

Development of E-LKPD on Smartphone Using Kodular and its Effect Test on Learning Activities and Learning Outcomes of Class X Students MAN 2 Levels on Ecosystem Materials

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Abstract. The aims of this study to produce E-LKPD with Smartphones using Kodular on Ecosystem material for students that is valid, practical, and effective on learning activities and learning outcomes based on material, visual communication, learning design and software utilization in class X MAN Langkat in the year of learning 2022/2023. This study was designed with a research and development (R&D) model and was carried out at MAN 2 Langkat with a total sample taken by purposive sampling and totaling 69 people. The results showed that the average learning outcomes (cognitive, affective and psychomotor) of students in classes taught using E-LKPD with Smartphones using Kodular had a positive effect compared to classes taught without using E-LKPD with Smartphones using Kodular. The results of the analysis of the Mann Whitney U-test, obtained a significance value (Sig) of students' learning activities, namely (0.014). This indicates that the sig. <0.005, which means H₀ is rejected, meaning the hypothesis is accepted. The hypothesis test shows that classes that use E-LKPD with Smartphones using codular have a positive effect on learning outcomes and learning activities compared to classes that do not use E-LKPD with Smartphones using kodular in class X MAN 2 Langkat.

Keywords: E-LKPD, Smartphone, Kodular, Learning Activities, Learning Outcomes.

1 Introduction

The stage of change in the world including Indonesia is now entering the digital era [11]. The development of information technology in the current digital era has brought changes and influenced the field of education. The challenges in the world of education are increasingly complex and require serious preparation and thought. Students are faced with the challenge of becoming quality graduates, able to compete globally, and master technological developments [1]. Rapidly developing technology has resulted in various types of products Smartphone

(smartphone). The use of smart mobile phones among students can provide challenges as well as opportunities for teachers to optimally utilize technology for learning activities [2]. The digital era requires academics to use digital teaching materials that are easy, practical, can be stored on a laptop or telephone smart handheld [12].

Smartphone users among students can provide challenges as well as opportunities for teachers to make optimal use of technology for learning activities [3]. Facts on the ground show that students can spend hours interacting with smart phones [19]. Smart mobile phone in students are more used to chatting, browsing, play games, compared to learning activities [5]. This can have a negative impact on learning activities in schools as well as decreased student learning activities and outcomes [10]. Things to increase the activity and learning outcomes of students is a problem that must find a solution.

A parallel problem that arises based on the results of interviews with biology teachers at MAN 2 Langkat is the lack of teaching materials with Smartphones on smart mobile phones, causing students to have low motivation and attention in participating in the teaching and learning process [6]. Students tend to use smart phones for play activities that waste time and are lazy to study. Smart mobile phones should be used as media for teaching materials [14].

E-LKPD is a teaching material that contains instructions, tasks/activities that must be done by students presented in an electronic format [8]. The developed E-LKPD with Smartphone contains interactive technology and its development is in accordance with the demands of the Merdeka Curriculum [7]. Interactive means there is feedback between user (students) with the program (E-LKPD used). Students can be more independent and play an active role in learning with the help of an E-LKPD based android. By utilizing technology-based E-LKPD, it is one of the components of the 4.0 education era will be fulfilled [18].

E-LKPD with smart phones is still not available and is only available in a number of Senior High Schools (MAN) in Kab. Langkat. MAN 2 Langkat is one of the schools that does not yet have an E-LKPD based android. MAN 2 Langkat allows students to use smart mobile phones so that their use needs to be maximized for learning activities. The results of an interview with a biology teacher at MAN 2 Langkat obtained information that the teacher had never used learning media in the form of an E-LKPD in the biology learning process, especially on ecosystem material and student learning outcomes which were still low, seen from the average student midterm exam scores. who have not reached the KKM is 75.

The results of data analysis from a questionnaire filled out by biology teachers at MAN 2 Langkat found several problems which can be explained as follows. First, the teacher uses teaching materials in the form of textbooks, LKPD, sources from website, but teachers have not used electronic teaching materials such as E-LKPD based android. Second, teachers use LKPD for learning activities, but the LKPD used does not have an assessment tool (practice questions).

