Development of General Chemistry Learning Media (Solution) Using Web Based Learning Model

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Abstract. A lecturer should think about how to employ creative and effective learning material to rebuild students' knowledge, skills, and creativity. With the aid of learning media and a web-based learning paradigm, this study intends to demonstrate the viability, efficacy, and improvement of student learning outcomes in learning general chemistry solution materials. The ADDIE development model is the one that is employed. Books and learning resources for general chemistry solutions using a web-based learning approach were produced as a result of this research and development, and they have been recognized as valid and successful in enhancing student learning results. The difference between student learning outcomes before and after using General Chemistry learning materials in a web-based learning approach demonstrates the improvement in student learning outcomes with an average increase 25.633.

Keywords: Solution, Media, Web Based Learning Model.

1 Introduction

The main difficulty for the ideal educational system is to prepare not only the nation's current generation but also the generation that will be able to be a future resident. The obstacles of the current global era are getting increasingly difficult, necessitating creative problem solving with a critical perspective [1]. The various types of education are unquestionably extremely different at the university level. In addition to offering courses, topics, and strategic concepts, university education is meant to foster the development of students' autonomous learning skills, such as taking initiative, taking responsibility, and studying independently [2].

The issue of the effectiveness and results of the learning process is one of the major issues with Indonesia's educational system. This problem relates to the availability of educational resources and materials that are not typically available without being restricted by space and time [3]. Additionally, the 21st century's modernization and globalization developments have had a significant impact on all sectors, including education. The flood of information has become increasingly out of control and given rise to what is described as the "digital information explosion" with the invention of optical cable technology and web browsers. One

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can quickly and very simply use a search engine to find the needed reference material. Technology advancements have successfully digitized educational materials and interaction procedures, enabling all of this [4].

The quickening pace of information and communication technology development has also altered the structure of daily life. Using media and digital technology, also known as the information super highway, has made education possible in the 21st century, which has been called the age of knowledge due to the exceptional acceleration of knowledge advancement. The technique in which learning activities are conducted within the time of knowledge should be modified to meet those needs. The design of learning materials needs to be more realistic so that students can experience issues and work together to develop answers. Students' searches for answers to problems they solve lead to questions, which they might subsequently research utilizing the information resources at their disposal [5].

A teacher or lecturer must meet a number of requirements for 21st century learning, particularly in terms of competencies and skills. The teacher or lecturer's primary responsibility is to get students are prepared for the 21st century [6]. Building students' learning capacities and assisting in their development to become continuous, active, independent learners are the main objectives of 21st century learning. The demands for professionalism of 21st century educators are not on the ability of educators to know and be proficient about everything, but rather educators have the expertise to learn alongside their students and become role models of trust, openness, and persistence to their students so that they can face the realities of 21st century digital life [7]. In order to balance the needs of the millennial generation and prepare students for 21st century life skills, 21st century learning must be technology-based. Students in the twenty-first century need to be proficient in science, comprehension skills, capable of teamwork or communication as well as critical and creative thought. This circumstance effectively demonstrates the discrepancy between expectations and reality [8].

The learning process is essentially a communication process in which messages (material) are delivered from the instructor (teacher or lecturer) to the recipient (students), and in order for the information to be effectively delivered, a media is required. Media plays a significant role in many aspects of communication, including learning. A lecturer must take into consideration how to rebuild students' knowledge, skills, and creativity through the use of creative and innovative learning tools [9]. Therefore, using technology-based learning, a lecturer needs to design distinctive and innovative methods, teaching resources, and learning media. Learning media employing web-based learning is one of the media that may be used in the learning process.

The newest method of navigating the internet is the Web, sometimes known as the WWW, or World Wide Web. The concept of hypertext connecting documents associated to the HTML (Hyper Text Mark Up Language) language for document formats is featured on the web, a distributed internet service [10]. A website is the entirety of a web page that is stored on a domain and contains the data. A website often includes a number of linked web pages [11]. The Internet facilitates the ability to take a student-centered approach, which results in a flexible, engaging, and inspiring learning environment. The internet can be utilized as a learning tool to help students comprehend concepts or course materials [12].

