Developing Learning Devices Based on Full Online Learning Using the Learning Management System Moodle to Improve Student Learning Effectiveness and Student Learning Independence

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Abstract
This research aims to: 1) develop online learning based learning devices using LMS Moodle which is valid, practical, effective to increase the effectiveness of student learning and student learning independence; 2) increasing the effectiveness of student learning and student learning independence by using online learning-based learning devices utilizing Moodle LMS. This study used a 4-D development model and was carried out in 10th grade state senior high school 18 Medan. The results showed that: 1) The validation of learning devices was developed with a total average value of 4,09 valid categories, the practicality of the learning devices in terms of the analysis of the results of observations of learning implementation with a score in trial I to trial II of 2.7 low category into 3,03 categories being, the effectiveness of learning devices has been determined. 2) An increase in the effectiveness of student learning with a normalized gain index, it was found that in the first trial to the second trial there was an increase in the value from a score of 0,44 to 0,54 moderate criteria and an increase in student learning independence based on the KAM category had an increase from the first trial. to trial II, in the high group it increased to 79 to 85, in the medium group it increased to 69,4.
Keywords: development of learning devices, online learning, student learning effectiveness, student learning independence

1. Introduction

In the world of education, technology can be used not only for administrative purposes but it is possible to use it as an alternative in the selection of learning media. This is stated in Permendiknas Number 22 of 2006 which explains that: "To increase the effectiveness of learning, schools are expected to use Information and Communication Technology (ICT) such as computers, props, or other media."

Technology can be used in a number of ways to improve and enhance mathematics learning. NCTM (2006) argues that technology plays a role as a facility in solving mathematical problems, communication, reasoning and evidence. In addition, technology can provide opportunities for students to explore mathematical ideas and support them in making connections both inside and outside mathematics. Mathematics learning has an important role in developing skills and thinking logically, systematically, and creatively. This is because mathematics has a function to develop the ability to calculate, measure and use mathematical formulas that are needed in everyday life. For that, it takes teacher creativity in the process of learning mathematics so that it can be interesting and not boring. (Permendikbud, 2013).

This statement is supported by Ambarita and Siburian (2013: 85) who also explain that one of the factors that makes a teacher successful is determined by his ability to plan learning, carry out a quality learning process, assess and evaluate quality learning outcomes. Furthermore, it is also explained that learning preparation becomes something that must be done, and the implementation of the application in the classroom rests on preparations that have been made by adjusting to local conditions. This opinion is in accordance with the contents of Law of the Republic of Indonesia Number 14 of 2005 Article 20 which states that in carrying out professional duties, one of the obligations of the teacher is to plan learning, carry out a quality learning process, and assess and evaluate learning outcomes. The goal is to streamline the learning process so that learning objectives can be achieved. Therefore, to develop a good learning tool, three criteria must be considered: valid, practical and effective.

Learning devices are devices that support students to achieve the desired competency standards. The learning devices used must be in accordance with the characteristics of the target (Depdiknas, 2008: 12). Learning devices are the most important part of a learning process. National Education System Law No. 20 of 2003 states that learning devices are a set of plans and arrangements regarding the objectives, content, and learning materials as well as the methods used as guidelines for implementing learning activities to achieve certain educational goals. This statement emphasizes that the content in learning devices must be designed based on a goal. Learning devices will also contain how we will use to achieve these learning objectives. In other words, learning devices are not only very important, but are at the core of a teaching and learning process.

In the learning process, students can be actively involved because they are the center of learning activities and competency building. Students must be involved in directed question and answer and seek solutions to various learning problems. Students should be encouraged to interpret the information provided by the teacher, until the information can be accepted by common sense. Through effective and meaningful learning, competence can be accepted and stored better, because it can be accepted and absorbed and easily understood by students (Mansyur, 2012: 90).