E-LKPD with Smartphone is made by using software coding. The application is created using Kodular which can be accessed via android thus enabling users to use this application using a smart mobile phone [13]. The results of research conducted by [15] also show that learning media are developed with applications [21]. Kodular is more effectively used in classroom learning than without using learning media. Likewise the results of research according to [4] which show that the development of codular applications is very suitable for use as learning media. As well as research according to [18] which shows that codular-assisted application

development on Android smartphones is interesting and feasible to use and able to improve students' critical thinking skills [9].

Based on this problem which has not been clearly revealed in the description above, the researchers undertook the development of an E-LKPD with the title "Development of an E-LKPD in Smartphone use Kodular and test its effect on learning activities and learning outcomes of class X MAN 2 Langkat on ecosystem material.

2 Method

Research and development methods or Research and Development (R & D). This research examines the quality of product development based on the criteria of validity, practicality, and effectiveness (Plom & Nieven, 2013).

Research model development aims to produce certain products and test the quality of the product. The product in this study is an E-LKPD device with a Smartphone using the Kodular application. The development model used in this study was adopted from the Plomp development model which consisted of three main stages, namely preliminary research, prototyping stage, assessment phase [16].

The quality of product development in this study is determined using certain criteria. The author uses the Plomp development model because according to [16], to determine the quality of the results of the development of learning models and tools, three criteria are needed: validity, practicality, and effectiveness. In this development research there is a formative evaluation, as expressed by [16] which can be illustrated in Figure.

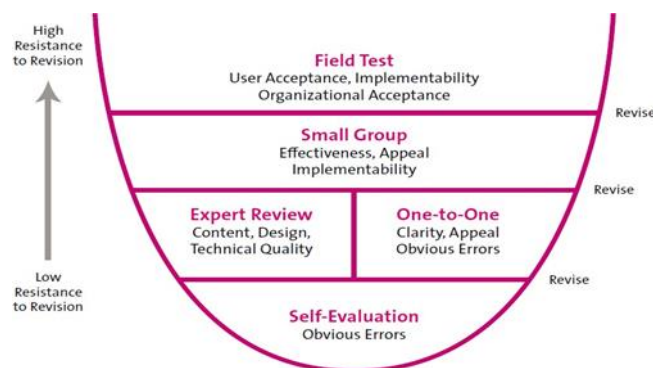


Fig 1. Formative evaluation layer chart

2.1 Research procedure

The research procedure for developing E-LKPD with Smartphone uses the Plomp design model which has three stages, namely as follows.

1. Initial Investigation Stage (Preliminary Research Phase)

Level preliminary research aims to obtain information relating to the product to be developed. This stage is carried out to get an overview of the conditions regarding the characteristics of

the product being developed and can be used in learning. The activities carried out at this stage are as follows.

a. Problem Analysis

This problem analysis is carried out to find out the problems faced in learning both from teachers and students. The problem analysis also includes learning materials that have been used in schools and learning materials that will later be developed, namely E-LKPD based android. The activities carried out at this stage are using the process of filling out a questionnaire by one biology teacher and a questionnaire filled out by students.

b. Needs Analysis

Needs analysis is carried out to determine the characteristics of the teaching materials to be developed, students are used as the target users of the teaching materials to be developed and to determine the teaching materials needed in the learning process. The activity carried out at this stage is filling out a needs analysis questionnaire filled out by students.

c. Curriculum Analysis

This curriculum analysis aims so that students can achieve learning objectives based on Learning Outcomes and Learning Goals Flow according to the curriculum independent. The author conducted a curriculum analysis by filling out a questionnaire by Biology subject teachers.

d. Concept Analysis

Concept analysis is carried out to identify, detail, and systematically arrange the concepts needed and can be used as a reference in the development of E-LKPD base android. The results of this analysis are used as a reference in developing based E-LKPD android.

