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Development of a Moodle-Based WordPress-Based Chemistry Learning Website to Improve Students' Learning Outcomes on The Elements Periodic System Material

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Abstract: Development of a Moodle-Based WordPress-Based Chemistry Learning Website to Improve Students' Learning Outcomes on The Elements Periodic System Material. Some studies say the periodic system of elements is one of the most difficult chemistry to learn, so using the right learning media is necessary. One of them is an integrated website and e-learning. This study aims to determine the feasibility, practicality, and effectiveness of a chemistry learning website based on WordPress Moodle to improve student learning outcomes on the material of the periodic system of elements. The method used in this research is Research and Development (R&D) with a 4D development model, namely Define, Design, Develop and Disseminate, tested on class X MIPA MA Amanatul Ummah Surabaya. The results of the expert validation assessment obtained data if the average percentage of content and construct conformity was 89.59% and 86.67%, respectively, in the very valid category. Furthermore, this learning media obtained a practicality percentage of 94% in the practicality test with a very practical category. In terms of media effectiveness, based on the increase in the pretest-posttest results obtained a percentage of 100% with an average n-gain score of 0.708 in the high category. Based on these results, the chemistry learning website generated from this study is valid and feasible to be used as a learning medium to improve student learning outcomes on the material of the periodic system of elements.

Keywords: Learning website, WordPress, Moodle, learning outcomes.

Abstrak: Pengembangan Website Pembelajaran Kimia Berbasis Wordpress Terintegrasi Moodle untuk Meningkatkan Hasil Belajar Peserta Didik Pada Materi Sistem Periodik Unsur. *Beberapa penelitian mengatakan sistem periodik unsur adalah salah satu ilmu kimia yang paling sulit dipelajari, sehingga perlu penggunaan media pembelajaran yang tepat. Salah satunya adalah website dan e learning yang terintegrasi. Penelitian ini bertujuan untuk mengetahui kelayakan, kepraktisan, dan efektivitas website pembelajaran kimia berbasis WordPress terintegrasi Moodle untuk meningkatkan hasil belajar siswa pada materi sistem periodik unsur. Metode yang digunakan dalam penelitian ini adalah Research and Development (R&D) dengan model pengembangan 4D yaitu Define, Design, Develop and Disseminate, diujicobakan pada siswa kelas X MIPA MA Amanatul Ummah Surabaya. Hasil penilaian validasi ahli diperoleh data jika rata-rata persentase kesesuaian isi dan konstruk masing-masing sebesar 89,59% dan 86,67% dalam kategori sangat valid. Selanjutnya media pembelajaran ini memperoleh persentase kepraktisan sebesar 94% pada uji kepraktisan dengan kategori sangat praktis. Dari segi keefektifan media, berdasarkan peningkatan hasil pretest-posttest diperoleh persentase 100% dengan rata-rata skor n-gain sebesar 0,708 dalam kategori tinggi. Berdasarkan hasil tersebut maka website pembelajaran kimia yang dihasilkan dari*

penelitian ini valid dan layak untuk digunakan sebagai media pembelajaran untuk meningkatkan hasil belajar siswa pada materi sistem periodik unsur.

Kata kunci: *Website pembelajaran, wordpress, moodle, hasil belajar*

▪ INTRODUCTION

Chemistry subject matter in SMA/MA is one of the subjects that students are less interested in because it contains many concepts that are pretty difficult for students to understand. It is also caused by many chemical reactions, calculations, and abstract concepts. In addition, students always consider chemistry lessons as new material because they are not taught in the previous educational strata, namely Junior High School (Ristiyani & Bahriah, 2016). Many studies show that the problematic point of students in understanding chemistry lessons is on concepts related to the microscopic world or invisible to the naked eye because learning chemical concepts must involve three levels of representation: macroscopic, submicroscopic, and symbolic levels (Dewi, 2018).

Research conducted by Rahman et al. shows that one of the chemical materials that are difficult to study because it contains abstraction is the periodic system of elements with a difficulty percentage of 71.12% (Rahman, et al. 2016). Moreover, the sub-material determines the location of the elements on the periodic table based on their atomic number. According to Murtandho (2014), the periodic system of elements is a chemical material that most high school students find difficult because of the many memorizations that makes students feel difficult and bored in understanding the material. Another cause of the periodic system of elements being challenging to understand material is the number of complex theories and the limited learning hours for only 2-3 meetings (Rahmatsyah, & Dwiningsih, 2021).

