Original Research Article

Development of web-based media in instrument analysis college to improve student competence

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ARTICLE INFO

ABSTRACT

This research aims to develop and obtain Web-based learning media that meets the eligibility requirements according to BSNP criteria, determine the increase in student competency by using the developed Web-based media and determine the percentage of student responses to Web-based media used in lectures on the topic of instrument analysis. This research method is a research and development method using the ADDIE model. Web-based media was validated by media experts and material experts, then the valid media was presented to 26 Chemistry Education students at Medan State University to see the influence of the Webb media developed and get responses on the web-based media used. The research results show that the Web-based learning media developed meets the BSNP eligibility criteria with an average percentage of 91.25%. The use of Web-based media can increase student competency in lectures on the topic of Instrument Analysis, namely 75% for experimental classes that use Web media and 56% for classes without Web media. Learning outcomes using Webb media are better than without using Webb media and student responses to the use of Webb-based media in lectures Topic evaluation Instrument analysis is very high. Thus, over all the Web-based media developed is good for use in lectures on the topic of Instrument Analysis, to provide students with learning experiences in using the Web.

Introduction

Instrument analysis is one of the important topics in the evaluation course which must be studied by education study program students as prospective teachers which will help them when they become teachers. Instrument analysis material consists of test and non-test instruments which require students to be able to create, test and analyze the instruments they have created. This has a lot to do with formulas and requires special calculations to analyze it (Richardson, 2005). During the teaching and learning process in Evaluation lectures, the difficulties experienced by students when working on assignments on instrument analysis material have an impact on their learning outcomes, the low final semester exam scores lie in the difficulty of students working on questions related to instrument analysis material.

Students' difficulties in studying Instrumental Analysis materials, which so far have only used Evaluation textbooks, should be assisted with the use of media. Media can accelerate student learning and help students to create a better view than just hearing (Kittidachanupap et al., 2012; Sittichailapa et al., 2015). Good learning media must attract students' attention, be able to develop students' interests, according to student characteristics, according to student learning styles, and in accordance with the goals to be achieved (Setiawan, 2017).

One of the media that is very popular today is using technology, such as using the internet (Novira et al., 2022). So there is a need for further guidance regarding learning media and follow-up to immediately connect internet technology in various regions so that the use of learning media using the internet is more communicative (Hanafi & Samsudin, 2012). Via the internet, accessing information is very easy to do anytime and anywhere, but there are several things that need to be considered, namely that the information obtained is often unstructured, this is resulting in learning activities not being optimal.

With the existence of Web-based learning media, it is hoped that students will gain maximum learning experience through a structured learning process that can be accessed anytime and anywhere and can also be controlled if necessary. Using Webb via smartphone can make students more interactive and involve students in learning. The web is a system that

can communicate easily by utilizing internet facilities so that communication activities can be carried out without being limited by distance, place and time (Bakti et al., 2016). Android or smartphone technology used as a learning medium can provide learning material applications that have an efficient and effective impact that students can download according to the material needed, so that they can repeat it at any time and study it themselves (Jengathe & Rojatkar, 2015).

Considering the explosive growth of Internet use and the increasing importance of social media and other media platforms, Webb-based media has emerged (Lee et al., 2015), the use of Web-based learning media using internet facilities. Through the internet, accessing information is very easy to do anytime and anywhere, but there are several things that need to be considered, namely that the information obtained is often unstructured, this results in learning activities not being optimal. With Webb-based learning media, it is hoped that students will gain maximum learning experience through a structured learning process that can be accessed anytime and anywhere and can be controlled if necessary.

In the web-assisted learning process, teachers can upload concept maps, learning objectives, material reviews and several apperception questions to the available Webb. The aim is for students to prepare themselves before the learning process takes place so that the learning process can take place optimally. Through the use of Webb, students can access material as often as necessary so they can repeat material they do not yet understand (Putri & Hernawan, 2015). Yektyastuti & Ikhsan (2016) reported, in chemistry content material, students become motivated to learn and work on questions, with the help of technology-based media or Android.