2. Prototyping Stage (Prototype Phase)

This development stage aims to develop alternatives that will be used as solutions to solving problems obtained at the initial investigation stage. At this development stage a series of prototypes was developed. The prototype is evaluated according to formative evaluation. [16] revealed that formative evaluation has several layers which include self evaluation, expert review, one to one evaluation, Small group discussion, and field test. The type of formative evaluation to be used will be explained in the following prototype development activities.

a. Prototype Development 1

Planning results prototype at an early stage named with prototype 1. Prototype 1 evaluated through the self-evaluation stage (self-evaluation), namely by revising the E LKPD itself which has been designed using a check list to check for errors that were still found in prototype 1 and then revising it. This stage produces prototype 2.

b. Prototype Development 2

Prototype 2 was evaluated by performing expert validation (expert review), namely the E-LKPD is discussed with experts in order to obtain a valid E-LKPD with a Smartphone. The validated aspects include material aspects, learning design aspects, display aspects (visual communication), and utilization aspects software. Then implemented one to one evaluation,

namely by asking 3 students to give their comments on the E-LKPD with a smartphone that has been designed. Based on the validation results and comments that have been given by students, the E-LKPD with Smartphone is revised.

c. Prototype Development 3

The development of Prototype 3 is the revised result of Prototype 2. Prototype 3 is evaluated by means of small group evaluation (Small group evaluation), namely the revised E-LKPD with a Smartphone is practiced in a group of students consisting of 6 people. This small group evaluation was carried out to find out the practicality of the product that had been designed

d. Prototype Development 4

The development of prototype 4 is the revised result of prototype 3. Prototype 4 will proceed to the assessment stage (assessment phase) by conducting a large group trial (field test) in the classroom. Prototype development was developed by the author himself by self-taught learning by looking for references from Google and YouTube and it took ± 1 year from the start learning to make prototypes using kodular.

3. Evaluation Level (Assessment Phase)

This stage is the final stage in the design assessment (design research) namely a large group test of one class to see the practicality and effectiveness of the prototype. Practicality is carried out by filling out practical questionnaires by teachers and students on the use of E-LKPD based android. Further assessment on assessment phase is product effectiveness. Product effectiveness means a measure that states whether or not there is an effect or influence of the product being developed on the user.

3 Results and discussion

3.1 Results of Initial Investigation Stage Analysis (Preliminary Research Phase)

This stage is carried out to get an overview of the conditions regarding the characteristics of the product being developed and can be used in learning. The initial investigation phase was carried out in several stages. These stages are problem analysis, needs analysis, curriculum analysis, and concept analysis.

Problem Analysis

Problem analysis aims to find out the problems faced by students and teachers in biology subjects and find solutions to these problems. Problem analysis data was obtained from the results of a questionnaire filled out by biology teachers and students in class X, MAN 2 Langkat.

The results of data analysis from a questionnaire filled out by a biology subject teacher in class X, found several problems regarding the implementation of learning activities which can be explained as follows. First, the teacher uses teaching materials in the form of textbooks, LKPD, sources from website. but teachers have not used electronic teaching materials such as E-LKPD based android. Second, teachers use LKPD for learning activities, but the LKPD used does not have an assessment tool (practice questions).

The results of data analysis from a questionnaire filled out by 36 students from class X-D MAN 2 Langkat found several problems regarding the implementation of learning activities which can be explained as follows. First, Students experience learning difficulties in some biology material for class X Semester 2, namely material about ecosystems with a percentage (77.77%) reinforced by the achievement of the average daily test scores of students who have not reached the minimum completeness criteria or KKM. Second, students spend a lot of time interacting with smart phones, but not many use them for learning activities. Third, students are allowed to use smart phones for learning activities, but electronic-based teaching materials android there is still minimal availability in schools.

The results of the student questionnaire analysis also show that students in class X MAN 2 Langkat have a smartphone-based smart phone android with a percentage of 100%. This percentage figure shows that every student at school already has a smartphone. All students have smart phones but do not use them in learning activities as explained below. The use of smart mobile phones used by students for learning activities (55.55%) and games (50%) gets a lower percentage than the percentage for chatting (77.77%) and browsing (75%).

Students use their time to interact with smart phones from one to more than four hours per day. The percentage results show the use of time to interact with smart phones as follows. One to two hours per day as much as 11.11%, two to four hours per day as much as 50%, and more than four hours per day as much as 38.88%. The use of smart mobile phones should be used as an educational medium that makes it easier for students to understand learning material about ecosystems.