As with the importance of the effectiveness of student mathematics learning in learning, there is also a need for attitudes that must be possessed by students including learning initiatives, monitoring, managing, controlling learning, and evaluating the learning outcome process, which is an indicator of student learning independence (Sumarmo, 2004). Emphasis on cognitive aspects is not enough, but there needs to be a balance between cognitive, skill and character. This is in line with what was stated by Sariono (2013: 6) "The 2013 curriculum tends to emphasize the balance of three educational domains. If in the previous curriculum the cognitive domain was ranked first, then the 2013 curriculum tends to balance it with more emphasis on the aspects of skills and character (psychomotor and affective). "

The importance of developing independent learning in accordance with Sumarmo's statement above (in Sugandi, 2013: 104) learning independence is a process of careful self-design and monitoring of cognitive and affective processes in completing an academic task. The above problems ultimately converge on student learning independence in general, namely self-confidence, having their own initiative, responsibility and high motivation. Every student wants independent learning itself, but that desire is only limited to wanting without any effort and implementation results in students being considered less independent in learning.

From the description above, it can be stated that the independence of student learning is no less important than the learning outcomes of student learning effectiveness. However, along with the low learning outcomes, the effectiveness of student learning in mathematics will also result in low student learning independence. The independence that a person has will develop with the more problems and challenges that are given so that someone will try based on their abilities to solve problems without the help of others, this can cause the child's independence to develop properly.

To support the achievement of learning objectives, in addition to the use of appropriate learning models, the use of ICT media is an appropriate learning strategy because it is very loved and awaited by children. It is undeniable that children's interest in mastering technology is very large, we can see that so many children, both at non-school age (early age) and school age who lose their learning time because they are too engrossed in the world of technology such as playing games, playing mobile phones, and play the computer.

At the time of the spread of the corona virus pandemic or COVID-19, it has presented its own challenges for educational institutions in Indonesia. To anticipate the transmission of the virus, the government has issued policies such as social distancing, physical distancing, to large-scale social restrictions (PSBB). This condition requires people to stay at home, study, work, and worship at home. The result of this policy made the education sector such as schools and universities to stop the face-to-face learning process. Instead, the learning process is carried out online which can be carried out from each student's home.

In accordance with the Minister of Education and Culture Circular Number 4 of 2020 concerning the implementation of educational policies in the emergency period of the spread of the corona virus disease (COVID-19), it is recommended to carry out the learning process from home through online / online learning. The readiness of service providers and students is a demand for online learning. The implementation of this online learning requires supporting devices such as computers or laptops, devices, and other devices as intermediaries which of course must be connected to an internet connection.

By implementing online learning from home, teachers are required to be more innovative in arranging learning steps. This change in teaching methods certainly makes teachers and students adapt from face-to-face learning in class to online learning (Mastuti, et al, 2020). Several previous studies have stated that online learning outcomes are better than face-to-face learning (Nira Radita, et al, 2018; Means, et al, 2013), while other research states that learning outcomes using face-to-face learning are better than those using online learning (Al-Qahtani & Higgins, 2013). Technically, in online learning, supporting devices such as devices and internet connections must both be available to both teachers and students (Simanihuruk, et al, 2019).

Online learning requires students and teachers to communicate interactively by utilizing information and communication technology, such as computer media with the internet, telephone or fax. The use of this media depends on the structure of the learning material and the types of communication required. Conversation transcripts, information samples, and written documents linked to online learning or Web learning showing full-text examples are typical ways that the importance of learning materials is documented online. More visual communication includes whiteboard imagery, sometimes coupled with conversation sessions, and video conferencing, which allows students who prefer to use different media to work with messages that are not printed. So, the reason why choosing Online Learning to take advantage of the Moodle LMS is because it can increase the effectiveness of students 'mathematics learning and also students' learning independence.

