Development of Website-Based Biology UKBM Module with Discovery Learning Model on Student Learning Outcomes at MAN 1 Medan

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Abstract. This study aims to determine the development of the website-based UKBM Biology module with the discovery learning model at MAN 1 Medan in improving student learning outcomes. The type of research used in this research is the 4D research model developed by S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel in 1974. This research was conducted from March to May 2023. Based on the expert validation process it shows that this module very valid with a score of 88% material experts, 84% learning design experts, 86% website design experts, 87% biology teachers. Independent t test was conducted to see whether there were differences in the results of the students^ post-tests from the experimental group and the students post-tests from the control group. Based on the data analysis results, it is known that the value of Sig. (2-tailed) is 0.000 <0.05, so it can be concluded that there is an average difference in student learning outcomes between the experimental class and the control class. So it is known that the N-Gain value for the experimental class is 77.27 which means that the UKBM Biology module uses a website with an effective discovery learning model to apply in biology learning in class X MAN 1 Medan.

Keywords: UKBM Biology Module, Website, Discovery Learning

1 Introduction

Regulation of the Minister of Education and Culture No. 158 of 2014 which regulates the Implementation of the Semester Credit System at the elementary and secondary education levels, which contains the Semester Credit System (SKS) is a form of education administration in which students agree on the amount of study load each semester in educational units according to their talents, interests, and learning abilities[1]. UKBM is designed to be used in classical learning, group learning, individual learning or learning in the network or offline according to the varied learning needs of students[2].

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[1] Sutanto, *Pedoman Penyelenggaraan Sistem Kredit Semester di SMA* (Jakarta: KEMENDIKBUD, 2017), hlm. 5

[2] Septiana, *Unit Kegiatan Belajar Mandiri,* Jurnal Pendidikan Biologi, 2(1): 61-70.

One way to make it easier for teachers to convey learning is to use learning modules. In the substance module, the emphasis is on student independence (self-study for a certain period)[3]. The teacher's teaching and learning process does not have to be fixed by using only one learning method or strategy, a teacher is able to use a variety of learning strategies or methods[4]. Along with the development of the times, the learning process requires the role of technology. Currently learning modules have been developed that use digital devices such as computers, smartphones (mobile phones, cellphones, laptops and the like)[5].

One learning model that can be used to develop cognitive and socio-emotional aspects is a cognitive instructional model known as discovery learning. Discovery Learning emphasizes the importance of understanding what is learned and requires activeness in learning as the basis for true understanding and emphasizes inductive thinking processes in learning[6].

Research development or Research & Development is understood as research activities that begin with research and continue with development[7]. Based on the Guidelines for Implementation of SKS (2017) complete learning units, hereinafter referred to as Independent Learning Activity Units (UKBM) are lesson units arranged sequentially from easy to difficult[8]. UKBM was prepared by the MGMP TEAM in schools consisting of teachers of each subject[9]. The module is a form of learning book. In the substance module, the emphasis is on student independence (self-study for a certain period)[10].

The dissemination of information that is very fast and not bound to space and time has become the advantage of the website, with the website one can easily do various things without having to leave his home, for example registering at an educational institution, accessing various learning resources, discussing with others, and publishing. results of his thoughts[11].

The discovery learning model was first developed by Jerome Bruner, a psychologist who was born in New York in 1915. Bruner considers that discovery learning is in accordance with the active search for knowledge by humans and by itself provides the best results[12]. The learning model that is felt to be able to empower social attitudes, aspects of cognitive knowledge and science process skills is the Discovery Learning learning model[13].