The utilization of online resources in web-based learning allows for tasks to be carried out without being limited by time, place, or distance [13]. Learning that is based on instructional materials delivered through web browsers like Internet Explorer, Mozilla Firefox, Opera, Netscape, and others is referred to as web-based learning [3], A remote learning system based on information technology that uses links between web sites is called "web-based learning." [10].

Use of a programming language is required for Web-based learning to take the shape of the internet and be implemented as online education. HTML, Java, PHP, and other programming languages are frequently used to construct web-based application programs. One of the computer languages used for the web is called PHP (Hypertext Preprocessor). Because PHP is a server-side programming language, the written PHP code will be executed on the server side, preventing website users from viewing the PHP script's source code. Web-based learning is designed using the PHP programming language, but it also needs a database as a means of storing a lot of questions and learning applications; MySQL is the database used [10].

The use of web-based learning tools that enable the use of information and communication technology by teachers when conducting lessons is very advantageous. Additionally, learners can benefit from quick internet access and learning activities that make it simple for them to comprehend teachings and that they can access at any time. The learning procedure can be carried out more effectively and efficiently when using web-based learning media, which can be loaded with a variety of engaging learning materials to guide students in doing real-world practice. Additionally, the educational process can serve as a forum for queries, inspiration, and passion that is more engaging for students engaged in individual study [14].

Based on the above occurrences and descriptions, it is essential to develop general chemistry learning materials in solution materials using a web-based learning model, it should facilitate the execution of an effective and efficient learning process. Additionally, the limited time in face-to-face learning (conventional) can be replaced and given access in a free manner online using web-based learning media. The Web Based Learning model's use of learning resources is also anticipated to improve the effectiveness of student learning results. This study's objective is to describe the viability (validity) and efficacy of learning media utilizing a web-based learning (WBL) model created in general chemistry learning in solution materials as well as the enhancement of student learning outcomes through learning media utilizing a web-based learning (WBL) model produced.

2 Method

The approach utilized to address research issues is developmental research, which makes use of developing using the ADDIE concept. The research process was carried out in stages, including: (a) analysis, which involved performing an analysis to gather data on student needs and reading literature pertinent to the developing product; (b) Design, which is the phase in which the goals are established and the General Chemistry learning media for the solution materials are created utilizing a web-based learning (WBL) model that is currently being created; Development is the process of turning a design into a finished product that is ready for use; (d) Implementation, which entails using the WBL model to incorporate General Chemistry learning media in solution materials; and e) Evaluation, which entails assessing the

impact of the General Chemistry learning media on the attainment of student learning objectives.

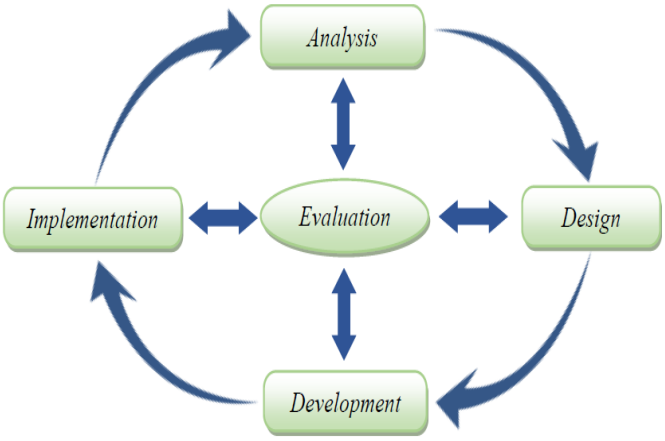

Fig. 1. ADDIE Development Model

Data collected in both qualitative and quantitative forms. Based on the expert validation sheet instrument, qualitative data were gathered from the evaluation, counsel, and input of media professionals and subject matter experts. The achievement of student test results on the solution material generated quantitative statistics. The SPSS program was used to examine the effectiveness and improvement of student learning outcomes using a t-test with a paired sample t-test method.

3 Results

3.1 Product's viability

Expert validators analyze and assess the viability (validity) of general chemistry learning media using the developed web-based learning (WBL) model based on the viability of the material and the viability of the media.