To overcome these problems, the teacher needs to design learning activities that can foster independence and improve students' problem-solving abilities through the preparation of learning devices. The learning devices in question include the Learning Implementation Plan (RPP), LKPD and research instruments based on Online Learning. Online Learning can be combined with the implementation of a Learning Management System (LMS) in online learning, one of which is Moodle.

Through the use of Moodle which is used as a source of online learning media. Its use can support the implementation of learning to increase student learning effectiveness and student learning independence. Online Learning utilizes Moodle is a medium that provides convenience in distributing learning materials and practice questions as needed. The teacher can upload various forms of learning material so that it can make it easier for all students to download the material independently and study it before learning takes place. Online Learning using Moodle can also be used to give quizzes or assignments with a predetermined deadline.

Referring to the descriptions above, the researcher wants to improve mathematics learning that is in accordance with existing needs and resources and has a view of technological developments and the demands of the era of globalization and curriculum, it is necessary to have an effort "Development of Learning Devices Based on Full Online Learning Utilizing Moodle LMS to Increase Student Learning Effectiveness and Student Learning Independence.

2. Theoritical
Learning Tool Development
Learning devices are a set of learning resources that allow students and teachers to carry out learning activities. According to Trianto (2009: 201) learning devices include: learning implementation plans (RPP), student activity sheets (LKPD) and evaluation instruments where in this study in the form of student learning effectiveness tests and student learning independence questionnaires with online learning-based learning using LMS Moodle on the material of function relations in class X.

Online Learning
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LMS Moodle
Learning Management System (commonly abbreviated as LMS) is a software application for online activities, electronic learning programs (e-learning programs), and training content.

MOODLE (short for Modular Object-Oriented Dynamic Learning Environment) is a software package produced for internet-based learning activities and websites that use the principles of social constructionist pedagogy. MOODLE is an application of teaching and learning concepts and mechanisms that utilize information technology, known as the concept of electronic learning or e-learning. Moodle can be used freely as an open source product (open source) under the GNU license. Moodle can be installed on any computer and operating system that can run PHP and supports SQL databases.

Student Learning Effectiveness
Effective learning is a teaching and learning process that is not only focused on the results achieved by students, but on how an effective learning process is able to provide good understanding, intelligence, persistence, opportunities, and quality and can provide behavioral changes that are applied in life. There are three indicators put forward by Diah and Kusumawati (2013) in student learning effectiveness, namely the right level of teaching, quality of pursuit, teacher and student responses to positive problems. So, effectiveness shows the level of success in achieving a goal after the implementation of the teaching and learning process. With the achievement of the indicator of learning effectiveness is to see the completeness of the value of learning outcomes from students, the value of student learning outcomes is said to be complete if it has passed the KKM value set by the school, the appropriate level of learning is seen from the log of student activity in online learning using Moodle LMS and teacher responses. and students seen from the observation sheet and questionnaire.

Student Learning Independence
According to KBBI, independence is a state of being able to stand alone without depending on other people. Independent learning means independent learning, but the purpose of student learning independence does not mean that students must always learn on their own. Independence in learning comes from the word independent. Independence is an attitude and behavior that is not easily dependent on others in completing tasks (Mustari, 2011:

93-94). Independent children are children who are active, independent, creative, competent and spontaneous. Unillah (2011: 72) argues that being independent means that children (students) can serve their own needs while being responsible for themselves.

Based on the explanations of experts regarding the meaning of independent learning, it can be concluded that independent learning is a person's ability to fulfill his own personal needs without much help from other people, especially parents.

Learning independence is usually characterized by the ability to determine self-determination, be creative and initiative, regulate behavior, be responsible, be able to hold back, make decisions on your own and be able to solve problems without any influence from others (Desmita, 2009: 185). Based on these descriptions, in detail the indicators of learning and learning independence are self-confidence, initiative, responsibility and motivation.

3. Methods
Research Pattern
This research is a development research that uses a 4-D development model, namely the stages of defining (defining), designing (designing), developing (developing) and disseminating (spreading). However, in this research it was only carried out in 3-D, namely defining, designing, developing, the fourth stage was carried out in a limited manner due to limited time and cost.