One way to overcome this is the use of learning media. In short, learning media can be interpreted as a thing (whether it's a tool, material, or situation) that can be used as a means of communication in teaching and learning activities. This learning media can be online (accessed via the internet) or offline (used directly) (Miftah, 2013). The periodic system of elements is one of the materials that require online learning media to support limited learning hours. So, by utilizing this online or online learning media, learning will be much more effective and efficient to create quality learning outcomes (Basar, 2021).

One of the appropriate learning media used to support chemistry learning is e-learning. This is because e-learning is a learning medium that provides excellent opportunities for students to be active when participating in learning. So, in addition to getting material from the teacher, students can also learn more independently whenever and wherever (Febryana & Pujiastuti, 2020). Making e-learning is not easy, but it can be overcome using the best e-learning platform in the world, namely Moodle. Moodle is an open-source learning management system (LMS) that can be used and modified by anyone with a GNU (General Public License). This Moodle will make it easier for someone to build e-learning to help teachers deliver learning materials (Giatman, 2018).

The Moodle-based e-learning development process is very commonly used. However, if e-learning is modified and integrated with the WordPress content management system (CMS), will be maximized the results. This is because the integration of CMS and LMS has proven to facilitate designing and creating learning

websites as a tool for providing material to students (Daru, 2013). The choice of WordPress as a CMS for developing a chemistry learning website is due to the many features and advantages in it. So that the development of the chemistry learning website will be maximized with the help of several plugins (Pratiwi et al. 2020), this WordPress integration with Moodle will have a much significant impact on the development of learning websites.

Based on these considerations and sources, the author sees the need to develop a Moodle-based WordPress-based chemistry learning website to improve student learning outcomes on the material of the periodic system of elements. Teachers can later use this learning website as learning media and learning resources to explain the periodic system of elements.

▪ METHOD

The method used in this study is the Research and Development (R&D) research method which adapts the Thiagarajan 4D development model with four stages of development, namely: Define, Design, Develop, and Disseminate.

At the definition stage, several important analyzes were carried out as the foundation for building a learning website. Some of the analyzes carried out include: preliminary analysis, student analysis, task analysis, concept analysis, to analysis of objectives. All these analyzes are needed at the definition stage to clarify the description of the learning website that will be developed.

At the design stage, the media selection is carried out by selecting media that follow the objectives of the learning materials, selecting the format, and making learning media followed by revisions from the media reviewers. After that, proceed to the development stage, which includes validation and revision of the device. Media validation instruments are used to measure the feasibility of learning media. The validators in this study were expert media lecturers and one chemistry teacher. The validation results are based on the Likert scale in table 1 below:

Table 1. Likert Scale Validation

Scale	Category
1	Not very good
2	Not good
3	Pretty good
4	good
5	Very good

The calculation results from the Likert scale will be entered into the following formula so that it can be interpreted:

$$P\ (\%) = \frac{sum\ of\ result\ scores}{criteria\ score}\ x\ 100$$

With:

P = validation percentage

Criteria score = *highest score of each item x number of items x number of validators*

The percentage calculation from the formula will be interpreted with the five criteria in table 2 below:

Table 2. Criteria for Interpretation of Validity Scores

Percentage (%)	Category
0-20	Totally invalid
21-40	Not valid
41-60	Quite valid
60-80	Valid
81-100	Very valid

The learning media developed can only be called feasible and valid to use when getting a percentage in each aspect of 61%, if it is still not above that number, then the media must continue to be revised in order to get high validity (Riduwan, 2016).