Needs Analysis

Needs analysis was carried out to determine the characteristics of E-LKPD based android developed to suit the needs of students. The results of the analysis of students' needs for E-LKPD based android is as follows. First, students stated that they agreed if there were learning materials in the form of E-LKPD based android at school with a percentage of 100%. Second, students stated that they agreed that the E-LKPD based android includes cover page, cover, menu, profile, usage instructions, Learning Outcomes, Learning Objectives and indicators, student learning activities, learning videos, evaluations, evaluation keys, and bibliography with a percentage of 94.44%. Third, students stated that they agreed if the E-LKPD based android equipped with biology material and displayed interesting pictures and videos to make it easier to understand the material with a percentage of 100%.

E-LKPD based android made from the results of the analysis of the needs of students. Learners are involved in choosing the color and type of writing on the E-LKPD based android. The results of the analysis of students' needs for the color of writing that students want for E-LKPD based android.

The results of the analysis of students' needs for the type of writing on cover E-LKPD based android is Berlin Without FB Demi. Dominant students choose the type of writing times new roman as the contents of E-LKPD based android. Cover on E-LKPD is made using the type of writing Berlin Without FB Demi. combined with times new roman. Fill in the based E-LKPD android made with writing type times new roman.

Curriculum Analysis

This curriculum analysis aims to produce E-LKPD based android which refers to the curriculum that is appropriate and meets the competencies that have been set. The curriculum

analyzed is the curriculum used in schools, namely the Merdeka Curriculum. This analysis is more focused on the details of Learning Outcomes, Learning Objectives and Assessment Indicators for ecosystem material.

Learning Achievement	Learning Objectives	Assessment Indicator
Students have the ability to create solutions to problems based locally or globally from their understanding of the ecosystem and the interactions between components	Identify ecosystem components by presenting reports on ecosystem observations in the surrounding environment	Presents a report on the identification of ecosystem components in 1 ecosystem
	Develop food webs or food chains from observations of existing ecosystems in the surrounding environment	Presents 3 food chains and 1 food web
	Analyze the interactions that occur between ecosystem components by presenting observation reports	Presenting an analysis of 3 interactions that occur between ecosystem components

Concept Analysis

The purpose of the concept analysis is to identify the existing concepts in the learning indicators as a guide in designing E-LKPD based android. The results of the concept analysis for ecosystem material.

Learning Achievement	Essential Concept
Students have the ability to create solutions to problems on a local or global basis from their understanding of ecosystems and interactions between components	<ul style="list-style-type: none"> · Definition and Composition of Ecosystem Components · Types of Ecosystems and interactions between organisms · Food pyramids, food chains and food webs · Biogeochemical Cycles

Based on the data obtained, several concepts need to be improved in the ecosystem material. Concepts that need to be added to the material components that make up the mangrove ecosystem, interactions that occur in mangrove ecosystems, food pyramids, food chains and food webs that occur in mangrove ecosystems and the carbon cycle that occurs in mangrove ecosystems.

3.2 Development and Prototyping Stage (Development or Prototyping Phase)

The prototype stage or development stage begins after the initial investigation phase has been completed. The results of the initial investigation phase are used as guidelines in product

development in the form of E-LKPD based android. The results of development activities carried out at this stage are as follows: cover based E-Lkpd android the main menu (material menu display, material, material description display), learning activity, bibliography, exercise (display exercise page), evaluation (display of evaluation questions), profile.