Subject
The subjects in this study were students of 10th grade state senior high school 18 Medan consisting of X Mipa-1 and X Mipa-2.

Data Collection Instruments
The instruments used in this study include: validation sheets, student learning effectiveness tests, learning implementation observation sheets, and teacher and student response questionnaires.

Data analysis
To measure the validity of learning devices, research instruments were compiled and developed. These instruments are in the form of validity instruments for learning devices, validation sheets for learning implementation plans, validation sheets for student worksheets, and validation sheets for student learning effectiveness tests and student learning independence. To measure the practicality of learning devices, the practical aspects of this developed learning device can be seen from the results of validation by experts, and the results of learning implementation. To measure the effectiveness of learning devices, the criteria for determining the effectiveness of online learning-based learning devices are using the Moodle LMS based on three indicators of learning effectiveness, namely: (1) The achievement of learning completeness if 85% of students who take the student learning effectiveness test have obtained a score of 75; (2) the ability of the teacher to manage learning is at least quite good (3) the response of teachers and students to learning.

4. Result
Based on the formulation of the problems put forward in Chapter I and the data obtained from the results of trials I and II, it will be known whether the formulation of the problems posed has been answered or not. The results of data analysis obtained from the results of trial I and trial II indicate that: 1) the online learning-based learning tool utilizes the Moodle LMS developed as valid, practical and effective; 2) increasing the effectiveness of student learning and student learning independence through the development of learning devices based on Online Learning using the Moodle LMS.

Discussion of the Results of the Validity of Learning Devices
Based on the results of the validation of learning devices based on Online Learning using the Moodle LMS developed, it was found that this learning tool was valid or had a good degree of validity. Furthermore, the results of the validation of the learning plan (RPP), student worksheets (LKPD), the initial and final tests of student learning effectiveness are also valid. This means that the learning device can meet the demands of learning needs to increase the effectiveness of student learning in relation to material and functions. shows the summary of the results of the validation of learning devices and all learning instruments.

Table 1. Summary of the results of the validation of the validated learning devices and learning instruments

No.	Product / Device Assessed	Average Value of Total Validity (V_i)	Category
1	Lesson plan	4,12	Very Valid
2	Student Activity Sheet	4,01	Valid
3	Initial Test of Student Learning Effectiveness	4,08	Valid
4	Final Test of Student Learning Effectiveness	4,16	Very Valid

Discussion of the Results of the Practicality of Learning Devices

Through the observation sheet on the implementation of learning using online learning-based learning devices using the developed Moodle LMS that was given to an observer at each trial meeting I and II, the results obtained were as in Table 2..

Table 2. Summary of the results of observations of the implementation of learning

	Trial I		Trial II	
	Meeting I	Meeting II	Meeting I	Meeting II
Score	2,47	2,93	2,81	3,25
Average	2,7		3,03	
Category	Low		Middle	

Discussion on the Results of the Effectiveness of Learning Devices

Based on the results of trial I and trial II, the learning devices developed have met the effective category in terms of the achievement of student learning effectiveness and student learning independence, the ability of teachers to manage learning well, and positive responses from teachers and students. This is explained as follows.

Achievement of Student Learning Effectiveness Tests

Based on the results of the test analysis in trials I and II, it was found that the effectiveness of student learning had met the completeness criteria classically. This is because the material and problems that exist in the learning device developed are in accordance with the conditions of the student's learning environment. By using this learning tool students will more easily understand the transformations that occur at a point and wake up.