Previous development-related research found an increase in learning outcomes of 89.38% in the use of media developed in Program Development courses (Sugiharti et al., 2022). Furthermore, it was found that there was an influence of the developed animation media on improving learning outcomes in the Chemistry learning outcomes evaluation course as well (Sugiharti et al., 2020). The results of web-based chemistry learning research developed by Dumgair (2013) concluded that web-based chemistry learning media can be used as an independent learning resource for high school students. Further research was conducted by Khotimah et al. (2021) that the application of weblog-based E-learning as a learning resource was effectively used in learning and increased learning outcomes. Meanwhile, Irmayanti & Nugroho (2016) found that Webblog media is very good for increasing learning motivation. This research aims to find out whether the developed Web-based learning media meets the feasibility according to the BSNP criteria, find out whether student competency has increased by using the developed Web-based media and find out the percentage of student responses to the Web-based media used in lectures on the topic of instrument analysis.

Methods

This research was conducted at the Unimed Faculty of Mathematics and Natural Sciences Education Study Program, Jalan Willem Iskandar Pasar V Medan Estate. While the subjects in this study were students who were taking the Evaluation course, a class consisting of 26 students who were taken purposively. This research method uses research and development methods using the ADDIE model (Thim-Mabrey, 2006).

Analysis Stage

At the analysis stage, defining what will be learned and carried out by lecturers and students in carrying out the learning process in the classroom.

Design Stage

In developing this Web-based media, the researchers made Webb using Blogger, because it is simple to make, free and has complete features. The database contains all types of data including words, numbers, images, videos and files and can use software called a Data Base Management System (DBMS) to store, retrieve and edit data.

Development Stage

At this stage what researchers do is produce programs in the form of program code that has been previously designed.

Evaluation Stage

In the evaluation of the activities carried out is testing the Webb media that has been developed. Webb-based media was validated by 2 lecturers who taught the evaluation course as validators.

Implementation Stage

In implementation, the activities carried out by researchers are implementing validated web-based media to students who are studying the topic of Instrument Analysis during lectures.

Data Analysis

The assessment scale used is the National Education Standards Board (BSNP) eligibility questionnaire. At the implementation and Evaluation stage, the quasi-experimental method was used with pre-test and post-test control with one type of treatment. Data analysis used the gain test, one-party t test and descriptive analysis of student responses by calculating percentages

Results and Discussion

Analysis Stage

The Analysis phase was obtained through discussions with the lecturer team teaching the Evaluation course, and the result was that media was needed to increase student competence, especially in Instrument analysis topics. Webb media will be developed through blogger because it can be filled with many types of data, and can be used by all students who need it just by providing the link.

Design Stage

This stage generates webb links. At this stage the research team designed the Webb media using System Management Data Base (DBMS) software to store, retrieve and edit data, and the resulting Website link: https://gul-analysisinstrumenterapan.blogspot.com/, with the following display (Fig-1).
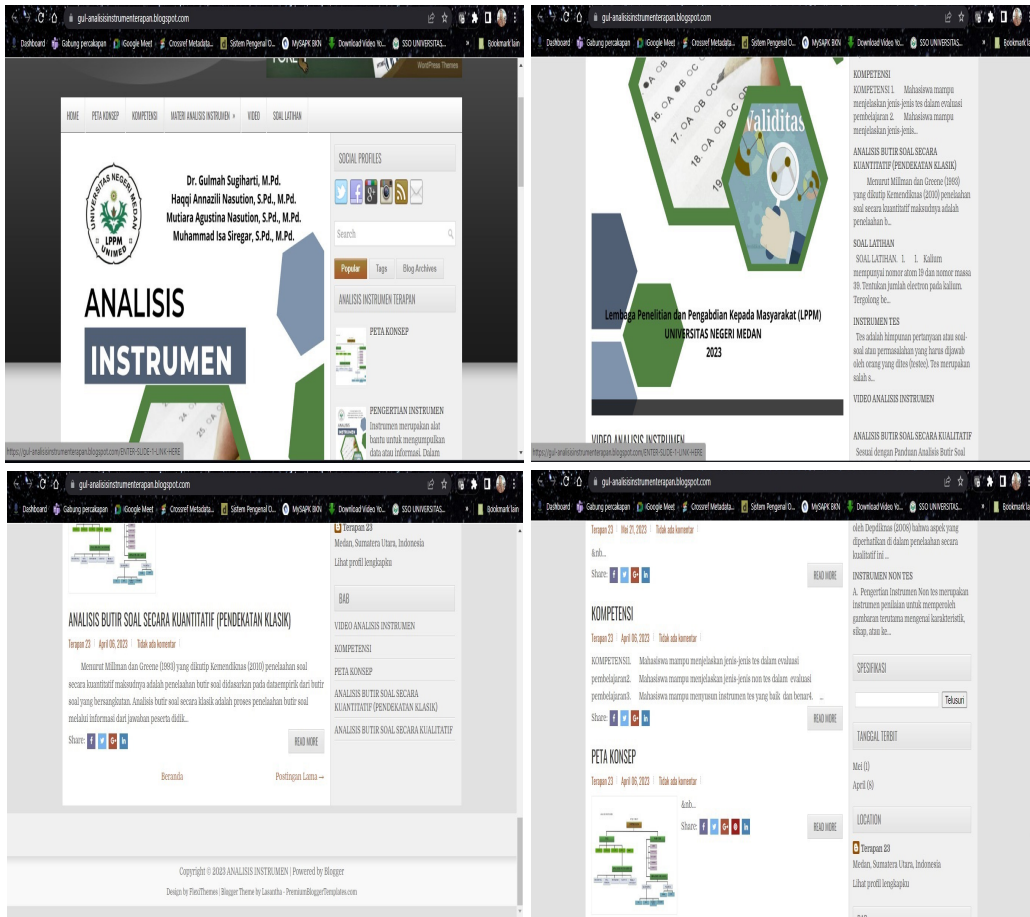