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[3] Udin, *Metodologi Penelitian Pendidikan* (Sidoarjo: UMSIDA, 2018), hlm. 45

[4] Abdjul, *Penerapan Model Pembelajaran Discovery Learning Untuk Meningkatkan Hasil Belajar Biologi Pada Siswa Kelas X SMA Negeri 1 Buntulia.* Jurnal Ilmu Pendidikan Nasional. 08(1), hlm. 343-348

[5] Kristin, *Analisis Model Pembelajaran Discovery Learning dalam Meningkatkan Hasil Belajar Siswa SD.* Jurnal Pendidikan Dasar Perkasa, 2(1), hlm. 90-98

[6] Nurdyansayah, *Inovasi Model Pembelajaran* (Sidoarjo: Nizamia Learning Center, 2016), hl. 89

[7] Latief, *Penelitian Pengembangan* (Malang: Universitas Negeri Malang, 2009), hlm. 118

[8] Handayani, *Model-Model Pembelajaran Inovatif di Era Revolusi Industri 4.0* (Malang:Literindo Berkah Berkarya, 2020), hlm. 75

[9] Romdaniyah, 2020

[10] Helaluddin, *Penelitian dan Pengembangan* (Banten: Media Madani, 2020), hlm. 67

[11] Hermawan, *Pengembangan Multimedia Pembelajaran Interaktif Pokok Bahasan Segitiga dan Jajargenjang Kelas IV SD* (Surakarta: Universitas Muhammadiyah Surakarta, 2016), hlm 113

[12] Sundari, *Implementasi Teori Belajar Bruner dalam Model Pembelajaran Kurikulum 2013.* Jurnal Papeda, 3(2), hlm. 47-53

[13] Handoko, *Pengembangan Modul Biologi Berbasis Discovery Learning Pada Materi Bioteknologi Kelas XII IPA di SMA Negeri 1 Magelang.* Jurnal Inkuiri. 5(3), 144-154

The discovery learning model helps students to improve and enhance cognitive skills and processes. Discovery efforts are key in this process. The knowledge gained through this model is very personal and powerful because it strengthens understanding, memory and transfer[14]. Discovery learning is a learning strategy that tends to ask students to make observations, experiments, or scientific actions to draw conclusions from the results of these scientific actions[15].

Discovery learning model learning is a model for developing an active way of learning students by finding themselves and investigating themselves, so that results will be obtained that will last a long time in students' memories and are not easily forgotten by students[16].

In Widiastuti's research (2021), a plant tissue structure e-module was produced using the Flip PDF Professional application, supplemented with more contextual and representative images and videos that can be opened using a laptop/handphone offline and can be used without the help of other media[17].

Based on the observations that have been made, it was found that there were some deficiencies found when using UKBM Biology at MAN 1 Medan such as the presentation of the questions at UKBM which were not analytical but only descriptive. Students are not required to think critically in terms of the questions presented only based on the material in the student handbook. At UKBM Biology there is no group learning as a whole learning is only individual. Biology UKBM lessons cannot be accessed online. KD-based Biology UKBM but does not fully represent the achievement of KD. in implementing the UKBM Biology website, teaching skills are also needed so that learning objectives can be achieved properly. It takes an innovation in learning by adding learning variations using the discovery learning model. Based on this description, it is necessary to conduct development research on Biology UKBM with the title Development of UKBM Modules (Teaching and Learning Activity Units) Biology Using the Website with the Discovery Learning Model Class X MAN 1 Medan.

Research purposes:

1. Knowing the feasibility of the UKBM biology module using the website with the discovery learning model at MAN 1 Medan according to experts.

2. Knowing the effectiveness of the UKBM biology module using the website with the discovery learning model at MAN 1 Medan.

2 Implementation Method

The locations for the research were Madrasah Aliyah Negeri 1 Medan (MAN 1 Medan), Medan State University (UNIMED), the UNIMED Digital Library, and the Regional Library of North Sumatra. The research time is from December 2022 to May 2023. The type of

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[14] Sulfemi, *Penerapan Model Pembelajaran Discovery Learning Meningkatkan Motivasi dan Hasil Belajar.* Jurnal Rontal Keilmuan PKN, 5(1), hlm-87-96

[15] Purmadi, *Pengembangan Bahan Ajar Berbasis Website Berdasarkan Gaya Belajar Siswa,* Jurnal Inovasi Teknologi Pendidikan, 3(2), 151-165

[16] Astuti, Penerapan Model Pembelajaran Discovery Learning Untuk Meningkatkan Hasil Belajar Biologi, Jurnal Pendidikan Biologi, 2(1), hlm. 5-9

[17] Widiastutik, Pengembangan E-Modul Struktur Jaringan Tumbuhan Berbasis Discovery Learning Untuk Meningkatkan Hasil Belajar Siswa. (Semarang: Universitas Negeri Semarang 2021)

research used in this study is the 4D research model. The 4D model developed has stages, namely the define, design, develop, and dissemination stages.