Table 3. Summary of achievement of student learning effectiveness tests

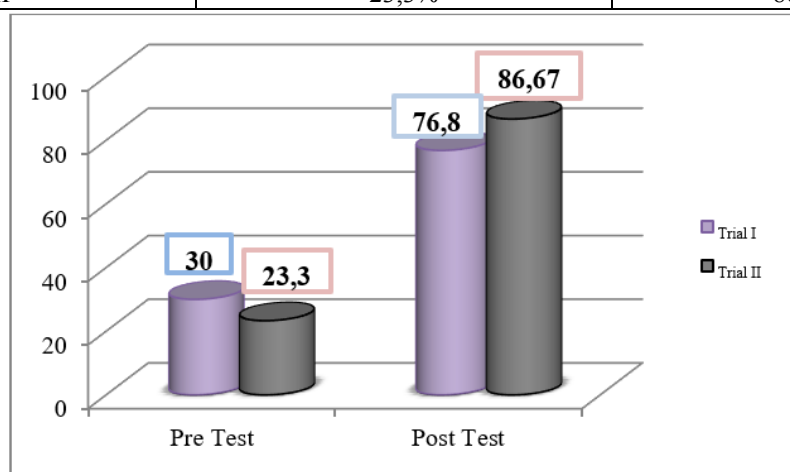| Trial	Achievement	
	Pre Test	Post Test
I	30%	76,8%
II	23,3%	86,67%

Figure 1. Percentage of Achievement in Student Learning Effectiveness Test Results Trial I and Trial II

Achievement of the Student Learning Independence Questionnaire

Based on the results of the questionnaire analysis in trials I and II, it was found that students' learning independence had increased from the results of trial I. This was because the material and problems that existed in the learning devices developed were in accordance with the conditions of the student's learning environment.

Observation of Teacher Ability to Manage Learning

Based on the analysis of the results of the observation of the teacher's ability to manage learning, it is known that the average score of the observation of the teacher's ability to manage learning during learning using online learning-based learning devices utilizing the Moodle LMS developed is in the 'Good' category. More clearly, the data from the observation of the teacher's ability to manage learning can be seen in Table 4.

Table 4. Summary of observations of the teacher's ability to manage learning

Trial I		Trial II	
Score	Category	Score	Category
3,31	Good	3,61	Good

Teacher and Student Response

Based on the analysis of the results of the teacher's responses that have been described previously, it was found that in the first trial and the second trial, the teacher felt interested in the learning devices developed. More clearly, the data are shown in Table 5.

Table 5. The summary of the results of the teacher and student response questionnaire analysis

Respondents	Trial I		Trial II	
	Score	Category	Score	Category
Teachers	3,67	Interested	3,88	Interested
Students	3,45	Interested	3,52	Interested

From the explanation of the four aspects of the effectiveness of the learning devices above, it can be concluded that the online learning-based learning tool utilizing the Moodle LMS developed is effective for use in learning material relations and functions to increase student learning effectiveness.

Increasing Student Learning Effectiveness

Based on the results of the analysis of the student learning effectiveness test in trial I and trial II, it shows that there is an increase in the effectiveness of student learning. This increase can be seen from the average student learning effectiveness test results obtained by students. Based on the normalized gain average, it was found that in the first trial there was an increase in student learning effectiveness with moderate criteria with a score of 0,44 0,3 <N-Gain≤0,7 and in the second trial there was an increase in the value with moderate criteria with a score of 0 , 42 (0,3 <N-Gain≤0,7). So it can be concluded that the online learning-based learning tool utilizing the Moodle LMS that was developed can increase the effectiveness of student learning.

Table 6. Increasing the effectiveness of student learning

Trial I		Trial II	
Score	Category	Score	Category
0,27	Medium	0,42	Medium

5. Discussion

Learning Tool Development

The learning devices developed in this study include the Learning Implementation Plan (RPP), Student Worksheets (LKPD), student learning effectiveness tests and student learning independence questionnaires. All of the learning devices developed use online learning based on the Moodle LMS.