Table 1. WBL Model Media Validation Results on Material Aspects

Assessment Aspect	Validator (Mean score)			Total Mean	Criteria
	I	II	III		
Viability of content	4.00	4.33	4.00	4.11	Valid
Serving viability	4.00	4.33	4.33	4.22	Valid
Language viability	4.00	4.40	4.40	4.27	Valid
Graphic viability	4.22	4.22	4.20	4.21	Valid
Mean Total Material Aspect Validation Results				4.20	Valid

Tabel 1, illustrates the outcomes of the assessment and evaluation of the general chemistry learning media by material experts validators utilizing a web-based learning methodology. The outcomes of the material expert validation had an average total score of 4,20 or were

deemed valid. Thus, it was determined that the general chemistry learning materials employing the web-based learning model were valid or practicable to be employed in learning based on the findings of the material expert validator's assessment.

Table 2. WBL Model Media Validation Results on Media Aspect

Assessment Aspect	Validator (Mean Score)			Total Mean	Criteria
	I	II	III		
Software engineering	4.50	4.50	4.40	4.47	Valid
Interface view	4.22	4.33	4.22	4.26	Valid
Verbal communication	4.13	4.38	4.25	4.25	Valid
Mean Total Result of Media Aspect Validation				4.33	Valid

Tabel 2, presents the outcomes of the assessment and evaluation of media expert validators on general chemistry instructional media utilizing a web-based learning methodology. The results of the validation by media experts received an overall average score of 4,33 and were deemed valid. The General Chemistry learning media solution material using a web-based learning paradigm was therefore determined to be valid or practicable to be implemented in learning based on the findings of the media expert validator's assessment.

3.2 Student learning outcomes

Through testing conducted both before and after using the solution material in General Chemistry learning media using a web-based learning approach, the success of student learning outcomes is determined. This phase involved 30 students and was finished in three steps: (1) an initial test (pretest) before students were given instructions; (2) the learning process, in which students study online by using solution resources; and (3) The third step, the final test (posttest), in general chemistry learning media using a web-based learning model that has been developed.

Table 3. Student Learning Outcomes

	N	Min	Max	Mean	Std. Deviation	Kolmogorov-Smirnov test	
						Statistic	Sig.
Pretest	30	37	73	58.83	8.647	0.149	0.086
Posttest	30	63	100	84.47	9.247	0.141	0.130

Tabel 3, The data were distributed normally, with a Kolmogorov-Smirnov test value of 0,149 and a p value of 0,086. It shows that the pupils met their pre-test goals before receiving the instruction. The mean score was 58,83, with a standard deviation of 8,647, and the range of scores was 37 to 63. The Kolmogorov-Smirnov test determined that the data had a normal distribution since the lowest student score was 63 and the highest was 100, with an average student score of 84,47, a standard deviation of 9,247, and the data. = 0,141 and p = 0,130. following the implementation of a web-based learning model and general chemistry learning media.

3.3 Product effectiveness

The improvement in student learning outcomes in passing examinations using a pretest-posttest model was used to examine the effectiveness of General Chemistry learning media on solution materials utilizing the established web-based learning model. With the use of the SPSS application, a t-test or paired sample t-test approach was used to analyze the test results..

Table 4. Product Effectiveness Test Results (t-test))

		Paired Differences		t	df	Sig. (2-tailed)
		Mean	Std. Deviation			
Pair 1	Posttest – pretest	25.633	7.739	18.141	29	0.000

Tabel 4, demonstrates the outcomes of a paired sample t-test method used to assess the effectiveness of general chemistry learning materials. With a difference in the average value (posttest-pretest) of 25,633, the analysis's findings indicated that the use of general chemistry learning media using a solution manual and a web-based learning model was effective in improving student learning outcomes. The results of the analysis produced a t_{count} value of 18,141 with a probability (sig.) of 0,000 < 0,05.

4 Conclusion

Using the ADDIE development approach, this research and development produced general chemistry learning resources that use solution materials for web-based learning. It has been deemed valid (capable) and effective for enhancing student learning results. Validity (feasibility) is qualitatively met based on the evaluation (validation) of the validators of material experts and media experts, which are typically defined in the valid category. The findings of statistical hypothesis testing with a probability value of < 0.05 and the use of General Chemistry learning media in solution materials using a web-based learning paradigm illustrate the effectiveness.. The improvement in student learning results before and after using the general chemistry learning resources using the resulting web-based learning model serves as proof of the improvement in student learning outcomes. The average gain in student learning outcomes or the difference between the pretest and posttest is 25,633.

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