Fig-1. Screenshot of Instrument Analysis Web display.

Development Stage

At this stage, the contents of the Webb media designed above have been completed, containing concept maps, competencies, instrument analysis material, learning videos and practice questions as evaluation. The Webb-based media validation results obtained are as follows in Table 1.

Table 1. Webb-based media validation results.

No	Assessment Component	Validators		Average
		1	2	
1	Content eligibility	92%	93%	92.5%
2	Eligibility of presentation	90%	88%	89%
3	Language eligibility	93%	93%	93%
4	Graphic eligibility	90%	91%	90.5%
	Avarage			91.25%

Implementation Stage

In the implementation stage, the activities carried out by researchers were implementing, testing web-based media that had been developed for students who were studying the topic of Instrument Analysis during lectures. Next, the test results are continued at the evaluation stage.

Evaluation Stage

The evaluation stage of the activities carried out was to provide test instruments after learning using the developed Web-based media, to see the increase in learning outcomes and student responses to the use of the Web-based media that had been developed. The results obtained are as follows:

Student Learning Outcomes

Before being given treatment, each experimental class was given a pretest to measure students' initial abilities using instruments that had been declared valid. In summary, the pretest and posttest results of students in the experimental class and control class can be seen in Table 2 and Table 3.

Table 2. Mean value of learning outcomes for experimental class students.

Average value	N	Min	Max	Mean	Std Deviation
Pretest	26	20	50	43.00	6.513
Posttest	26	70	95	82.17	6.524

Table 3. Mean value of control class student learning outcomes

Average value	N	Min	Max	Mean	Std Deviation
Pretest	26	20	45	37.50	5.37
Posttest	26	65	72	65.83	8.31

From Table 2 and Table 3 it can be seen that the average pretest score in the experimental class is 43 and the average posttest score in the experimental class is 85.17. Meanwhile, in the control class the pre-test average was 37.65 and the control average was 65.83. So, it can be concluded that the average score of students taught using Webb-based media is different from those taught without using Webb-based media. Gain calculation results for the experimental class and control class are as Table 4.

Table 4. Experimental gain test and control class.

Class	Average Gain	%Gain	Explanation
Experiment	0.75	75	High
Control	0.56	56	Currently

Table 4 shows that the average normalized gain value for the experimental class is 0.75 in the high category. Meanwhile, the N-Gain value in the control class is 0.56 in the medium category. So it can be concluded that there is a difference in the increase in student learning outcomes taught using Webb-based media and the increase in student learning outcomes taught without using Webb-based media. Research conducted by Khotimah et al. (2021) shows that the application of e-learning based weblogs as a learning resource is effectively used in learning and increases learning outcomes. Meanwhile, Jiang (2014) said that web-based learning can improve the knowledge and communication skills of college students.

Hypothesis Testing

The results of data analysis showed that the data was normally distributed and homogeneous. So the next hypothesis test results are as follows in Table 5.