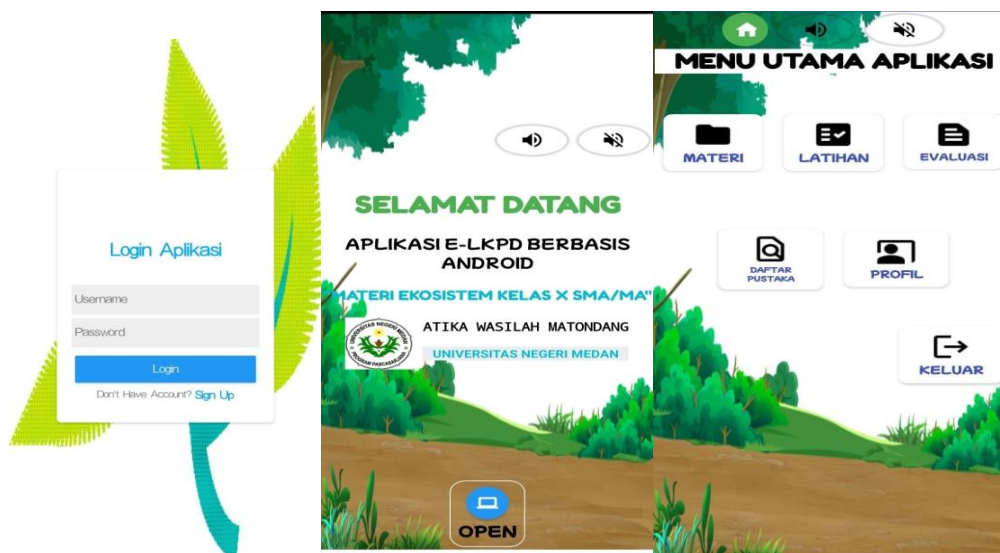


Fig. 1. Cover and the main menu based E-Lkpd android

Prototype Development Results I

E-LKPD based prototype design android starting with designing storyboard based E-LKPD android. Next, design a systematic presentation of the material and the learning objectives to be achieved which are divided into several learning activities. Making E-LKPD is guided by Learning Outcomes, Learning Objectives and Assessment Indicators in the Independent Curriculum. E-LKPD based android on this ecosystem material made using software coding. Components in e-based LKPD android is as follows.

Prototype Development Results II

Repair from self evaluation produce prototype II. The next stage is expert review and one to one evaluation on prototype II. Expert assessment is carried out from four requirements, namely aspects of construction, content, graphics, and language. then one-to-one validation one to one evaluation by three students with low, medium and high ability. The results of the validity test can be seen as follows.

Expert Review (Expert review)

Expert study is an assessment given by the validator, so you can see the validity of the E-LKPD based android for each aspect in several categories is very valid.

Table 1. Based E-LKPD Validity Test Results Android

Rated aspect	Rate (%)	Category
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Material Aspect	87,5	Very Valid
Aspects of Visual Communication	83,33	Very Valid
Learning Design Aspects	79,68	Valid
Aspects of Software Utilization	75	Valid
Amount	325,51	Very Valid
Rate	81,37	

One-on-one evaluation (One to One Evaluation)

One-on-one evaluation (one to one evaluation) aims to determine the feasibility of the product being developed. One-on-one evaluation was carried out on 3 students. At this stage three students were asked to assess and provide comments on the based E-LKPD android that has been developed. The results of the one to one evaluation for students can be explained as follows. First, the material presented in the E-LKPD is based android easier to understand. Second, the language used in e-based LKPD android is standard and easy to understand. Third, presentation and graphics on E-LKPD based android has an attractive appearance. The next step is to revise the E-LKPD based android on ecosystem material based on the suggestions given by the validator and considering the assessment of students in the one-on-one evaluation (one to one evaluation).

Prototype Development Results III

Improvements from the expert validation stage (expert review) and the one-to-one evaluation stage (one to one evaluation) produces prototype III which is then carried out in the next stage, namely practicality testing by small groups (small group). At this stage an evaluation was carried out from six class X students at MAN 2 Langkat.

E-LKPD based android which has been valid in the form of prototype III is continued for testing small group. This formative evaluation was carried out to see the practicality of the based E-LKPD android to students in small numbers.

Table 2. Based E-LKPD Practicality Test Results Android on Small Group

Assessment Aspects	Rate (%)	Category
Ease of Use	84,39	Very practical
Learning Time Efficiency	85,42	Very practical
Benefit	87,59	Very Practical
Amount	258,7	Very Practical
Rate	85,50	

Based on the results of the small group practicality test in Table, with an overall average of 85.50% (very practical). This shows that based E-LKPD android developed is already practical and can be used for large group trials at the stage field test.