The research was conducted at MAN 1 Medan, the research subjects used in this study were divided into an experimental class and a control class, where there was one experimental class carried out using the website-based UKBM Biology Module with the discovery learning model and one control class using a Textbook (BTP). Biology with conventional learning models.

In the context of developing learning models, design activities are carried out with steps such as validating design experts, where things that are validated include media appearance (maintainable, usability, compatibility, instructions for use, reusable), language and audio-visual communication. (communicative, creative, simple, interesting, interactivity, audio, visual, and flexible). Then do material expert validation where the things that are validated include aspects of learning and aspects of material content. Then the biology study teacher gave responses covering learning aspects, material aspects, language aspects, and media display aspects. Furthermore, revisions will be made to perfect the teaching material from various aspects. This validation and trial aims to control the content of teaching materials so that they remain in accordance with the needs of students[18].

Assessing student responses includes learning aspects, material aspects, language aspects, and media display aspects. Website-based Biology UKBM Module revision based on suggestions from the validator. Limited trials in classroom learning, according to the real situation that will be faced. Model revision based on test results. Implementation of the model in the wider class area. During the implementation process, the effectiveness of the model and model tools developed was tested. Testing the effectiveness can be done by experiment.

The Likert scale is used to measure attitudes, opinions and perceptions of a person or group of people. The answer to each instrument item that uses a Likert scale has a gradation value from very positive to very negative[19].

In Table 1, the Likert scale criteria are as follows:

Table 1. Likert Scale Criteria

Criteria	Score
Strongly Agree	4
Agree	3
Neither Agree	2
Disagree	1

Based on the percentages obtained, they are then transformed into sentences that are qualitative in nature to determine validity, according to Table 2 as follows:

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[18] Hardani, *Metode Penelitian Kualitatif dan Kuantitatif* (Yogyakarta: Pustaka Ilmu, 2020), hlm. 183

[19] Sugiyono, *Statistika Untuk Penelitian* (Bandung: Alfabetha, 2015), hlm. 67

Table 2. Validity Criteria

No.	Level of Validity	Predicate Validity
1.	$P > 80\%$	Very Good
2.	$61\% < P \leq 80\%$	Good
3.	$41\% < P \leq 60\%$	Acceptable
4.	$21\% < P \leq 40\%$	Poor
5.	$P \leq 20\%$	Very Poor

If there is an increase in learning outcomes between before and after the use of teaching materials, the teaching materials can be said to be effective and able to increase student knowledge. In this study, teaching materials were said to be effective, indicated by the pretest and posttest. Can be calculated using the following formula:

$$O_1 \ X \ O_2 \tag{1}$$

Information :

O1 : Pre-test value (before being given treatment)

X : Treatment

O2 : Post-test value (after being given treatment)

Analyzing the level of effectiveness can use the t-test. The t-test obtained data from field trials and then collected using pre-tests and post-tests. Then the t test formula is used following Sugiyono as follows:

$$t = \frac{X_1 - X_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2} - 2r \left(\frac{S_1}{\sqrt{n_1}}\right)\left(\frac{S_2}{n_2}\right)}} \tag{2}$$

Information :

X_1 = Average Sample 1

X_2 = Average Sample 2

S_1 = Standard Deviation of Sample 1

S_2 = Standard Deviation of Sample 2

S_1^1 = Variant of sample 1

S_2^2 = Variant of sample 2

r = Correlation between two samples

After doing the T-test, it is also necessary to do the N-gain. Test for increasing learning outcomes (gain) aims to determine the increase in student learning outcomes before being given treatment and after being given treatment.