Table 5. Hypothesis test (right-sided t-test)

Data	Mean	Std Deviation	N	t_{count}	t_{table}	Explanation
Class posttest experiment	82.17	6.52	26	2.75	1.69	Ha accepted
Control class posttest	65.83	8.31	26			

Based on the data analysis carried out, the results of the hypothesis test were obtained, namely right-sided t test, obtained tcount > ttable, with tcount = 2.75 > ttable = 1.684, this means the alternative hypothesis (Ha) is accepted. This shows that the learning outcomes of students who study using Webb-based media are higher than the learning outcomes of students who study without using Webb media. The research results of Sibarani & Sitorus (2021) found that learning outcomes using weblogs were higher and there was an increase in learning outcomes by 56.2% on Web media use. This is related to what is said (Kosassy, 2018) that by using the web all information related to the learning material being taught can be uploaded so that the material is more interesting and easier to learn. The web is a medium that uses technology and (Norman & Furnes, 2016), shows that learning using digital media or technology is more meaningful in terms of students' metacognition than non-digital. Meanwhile, Wasim et al. (2014) said that web-based learning offers great opportunities for learning and access to large amounts of knowledge and information.

Student Response Data

Overall, students' responses to the learning media developed were in the appropriate and very appropriate categories. Student responses to the web-based learning media developed were collected using a questionnaire technique using a questionnaire. The questionnaire was filled in by 26 students. The results of the questionnaire that have been analyzed show that in the Appearance Aspect, an average of 59.6% of students responded that the Web media developed was very appropriate and 40.4% gave appropriate responses and not a single student considered it inappropriate. Meanwhile, in the material aspect, 75.63% is very feasible and 24.37% is adequate. In terms of benefits, students responded 70.55% Very Appropriate and 29.45% Suitable for use in Evaluation lectures on the topic of Instrument Analysis.

Student responses to the Web media developed are related to research by Fatah et al. (2021) which found 100% of students enjoyed learning using the Web, 100% were interested in learning chemistry using the Web, 100% of students expressed interest in being motivated to learn using the Web, and 100% of students expressed learning using the web is interesting and fun, and 90% of students stated that learning chemistry using the web is nothing new. This finding is also in accordance with research conducted by Tee et al. (2013); Yuen et al., (2019); Zakaria & Daud, (2013) which stated that students showed satisfaction using Moodle-based services. The web as an online learning medium for learning.

Conclusion

The research results show that the Web-based learning media developed meets the BSNP eligibility criteria with an average percentage of 91.25%. that the use of Web-based media can increase student competence in lectures on the topic of Instrument Analysis, namely 75% for experimental classes that use Web media and 56% for classes without Web media. Learning outcomes using Webb media are better than without using Webb media and student responses to Webb-based media topic analysis instruments are in the appropriate category and very suitable for use in learning. Thus, overall it can be said that the use of Web media that was developed was very good in the Evaluation lecture on the topic of instrument analysis.

Conflict of Interests

The author(s) declares that there is no conflict of interest in this research and manuscript.

Acknowledgment

References

Bakti, S., Hasibuan, N. A., Sianturi, L. T., & Sianturi, R. D. (2016). Perancangan aplikasi pembelajaran CorelDraw X3 menggunakan metode web based learning (WBL). *JURIKOM (Jurnal Riset Komputer)*, 3(4), 32-35.

Dumgair, I. E. S. (2013). Pengembangan Media Pembelajaran Kimai dengan Materi Pokok Karbohidrat Berbasis Website sebagai Sumber Belajar Mandiri untuk Siswa SMA/MA. Skripsi. Yogyakarta: Universitas Negeri Yogyakarta.

Hanafi, H.F., & Samsudin, K. (2012). Mobile learning environment system (MLES): The case of android-based learning application on undergraduates' learning. *International Journal of Advanced Computer Science and Applications*, 3(3), 63-66. https://doi.org/10.48550/arXiv.1204.1839

Fatah, A. H., Asi, N. B., Anggraeni, M. E., Wulandari, A., & Latif, A. (2021). Pengembangan media pembelajaran kimia dasar berbasis web pada pokok bahasan termokimia. *Jurnal Ilmiah Kanderang Tingang*, 12(1), 56–64. https://doi.org/10.37304/jikt.v12i1.122

Khotimah, A. K., Sutarto, J., & Nugroho, S. E. (2021). Application of blog-based e-learning to improve cognitive learning outcomes and independent characters. *Journal of Primary Education*, 10(4), 461-473.

Irmayanti, S., & Nugroho, M. A. (2016). Pengembangan media pembelajaran akuntansi berbasis web blog untuk meningkatkan motivasi belajar. *Jurnal Pendidikan Akuntansi Indonesia*, 14(1), 45-54. https://doi.org/10.21831/jpai.v14i1.11366

Jengathe, G., & Rojatkar, D. V. (2015). Use of android in education system. *International Journal of Electrical and Electronics Research*, 3(4), 133-137.

