as evaluated by media experts, is shown in Figure 1.

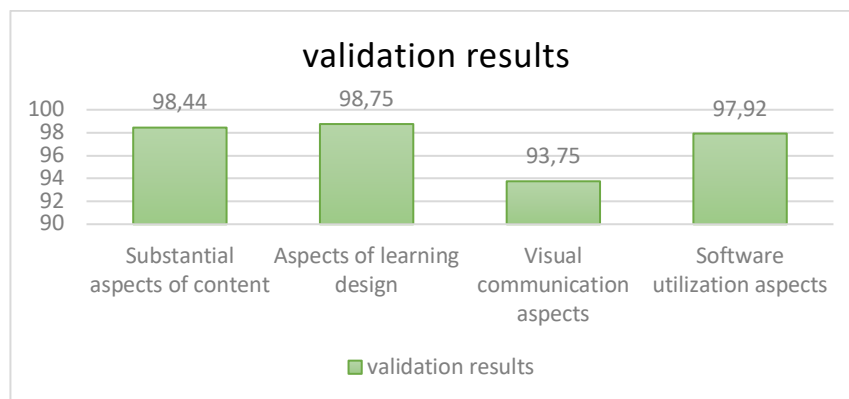


Figure 1. Validation Results by Media Experts

Validation by material experts was conducted on aspects including content feasibility, pedagogical aspects, language assessment aspects, and graphic aspects. The results of the first validation on the feasibility aspect of the content are 93.06%, which falls within the "valid" category after repairs have been made. The results of the second validation are 95.83%, also included in the "valid" category. The results of the validation on the pedagogic aspect in the first iteration were 87.50%, which was categorized as "valid" after improvement. The second validation result was 95.83%, which was also categorized as "valid". The validation results for the language assessment aspect in the first validation were 95.83%, which fell within the "valid" category. After the improvement, the 2nd validation results were 100%, also falling within the "valid" category. The results of the validation on the graphic aspect in the first validation are 87.5%, which is included in the "valid" category after repairs have been made. The second validation results are 100%, which are also included in the "valid" category. The graph of the validation results, as evaluated by material experts, is shown in Figure 2.

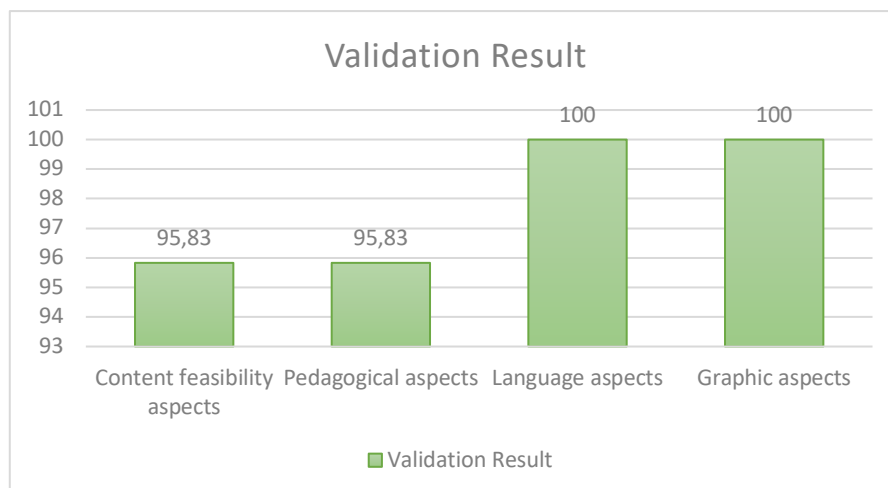


Figure 2. Validation Results by Material Experts

Trials conducted on several students received a positive response. One-on-one trials were conducted on students at SMAN 1 PKL Kerinci and MA Hidayatul Ma'rifah. The test results are presented in Table 4.