Prototype Development Results IV

Prototype IV is the same as prototype III. This is because at the stage small group there is no revision and the results of the practicality test show that it is E-LKPD based android has been very practical so that it can be used to a certain extent field test.

3.3 Evaluation Level (Assesment Phase)

Evaluation level (Assesment Phase) is carried out after several stages of the process of developing an E-LKPD based android and finished revising. At this stage the activities carried out are trial-based E-LKPD products android Two classes of samples were carried out. The two sample classes are divided into experimental classes, namely classes that carry out learning using E-LKPD based android and the learning process control class does not use E-LKPD based android. Assessment level results (Assesment Phase) This is data obtained from the results of practicality tests based on e-LKPD android large group students (field test) and practicality for teachers. In addition, effectiveness test data were also obtained which included cognitive, affective, psychomotor and learning activity data of students. The results at the assessment stage (Assesment Phase) as follows.

Based E-LKPD Practicality Test Android By Teacher

This activity was carried out to see the practicality of E-LKPD based android. The practicality assessment was carried out by a biology teacher who taught class X MAN 2 Langkat. The results of the practicality assessment of E-LKPD are based android given to biology teachers.

Table 3. Based E-LKPD Practicality Test Results Android by the teacher

Assessment Aspects	Rate (%)	Category
Ease of Use	81,25	Very practical
Learning Time Efficiency	87,50	Very practical
Benefit	83,33	Very Practical
Amount	252,08	Very Practical
Rate	84,02	Very Practical

Based on the results of the teacher's practicality in Table it can be seen that the practicality assessment given by the teacher to the E-LKPD is based android shows an average yield of 84.02% (very practical). The practicality test results show that E-LKPD is based android very practical used by teachers in the implementation of learning activities.

Based E-LKPD Practicality TestAndroid by Large Group Students (Field Test)

This activity was carried out to see the practicality of E-LKPD based android by students. The results of the practicality assessment of E-LKPD are based android given to students. The average result of the practicality test analysis based on e-LKPD android students.

Table 4. Based E-LKPD Practicality Test Results Android onField Test

Assessment Aspects	Rate (%)	Category
Ease of Use	85,24	Very practical
Learning Time Efficiency	82,29	Very practical
Benefit	84,72	Very Practical
Amount	252,25	Very Practical
Rate	85,08	

Based on the practical results of students, it can be seen that the practicality assessment given by students to E-LKPD is based android shows an average yield of 85.08% (very practical). The practicality test results show that E-LKPD is based android very practical to be used by students in the implementation of learning process activities.

Effectiveness Test Results

The effectiveness trial was carried out in two classes, namely in class X-B as the control class and X-D as the experimental class. Test the effectiveness of E-LKPD based android implemented to find out that the product that has been developed is E-LKPD based android eligible or not when used as learning material in the learning process. Effectiveness data is obtained from learning activities and learning outcomes of students which include the cognitive, affective, and psychomotor domains. The results of student learning activities were obtained from observation sheets of student learning activities. Learning outcomes in the affective domain of students were obtained through non-test techniques in the form of attitude observation sheets along with validated rubrics. The results of learning in the psychomotor domain of students were also obtained through non-test techniques in the form of skill observation sheets along with validated rubrics.

Learning activity

When the learning process takes place, observations are made of the learning activities of students by the observer. The total average learning activity of students during the learning process.

Table 5. Average Observations of Student Learning Activities in Experimental and Control Classes

Material	Class	Rate	Value Sig	Information
Ecosystem	Experiment	89,71	0.014	Working Hypothesis Accepted
	Control	84,73		

After knowing the average learning activity of students in the control and experimental classes on material about ecosystems, then a hypothesis test was carried out using a test Mann Whitney U-test. Test Mann Whitney U-test This is done to see the effect of using E-LKPD based android on process learning on student learning activities.

Test analysis results Mann Whitney U-Test, the significance value (Sig) of students' learning activities is 0.014. This indicates that the sig. < 0.05, which means H₀ is rejected, meaning hypothesis H₁ accepted, meaning that classes using E-LKPD are based android use Kodular has a positive influence on learning activities compared to classes that do not use E-LKPD based android use Kodular.