The assessment in terms of the practicality of the website is carried out through an analysis of student response questionnaires containing questions about the use of learning websites. The percentage of student response questionnaire data will later be analyzed based on the Guttman scale in table 3 below:

Table 3. Guttman Scale

Evaluation	Scale Value
Yes	1
No	0

The results of taking the student response data will be read using a quantitative descriptive method in the form of a percentage of the Guttman Scale data and entered in the following formula:

$$\text{Total score} = \frac{total\ score\ result}{total\ score\ criteria} \text{ x } 100\%$$

The percentage of results are interpreted into the five criteria for student responses in table 4 below:

Table 4. Interpretation Criteria for Response Score

Percentage (%)	Valuation
0-20	Very Impractical
21-40	Less Practical
41-60	Practical enough
61-80	Practical
81-100	Very practical

Practical learning websites must meet the percentage requirement of ≥81% of the calculation (Riduwan, 2016).

The method used to see the effectiveness of this learning media is by analyzing the test data from the pretest and posttest. Quantitative descriptive analysis is used using N-gain scores with the following calculation formula:

$$(g) = \frac{[\%(Sf) - \%[Si]}{[100\% - \%(Si)]}$$

Information:

(g) : improvement of learning outcomes
(Sf) : mean posttest score
(Si) : mean pretest score

The value (g) of the calculation is interpreted into the criteria for the effectiveness of the learning media in Table 5 below:

Tabel 5. N-gain Score Interpretation Criteria (Sundayana, 2014).

Value Range	Category
G ≥ 0,7	High
0,3 ≤ G < 0,7	Medium
G < 0,3	Low

Learning websites are considered effective if they get an increase in the N-gain score ≥ 0.7 in the high category.

▪ RESULT AND DISCUSSION

Define Stage

At this stage, interviews were conducted with chemistry teachers at the Amanatul Ummah Superior MA Surabaya. The results of the interview are that currently, hybrid learning during this pandemic only uses ordinary learning tools. According to the chemistry teacher, chemistry material requires appropriate learning media to support students' understanding both in and outside of class. This follows Ratmansyah's statement about the material complexity of the periodic system of elements (Rahmansyah & Dwiningsih, 2021). This analysis uses essential competencies 3.4 Analyzing the properties of elements in the group and 4.4 Presenting the results of data analysis not factors in the search and periodic properties of elements.

Design Stage

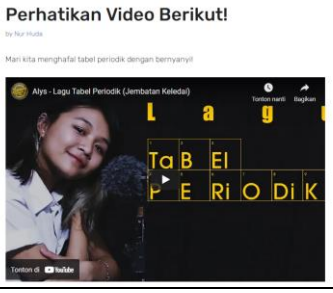
Based on the definition stage, the initial design is done by designing the initial product that will develop in a learning website. The domain used in the development of this website is rnhlearning.com, and the e-learning is on the kelas.rnhlearning.com domain. All the contents of this website are built with the WordPress content management system (CMS) and the Moodle Learning Management System (LMS), which are integrated to produce maximum website quality (Daru, 2013). The plugins used in making this website are Elementor pro, Generate Press theme, and Elementor kit, among others.

Figure 1, Website Menu Page Display

The website that has been designed will produce draft I, which the chemistry lecturer then reviews to get input and suggestions. After the review process, the researcher revised the website into draft II, which continued at the device validation stage. The results of the revision of the learning website design can be seen in **Table 6** below:

Table 6. Revision table of media review results

No	Suggestion	Revised Results
1	The chemistry learning website on the start page must be given in the opening, so that students do not go directly to the menu page. This opening page also serves as an introduction to the media for students.	
2	On the menu page, each page is better given a password (locked) so that students don't click randomly. So, learning can be more focused.	
3	Need to be given instructions or instructions for using the website. So that students can easily access the chemistry learning website and understand how to operate it.	

4	At first, the video contains a discussion of the material. This can make students bored. So that the video is replaced with a song singing the periodic system of elements so that students can remember the elements more easily.	

Development Stage

The website design that has been built produces draft I which is then reviewed by a media expert chemistry lecturer to get input and suggestions. The next step was to revise the website into draft II, which was followed by the device validation stage for two different media expert lecturers. The purpose of this media validation is to determine the feasibility of the website as a learning medium to improve student learning outcomes. According to Nieveen, a learning media can be said to be feasible with one criterion, namely the validity of the expert (Nieveen, N. 1999). In this study, media validation will be carried out by two expert lecturers with two validity criteria, namely content and construct validity which is used as learning media to improve student learning outcomes. The validation results can be seen in the following **table 7**:

Table 7. Percentage of Validation Results

No	Validity	Percentage (%)	Category
1	Contents	89,59	Very Valid
2	Construct	86,67	Very Valid
Mean		88,13	Very Valid

Based on table 3, it is known that if the chemistry learning website developed gets a percentage of 89.59% for content validity and 86.67% for construct validity; the two validity categories are very valid so that they are suitable for use as learning media.