Table 4. Media Work Value Per Learning Activity

Learning Activities	Nature of Learning Materials	Result					
		PD-01	PD-02	PD-03	PD-04	PD-05	PD-06
1	Theory	80	80	60	100	80	60
2	Theory	90	80	80	90	80	80
3	Theory	80	80	80	80	80	80
	Practicum	95	85	82	97	90	85
	Amount	345	325	302	367	330	305
	Average	86,25	81,25	75,5	91,75	82,5	76,25

Small-group trials were then conducted to assess the responses of both teachers and students. The teacher response test was administered to two teachers from SMAN 1 PKL Kerinci and one teacher from MA Hidayul Marifah. The result of the teacher's response to the learning media is 92.17%, which falls within the "good" category. The student response test was given to 10 students at SMAN 1 PKL Kerinci and 10 students at MA Hidayatul Marifah. The results of students' responses to the learning media are 90.12%, which fall within the "good" category. Revision is carried out after every validation and prototype testing.

The product of this research is WEB-based learning media using Google Sites on chemical bonding material that has been developed flexibly, so that it can be accessed online and offline by teachers and students via a link (web HTML). According to the results of the initial investigation, it is evident that students struggle with learning chemical bonding material. This is because chemical bonding materials contain complex concepts, so students need learning media that can engage them in independent learning. The results of the pre-research questionnaire data indicate that, in the context of chemical bonding, most students find the material difficult to understand because it involves abstract concepts and extensive theory that requires comprehension. An important investigation is conducted to ensure the resulting media is suitable.

In the design phase, an outline of learning media is developed systematically. Assessment instruments, designed by both material experts and media experts, are intended to evaluate products objectively and efficiently. Assessment instruments must be developed following the objectives to be achieved and based on the learning materials presented (Sadiman et al., 2018). The form of measuring tools can be by tests, observations, assignments, or behavior checklists. In this study, user response questionnaires are necessary to assess the extent to which users can effectively utilize the resulting product. In the realization/construction phase, the designs are then realized in real media and instruments. The products that have been produced are then validated by experts. Validation was conducted twice to ensure the resulting product was suitable for use in learning. This is also in line with Azwar (2012), which states that the validity of a product developed can be determined based on the results of validation activities.

Each validator is asked to assess and provide suggestions for the media that has been designed. Media validators are asked to assess and provide input on four aspects: content substance, learning design, visual communication, and software utilization. Material validators are asked to assess and provide input on four aspects: content feasibility, pedagogy, language assessment, and graphics. Validation tools are submitted to each validator in the form of validation sheets and validation rubrics to facilitate assessment and suggestions in the validation process (Enawaty & Erlina, 2016). The first validation is conducted by soliciting suggestions and comments from the media validator and reviewing the materials related to the media that have been created, which are then followed up on and revised. The second validation was conducted to request an assessment from the media and material validator regarding the revised media, by providing a learning media assessment sheet to the validator. Based on the data in Figures 1 and 2, the results indicate that the media developed falls into the very valid category, allowing it to proceed to the next stage.

One-on-one trials and teacher and student response tests were also conducted to assess whether the developed product was considered practical. The results of the one-on-one trials are presented in Table 4. The results showed that the trial scores exceeded the passing grade and could be implemented in class. Small-group trials were then conducted to assess the responses of both the teacher and the students. The teacher response test was administered to two teachers from SMAN 1 PKL Kerinci and one teacher from MA Hidayul Marifah. The result of the teacher's response to the learning media is 92.17%, which falls within the "good" category. The student response test was given to 10 students at SMAN 1 PKL Kerinci and 10 students at MA Hidayatul Marifah. The results of students' responses to the learning media are 90.12%, which fall within the "good" category. Revision is carried out after every validation and prototype testing.

CONCLUSION

Web-based learning media, developed using Google Sites for the chemical bonding material, are validated for their effectiveness in materials and media. The results of the media validation were declared to have met the aspects of substance, learning design, visual communication, and software utilization. The results of the material's validation were declared to have met the aspects of content feasibility, pedagogical aspects, language assessment, and graphics. The results of media and material validation fell into the valid category. Trials conducted with teachers and students yielded good results.

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