Learning Outcomes in the Cognitive Domain

Learning outcomes are students' gains after following the learning process and these gains include three areas of ability, namely cognitive, affective and psychomotor. Learning outcomes are characterized by (1) new behavior in the form of actual abilities (2) these new abilities are valid for a long time, and (3) these new abilities are obtained through a learning event [14].

Actions and learning outcomes can be manifested in the form of (1) first, knowledge material in the form of facts; information, principles or laws or procedural rules or work patterns or theories of value systems and so on, (2) mastery of cognitive behavioral patterns (observation) of thinking processes; remembering or reliving, affective behavior (attitudes of appreciation, appreciation, etc.); psychomotor behavior (skills psychomotor skills including those of an expressive nature), and (3) changes in good personality traitstangible norintangible.

The cognitive domain concerns intellectual learning outcomes which consist of six aspects, namely knowledge or memory, understanding, application, analysis, synthesis and evaluation. The first two aspects are called low-level cognitive and the next four aspects are considered high-level cognitive. The affective domain concerns attitudes which consist of five aspects, namely acceptance, answer or reaction, assessment, organization and internalization. The psychomotor domain concerns the learning outcomes of skills and the ability to act. There are six aspects of the psychomotor domain, namely reflex movements, basic movement skills, perceptual abilities, harmony or precision, complex skill movements, and expressive and interpretative movements [20].

The learning outcomes in the cognitive domain in this study were obtained through a final test in the form of a written test given to the control class and the experimental class at the end of the meeting in the learning process. This assessment is used to determine the effectiveness of E-LKPD based android that has been developed. The results of learning outcomes in the cognitive domain of students.

Table 6. Average Assessment of Learning Outcomes in the Cognitive Domain of Students in the Experimental and Control Classes

Material	Class	Rate	Value Sig	Information
Ecosystem	Experiment	80,44	0.036	Working Hypothesis
	Control	75,45		Accepted

After knowing the average learning outcomes in the cognitive domain of students in the control and experimental classes on material about ecosystems, then a hypothesis test was carried out using a test independent samples T test (t-test). This t-test was conducted to see the effect of using E-LKPD based android in the learning process on learning outcomes in the cognitive domain of students.

The results of the t-test analysis, obtained a significance value (Sig) of students' cognitive competence, namely 0.036. This indicates that the sig. < 0.05, which means H0 is rejected, meaning hypothesis H1 accepted, meaning that classes using E-LKPD are based android use Kodular have a positive influence on knowledge competency compared to classes that do not use E-LKPD based android use Kodular.

Affective Domain Learning Outcomes

During the learning process, observations were made on the affective domain (attitude) of students by the observer. The average results of the analysis of the affective domain (attitude) of students during the learning process can be seen in Table.

Table 7. Average Assessment of Learning Outcomes in the Affective Domain of Students in the Experimental and Control Classes

Material	Class	Rate	Value Sig	Information
Ecosystem	Experiment	77,00	0.000	Working Hypothesis Accepted
	Control	68,27		

After knowing the average learning outcomes of the affective domain of students, then a hypothesis test is carried out using the test Mann Whitney. Test Mann Whitney This is done to see the effect of using E-LKPD based android in the learning process towards improving learning outcomes in the affective domain of students.

Test analysis results Mann Whitney U-test, the affective value (Sig) of student learning was obtained, namely 0.000. This indicates that the value sig. < 0.05, which means H0 is rejected, meaning hypothesis H1 accepted, meaning that classes using E-LKPD are based android use Kodular has a positive effect on attitudinal competencies compared to classes that do not use E-LKPD based android use Kodular.

Psychomotor Domain Learning Outcomes

In addition to analysis of learning activity data and learning outcomes in the cognitive and affective domains, the researcher also analyzed data on the psychomotor learning outcomes (skills) of students obtained from observations of the psychomotor domain (skills) of students by the observer. The average results of the analysis of learning outcomes in the psychomotor domain of students using E-LKPD based android can be seen in Table.