Media Limited Trial Stage

1. Practicality Test

The next stage is a trial using the chemistry learning website, which is carried out on 24 students who have received material on the periodic system of elements at MA Superior Amanatul Ummah Surabaya. The results of this trial are in the form of a practical questionnaire related to students' responses and observations of student activities through google meet conducted by two students. This response questionnaire is related to (1) knowing the clarity of the material and its relation to increasing student understanding (content), (2) Knowing students' interest in the learning website (presentation), (3) Knowing the clarity of the language used in the learning website (language), (4) Identify the level of ease in using the learning website (graphics). The average student response recapitulation is as follows:

Tabel 8. Response Questionnaire Results

No	Component	Percentage	Criteria
1	Content	89%	Very practical
2	Presentation	92,23%	Very practical
3	Language	97,9%	Very practical
4	Graphics	95,8%	Very practical
Mean		94%	Very practical

From the data from the recapitulation table of the response questionnaire results, the results of the practicality of using chemistry learning websites with an overall average of 94%. Therefore, it can be concluded that the learning website is very practical to use following the score interpretation criteria, which is ≥81%.

2. Media Effectiveness Test

They are continued in the next stage, namely the effectiveness test, at this stage using a pretest and posttest sheet instrument consisting of a cognitive test in the form of multiple-choice questions with five answer options (a, b, c, d, and e). The results of the pretest and posttest will be tested for normality first to determine the normal distribution. The data is obtained in the following table:

Table 9. Normality Test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	,120	24	,200*	,973	24	,751
Posttest	,169	24	,073	,934	24	,118

The normality test is carried out using the IBM SPSS Statistic 20 application. Based on table 5. The normality test is known that sig. for the pretest is 0.751 and for the posttest is 0.116. The data can be concluded that the pretest and posttest values are normally distributed in the Shapiro-Wilk test, with a sig. > 0.05 (Putri, 2020). The normality test results were then tested with a t-test to determine the significant difference between the pretest and posttest scores. After the t-test, the results obtained can be seen in the following table:

Tabel 10. Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
PRE - POS	-37,22	14,56419	2,97290	-43,37075	-31,07092	-12,520	23	,000

Based on Table 9. the t-test above obtained a significance value (2-tailed) < 0.05, which means Ho is rejected and Ha is accepted. Following the rules of interpretation of

the t-test, Ho stated that there was no significant difference between the pretest and posttest. Meanwhile, Ha noted that there was a substantial difference between the pretest and posttest. Therefore, based on the results of the t-test analysis, can conclude that the chemistry learning website developed can be said to be very effective in improving student learning outcomes on the material of the periodic system of elements. In addition to the t test, to detect the effectiveness of learning is also carried out with the n-gain test and obtain the following data:

Tabel 11. N-Gain Score

Pretest	***Postest***	**N-gain**	**Criteria**
46,97	84,2	0,708	High

Based on table 10. The N-Gain score is 0.708. Therefore, can say that the N-gain score is 0.7 in the high category. Thus, can conclude that the chemistry learning website developed is effective in improving student learning outcomes on the material of the periodic system of elements.

▪ CONCLUSION

Based on the analysis and discussion that has been carried out, it can be said that: (1) this study resulted in a chemistry learning website design that received expert validity of 89.59% and 86.67% respectively in the very valid category (2) site practicality this chemistry learning website gets a percentage of 94% with a very practical category to use, and (3 this learning website is considered to have high effectiveness based on calculating an n-gain score of 0.708 after going through a limited trial stage by presenting a pretest and posttest. From the results of this analysis, it can be said that the Moodle-integrated WordPress-based chemistry learning website is suitable and effective for use as a learning medium. Thus, the chemistry learning website can improve student learning outcomes on the material of the periodic system of elements which is assessed as an abstract and challenging material to learn.

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