Table 3. Category Interpretation of N-Gain Effectiveness

No.	Presentation	Interpretation
1.	< 40	Very Effective
2.	40-45	Effective
3.	56-75	Neutral
4.	> 76	Uneffective

3 Results

1. Defenition

At this definition stage, an analysis of the resulting product is carried out, namely the UKBM Biology Module based on the website. MAN 1 Medan uses the 2013 curriculum with the SKS system (Semester Credit System) in the learning process. The implementation of the credit system is accompanied by the implementation of the Independent Learning Activity Unit (UKBM). UKBM which has been printed is given to students to assist learning, so that students are required to study independently and skillfully. There were several deficiencies found when using UKBM Biology at MAN 1 Medan such as the presentation of questions at UKBM which were not analytical but only descriptive in nature. Students are not required to think critically in terms of the questions presented only based on the material in the student handbook. The images presented at UKBM are colorless, only black and white, so the contents of the images are not clear. Students are not fully required to be active and think at a high level because the questions presented are limited to knowledge and understanding.

Based on the analysis of the needs of teachers and students, it was found that in classroom learning, the teacher usually uses a learning model with a direct discussion system between students and teachers in answering UKBM Biology questions. discussed together in class. The teacher also said that Biology UKBM really helped the teacher in conveying learning in class and made students enthusiastic in learning biology. Based on the student needs analysis questionnaire filled out by 68 respondents, it was found that 29% said they had difficulty understanding the concepts in biology learning. As many as 93% said that learning biology is a type of learning that really requires memorization and memory. Furthermore, in the category of how important UKBM Biology was in their learning, 89% said it was very important and 90% said UKBM Biology was able to make them interested in learning biology. The existence of UKBM biology makes students happy to study biology outside of school hours as much as 74%. The use of smartphones and their ownership of 100% of students is able to use smartphones to assist learning and is complemented by wifi in the MAN 1 Medan school.

The preparation of material for the UKBM Biology Module material using this website is based on the syllabus and also the 2013 curriculum. The concept of material for this website-based UKBM Biology module product refers to the basic competencies in the syllabus. UKBM is equipped with identities such as basic competencies and learning objectives to be achieved in accordance with the 2013 curriculum competency standards for even semester class X material.

The concept analysis stage is carried out by compiling the main part of the learning material in the website-based UKBM Biology module. This module consists of four materials, namely Plantae, Animalia, Ecology, and Environmental Change. The following is an example of a concept map display on Plantae material.

2. Design

The next stage is to design or design to develop the product. Product design or design is carried out in several processes such as the components contained in this UKBM module, namely the front page of the veranda which contains the title and introductory remarks from the author. Then the reader is directed to enter the table of contents menu which contains links to access what material they want to study. Readers can also access instructions for using the

UKBM module as well as a table of contents and a glossary. The materials used by researchers are Plantae, Animalia, Ecology, and Environmental Change. The material consists of front pages containing identity, namely titles, materials, basic competencies, learning objectives, concept maps, introductions, and pretests. After that the reader will be directed to access learning activities which contain material related to the title of the discussion and can continue to read the summary. After studying the material then proceed with doing exercises and formative tests. After that the reader can work on further learning activities. If all learning activities have been carried out properly, it can proceed to the posttest section to measure students' abilities after learning the material.

After designing the components and materials, the researcher continued the development of this UKBM module to the design design stage, such as choosing colors and background designs for module materials/contents, choosing the right color combinations, and themes so that it was expected to make it easier for students to learn biology. The menus in the UKBM Biology module use a website with the discovery learning model at MAN 1 Medan, namely:

Fig.1. View of the homepage of the UKBM biology module with the discovery learning model

Fig.2. Display of learning activities in the UKBM Biology module with the discovery learning model