Increasing the Effectiveness of Student Learning by Using the Development of Learning Devices Based on Online Learning Utilizing the Moodle LMS

Based on the results of the analysis of the student learning effectiveness test in trial I and trial II, it shows that there is an increase in the effectiveness of student learning. This increase can be seen from the average student learning effectiveness test results obtained by students below.

Table 7. Increasing Student Learning Effectiveness

Trial I		Trial II	
N-Gain	Category	N-Gain	Category
0,44	Medium	0,54	Medium

From table 1. based on the normalized gain index, it is found that in the first trial there was an increase in the value with moderate criteria with a score of 0,44 and in the second trial there was an increase in the value with moderate criteria with a score of 0,54. So it can be concluded that the online learning-based learning tool utilizing the Moodle LMS that was developed can increase the effectiveness of student learning.

Increasing Student Learning Independence After Using Online Learning-Based Learning Devices Using Moodle LMS

Based on the results of the analysis of student learning independence in trial I and trial II showed an increase in the value of student learning independence, this can be seen from the increase in the average value of student learning independence on each indicator in trial I to trial II in the table below. .

Table 8. Increased student learning independence

	Indicator	Trial I	Trial II
Confidence	• Presentation in front of class • Quietness in Speaking • Participation in opinion	2,37	2,76
Initiative	• Great curiosity • Be open to new experiences • The desire to discover and research	2,45	2,82
Responsible	• Commitment to tasks • Willing to be responsible	2,56	2,93
Motivation	• Desire for the good • There are needs that must be met	2,55	3,05

From table 8, it is found that online learning-based learning devices using LMS Moodle have a positive impact on increasing student learning independence. This shows that the use of learning devices with online learning-based learning utilizing the Moodle LMS developed has an impact on increasing student learning independence.

Practicality and Effectiveness of Learning Devices developed with Online Learning-Based Learning Utilizing Moodle LMS

From the results of data analysis, it was obtained that online learning based learning devices using Moodle LMS were developed practically in the second trial, which can be seen from the valid learning devices and the implementation of online learning based learning devices utilizing Moodle LMS is in the IO criteria = 3,03 medium. Based on the results of data analysis, it was obtained that online learning based learning devices using the Moodle LMS were developed to meet the effective category in the second trial. This can be seen from the results of data analysis that have met the three indicators of effectiveness.

6. Conclusion

1. The validation of learning devices based on Online Learning utilizing the Moodle LMS developed is in the 'Valid' category in terms of the analysis of the results of the validity of the learning devices by the validators with a total average value of 4,09. The practicality of the learning device in terms of the analysis of the results of the observation of learning implementation The score obtained in trial I was 2,7 (category "Low") and did not meet the criteria for research success. However, after making several revisions, in the second trial the learning feasibility observation score increased to 3,03 (category "moderate"). So that the developed learning device succeeds in meeting the practicality criteria of the learning device. The learning devices developed have met the set effectiveness criteria. In the first trial, the achievement of student learning effectiveness was 76,8% (23 students) and in the second trial it was 86,67% (26 students). The average score of the observation of the teacher's ability to manage learning was 3,31 (category "Good") in trial I and 3,61 (category "Good") in trial II. The mean teacher responses were 3,67 (category "Interested") in Trial I and 3,88 (category "Interested") in Trial II. The average student responses were 3,45 (category "Interested") in Trial I and 3,52 (Category "Interested") in Trial II.

2. Increasing the effectiveness of student learning is also seen in each indicator of student learning effectiveness. Based on the normalized gain index, it was found that in the first trial there was an increase in the value with moderate criteria with a score of 0,44 (0,3-Gain≤0,7) and in the second trial there was an increase in the value with moderate criteria with a score of 0,54 (0,3 <N-Gain≤0,7). the increase in student learning independence based on the KAM category has increased from trial I to trial II, in the high group it increases to 85, in the moderate group it increases to 69,4. So it can be concluded that the online learning-based learning tool utilizing the Moodle LMS that was developed can increase the effectiveness of student learning.

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