Kittidachanupap, N., Singthongchai, J., Naenudorn, E., Khopolklang, N., & Niwattanakul, S. (2012). Development of animation media for learning English vocabulary for children. *IEEE International Conference on Computer Science and Automation Engineering (CSAE)*, 2, pp. 341-345. https://doi.org/10.1109/csae.2012.6272788

Kosassy, S. O., Gistituati, N., Jama, J., & Montessori, M. (2018). The implementation of contextual learning approach in e-learning based on weblog toward students learning achievements. *Journal of Counseling and Educational Technology*, 1(2), 59. https://doi.org/10.32698/0151

Lee, N., Sha, B.-L., Dozier, D., & Sargent, P. (2015). The role of new public relations practitioners as social media experts. *Public Relations Review*, 41(3), 411–413. https://doi.org/10.1016/j.pubrev.2015.05.002

Norman, E., & Furnes, B. (2016). The relationship between metacognitive experiences and learning: Is there a difference between digital and non-digital study media?. *Computers in Human Behavior*, 54, 301-309. https://doi.org/10.1016/j.chb.2015.07.043

Novira, P., Silaban, S., & Silalahi, A. (2022). The development of animated video-based as media for teaching electrolyte and non-electrolyte solution. *AIP Conference Proceedings*, 2468, p. 040007. https://doi.org/10.1063/5.0103926

Putri, D. I., & Hernawan, H. (2017). The effectiveness of using media web centric learning course to improve students understanding in subjects of embryology in biology education department STKIP Garut. *Prosiding Seminar Nasional Pendidikan Biologi*, 1, pp. 34-41.

Richardson, J. T. E. (2005). Instruments for obtaining student feedback: a review of the literature. *Assessment & Evaluation in Higher Education*, 30(4), 387–415. https://doi.org/10.1080/02602930500099193

Setiawan, A. L. (2017). Pengembangan media pembelajaran trainer kit sistem pengendali elektromagnetik. *Jurnal Pendidikan Teknik Elektro*, 7(4), 265-272.

Sibarani, B. E., & Sitorus, M. (2021). Pengaruh penggunaan media webblog berbasis HOTS terhadap motivasi dan hasil belajar pada materi laju reaksi. *Jurnal Inovasi Pembelajaran Kimia*, *3*(2). https://doi.org/10.24114/jipk.v3i2.22810

Sittichailapa, T., Rattanachai, R., & Polvieng, P. (2015). The development of model learning media of sorting algorithm. *Procedia - Social and Behavioral Sciences*, 197, 1064–1068. https://doi.org/10.1016/j.sbspro.2015.07.333

Sugiharti, G., Dalimunthe, M., & Syuhada, F. A. (2020). Learning media animations for subjects evaluation and chemistry learning outcomes. *Journal of Physics: Conference Series*, 1462(1), 012021. https://doi.org/10.1088/1742-6596/1462/1/012021

Sugiharti, G., Dalimunthe, M., Syuhada, F. A., & Nasution, H. A. (2022). Learning media course development of chemistry learning program. *AIP Conference Proceedings*, 2659, pp. 070001. https://doi.org/10.1063/5.0113540

Tee, S. S., Wook, T. S. M. T., & Zainudin, S. (2013). User testing for moodle application. *International Journal of Software Engineering and Its Applications*, 7(5), 243–252. https://doi.org/10.14257/ijseia.2013.7.5.22

Thim-Mabrey, C. (2006). Sprachwandel in übersetzungsbearbeitungen zwischen 1846 und 1999. *Neuphilologische Mitteilungen*, 107(3), 361-373.

Wasim, J., Sharma, S. K., Khan, I. A., & Siddiqui, J. (2014). Web based learning. *International Journal of Computer Science and Information Technologies*, 5(1), 446-449.

Yektyastuti, R., & Ikhsan, J. (2016). Developing android-based instructional media of solubility to improve academic performance of high school students. *Jurnal Inovasi Pendidikan IPA*, 2(1), 88-99.

Yuen, A. H. K., Cheng, M., & Chan, F. H. F. (2019). Student satisfaction with learning management systems: A growth model of belief and use. *British Journal of Educational Technology*, 50(5), 2520–2535. Portico. https://doi.org/10.1111/bjet.12830

Zakaria, E., & Daud, M. Y. (2013). The role of technology: Moodle as a teaching tool in a graduate mathematics education course. *Asian Journal of Management Science & Education*, 2(4), 46-52.