Fig.3. Display of Student Activity Sheets in the UKBM module

Fig.4. Display of the formative test menu in the UKBM Biology module

3. Develop

At the development stage validation was carried out by experts, namely material experts, learning design experts, and website design experts. This validation and trial aims to control the content of teaching materials so that they remain in accordance with the needs of students[20]. Based on revisions and suggestions by experts, namely material experts, learning design experts, and website design experts, the following data is obtained:
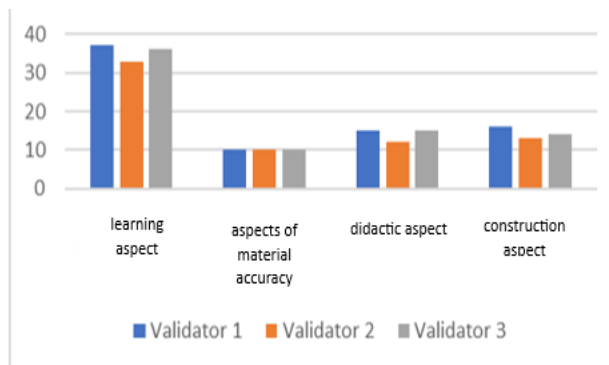
Fig.5. Material Expert Validation Diagram

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[20] Zunaidah, *Pengembangan Bahan Ajar Mata KUliah Bioteknologi Berdasarkan Kebutuhan dan Karakter Mahasiswa Universitas Nusantara PGRI Kediri.* Jurnal Pendidikan Biologi Indonesia, 2(1), hlm. 19-22
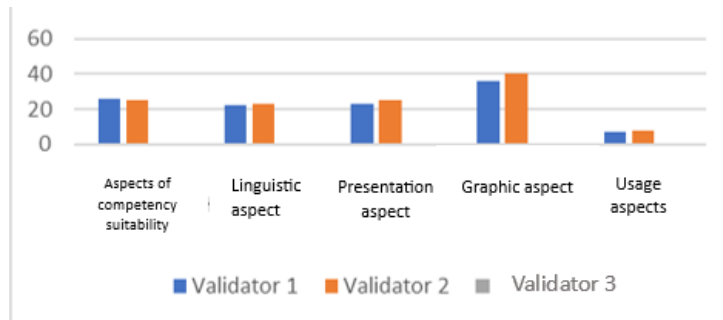
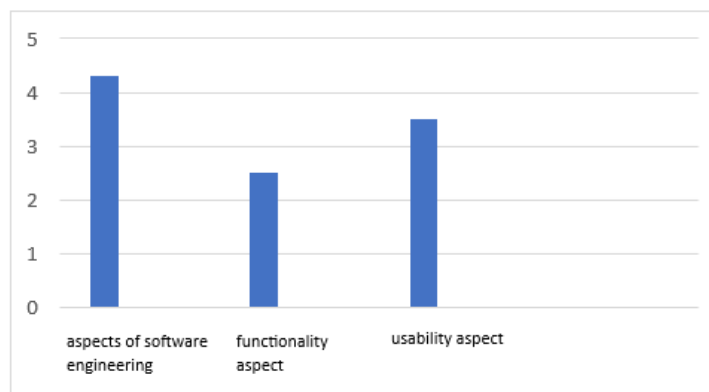**Fig.6.** Learning Design Expert Validation Diagram

Fig.7. Website Design Expert Validation Diagram

The display of changes before and after the module revision in Table 6 is as follows:

Table 6. Display of Changes Before and After the Module Revision

BEFORE	AFTER

BEFORE	AFTER

4. Disseminate

The next stage is the disseminate stage, which is the stage of product dissemination. UKBM Biology products using this website are distributed to biology teachers at MAN 1 Medan and class X students at MAN 1 Medan.