Table 8. Average Assessment of Learning Outcomes in the Psychomotor Domain of Students in the Experimental and Control Classes

Material	Class	Rate	Value Sig	Information
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Ecosystem	Experiment	78,83	0.002	Working Hypothesis Accepted
	Control	71,15		

After knowing the average learning outcomes in the psychomotor domain of students, then a hypothesis test is carried out using the test Mann Whitney. Test Mann Whitney This is done to see the effect of using E-LKPD based android in the learning process towards improving learning outcomes in the psychomotor domain of students.

Test analysis results Mann Whitney U-test, the psychomotor significance value (Sig) of students' learning was obtained, namely 0.002. This indicates that the sig. < 0.05, which means H0 is rejected, meaning hypothesis H1 accepted, meaning that classes using E-LKPD are based android use Kodular has a positive effect on skills competency compared to classes that do not use E-LKPD based android use Kodular.

3.4 Discussion

E-LKPD based android use Kodular about ecosystem material for class X SMA was developed through a series of processes [15]. The process is in accordance with the existing research stages in development research (research development) [18]. Research development consists of three stages, namely preliminary research (preliminary research), prototyping stage (development stage), assessment phase (evaluation level) [16].

The initial stage of developing E-LKPD based android is the level preliminary research or preliminary studies. This stage is carried out to get an overview of the conditions regarding the characteristics of the product being developed and can be used in learning. In this early stage, several analyzes were carried out including problem analysis, needs analysis, curriculum analysis, concept analysis.

The results of the problem analysis found that the teacher used teaching materials in the form of textbooks, worksheets, sources from website. but teachers have not used electronic teaching materials such as E-LKPD based android [20]. Electronic teaching materials such as E-LKPD based android less used in learning. Device android as a form of current technological progress, it needs to be utilized more optimally for learning activities. According to [17], "Learning in schools needs to use a series of electronic equipment that can work more effectively and efficiently".

The results of the analysis of the problems regarding the components contained in the LKPD show that the LKPD that is usually used by teachers still does not have an assessment tool. LKPD components according to [23] includes titles, study instructions, competencies to be achieved, supporting information, tasks and work steps, assessment. Assessment is one of the important elements in LKPD. E-LKPD can be used as an evaluation tool for the achievement of student learning outcomes. E-LKPD is used as a means of training students which can be opened via android [20].

Researchers developed one of the electronic learning media that can be operated via smart mobile phones, namely E-LKPD based android. Development of E-LKPD based android adapted to the needs of students, the school curriculum, as well as the material concepts needed by students. According to [4] "the use of Student Worksheet (LKPD) learning media is an alternative to increase understanding of concepts and student learning activities". Learning

will be easier if it is supported by learning resources in the form of specially designed E-LKPD [22].

Development stage or prototyping stage starting from the development of prototype I to prototype VI which is then followed by the assessment stage or assessment phase. The assessment stage is carried out to test the based E-LKPD product android by comparing the use of e-based LKPD android in the experimental class using printed E-LKPD which is commonly used by teachers in the control class.

E-LKPD based android underwent several revisions during its development process. The revision process produces valid, practical, and effective products. [16] states that to get a good quality product, the product must have valid, practical and effective criteria by conducting validity, practicality, and effectiveness tests. Discussion on the validity, practicality, effectiveness of E-LKPD based android use Kodular regarding ecosystem material, is described as follows:

4 Conclusion

Based on the process of developing and discussing E-LKPD based android, the following conclusions were obtained.: E-LKPD based android on ecosystem material that has been developed using the Plomp model has E-LKPD based validity results android has a very valid category based on material aspects (very valid), learning design aspects (valid), aspects of visual communication display (very valid) and aspects of software utilization (valid), E-LKPD based android the ecosystem material that has been developed has practicality in a very practical category based on assessments by teachers and class X students at MAN 2 Langkat, E-LKPD based android on ecosystem material that has been developed to have effectiveness through the assessment of learning activities, E-LKPD based android on ecosystem material that has been developed to have effectiveness through the assessment of student learning outcomes in the cognitive, affective, and psychomotor domains.

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