Table 7. Results of Teacher Validity Analysis

No.	Teacher	Score	Percentage	Category
1.	Teacher 1	52	100	Very Good
2.	Teacher 2	41	79	Good
3.	Teacher 3	43	83	Very Good
	AVERAGE		87	Very Good

Table 8. Individual Trial Results

No	Aspect	Score	Percentage	Category
1	Ease of use aspect	90	94	Very Good
2	Aspects of learning time efficiency	21	87	Very Good
3	Benefit Aspect	60	83	Very Good
AVERAGE		171	89	Very Good

Table 9. Small Group Trial Results

No	Aspect	Score	Percentage	Category
1	Ease of use aspect	249	87	Very Good
2	Aspects of learning time efficiency	63	87	Very Good
3	Benefit Aspect	187	87	Very Good
AVERAGE		499	87	Very Good

Table 10. Limited Field Trial Results

No	Aspect	Score	Percentage	Category
1	Ease of use aspect	864	90	Very Good
2	Aspects of learning time efficiency	210	89	Very Good
3	Benefit Aspect	646	90	Very Good
AVERAGE		1720	90	Very Good

Based on the summary of the results of the questionnaire in the table above, it can be seen that the total value of the overall student answers is 1720 of the ideal value of all student answers. So from these results it can be seen that the total percentage obtained from the results of the questionnaire is 90. This value indicates that the UKBM module using the website meets very good criteria and can be used in the learning process.

The effectiveness of the UKBM Module was determined based on the pretest and posttest result value data presented in the table below which was obtained before and after using the UKBM Biology module using the website for 30 people in Table 11 as follows:

Table 11. Data on learning outcomes for the experimental class and the control class

Class	Topics								Average Pretest	Average Postest
	Plantae		Animal		Ecology		Environmental Changes			
	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test		
experiment	46	79	43	91	61	90	60	97	53	89
Control	25	81	40	80	41	80	41	81	37	80

Based on the two tables above, it can be seen that there was an increase in pretest and posttest results in the control and experimental classes, namely in the control class the pretest score was 37 while the experimental class was 53. Furthermore, in the posttest section for the control class was 80 and the experimental class was 89.

Calculation of the normality test was carried out using SPSS 22. The results of the calculation of the normality test in the pre-test and post-test of students in the control class and the experimental class in the Kolmogorov Smirnof were greater than 0.05, which means that the data is normally distributed.

The homogeneity test aims to determine whether the scores obtained by students in the experimental class and control class are homogeneous or not. Class homogeneity test results obtained "Sig. > 0.05 which means that the data is homogeneously distributed.

Test the hypothesis in the experimental class and control class using the T test with the help of SPSS 22. The results of the pretest calculations in the experimental class and the control class are known that Sig (2-tailed) > 0.05, namely 0.175, it can be seen that there is no difference in the results of students' pretests in the control class and the experimental class because they have not been treated so they have the same initial conditions. Based on the calculations, Sig (2-tailed) < 0.05 is 0.000. So it can be concluded that there is a difference in the average student learning outcomes in the experimental and control classes in the UKBM Biology module research using a website with the discovery learning model at MAN 1 Medan.

Then the N-Gain test was carried out to determine the effectiveness of using the UKBM Biology module using a website with the discovery learning model at MAN 1 Medan. Based on the results of the N-Gain test, it is known that the N-Gain value for the experimental class is 77.27, which means that the UKBM Biology module uses a website with an effective discovery learning learning model to apply in biology learning in class X MAN 1 Medan. Whereas for the control class using Biology textbooks (BTP) with conventional learning models, the N-Gain value was 68.7 which was classified as quite effective in class X biology learning at MAN 1 Medan.

4 Conclusion

1. According to material experts, the feasibility of the UKBM module using a website with a discovery learning model received a score of 88, which means it is very feasible.
2. The feasibility of the UKBM module using a website with a discovery learning model according to learning design experts is 84, which means it is very feasible.
3. The feasibility of the UKBM module using a website with a discovery learning model according to biology teachers 87 and is classified as very feasible.

4. The biology teacher's response regarding the UKBM module using a website with a discovery learning model is very good with a score of 87.
5. Student responses regarding the UKBM module using a website with a discovery learning model are very good with a score of 90.
6. Based on the data calculations that have been carried out, it is known that the N-Gain value for the experimental class is 77.27, which means that the UKBM Biology module uses a website with a discovery learning learning model that is effective for application in biology learning in class X MAN 1 Medan.

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