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Development of learning devices based on merdeka belajar with the theme of environmental pollution for class VII students of Public Junior High School 3 Tondano

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Abstract
This research is a Research on Development of Learning Devices based on Merdeka Belajar. The objectives of this research are: (1) to produce a science learning tool based on independent learning that meets the criteria for proper learning. (2) Knowing the improvement of student learning outcomes from the application of learning tools based on independent learning. The method used in this study is a Research and Development Approach following the stages of development research according to Brog and Gall which was revised by Palilingan with the following steps: (1) Planning, (2) Exploration Studies, (3) Development of Initial Forms of Products (4) Data Collection and Data Analysis Instruments, (5) Expert Product Validation consisting of media experts and material experts, (6) Revision based on Validation Results, (7) Dissemination. The results of this study indicate that: based on the assessment: (1) media expert validation obtained an average of 86.45 including the Very Eligible category (2) Material 1 expert validation (Lecturer) obtained a score of 189 with a percentage value of 82.17% the value belongs to the category Very High, while the assessment carried out by material expert 2 (teacher) obtained a score of 195 with a percentage value of 84.78%, where the value was included in the very high category (3) This Learning Tool received a positive response from students with average learning outcomes. The average pre-test was 51, with a completeness percentage of 16%, while the post-test score showed an increase in the average score of 74.5 with a Completeness percentage of 88%. Also supported by questionnaire response 1 (teacher) obtained a percentage of 95%. The percentage is included in the very good category. 2 (Students) the score achieved for the category Strongly Agree (SS) 73%.

Keywords: development, learning tools, environmental pollution

Introduction

The rapid development of the era is marked by advances in science and technology. Technological inventions and innovations have offered a lot of convenience, comfort and luxury in modern life. Tri Sugiono *et al*, (2017). In the 21st century, there have been various rapid developments in science and technology, this is indicated by the existence of information and communication technology that spreads rapidly and widely in every part of life, including education. (Tanauma Adrey 2015) [6].

Education in Era 4.0 should prioritize a culture of innovation and independence in learning but must still have the spirit of Pancasila. Education after the Covid-19 pandemic must have a comfortable mental attitude with discomfort that supports the acceleration of the realization of a culture of innovation. The existence of a pandemic has forced educators to rethink approaches to learning that can support the acceleration of the realization of student-centered learning, and this pandemic has reduced anxiety about technology and accelerated the development of a technology-based national education platform. (M. Sity, 2020) Things that need to be considered by teachers in designing learning by choosing approaches, strategies, models and learning techniques will form a learning model that describes the process and creation of environmental situations that allow students to interact so that changes or developments occur in students.

Based on the results of an interview with one of the science teacher resource persons at Public Junior High School 3 Tondano, on Wednesday, September 30, 2020 at school, information was obtained that learning is carried out via online (on the network). The learning that is currently being used has been implemented since the COVID-19 pandemic, but the curriculum used refers to the 2013 revised 2017 curriculum and the Learning Devices used are adopted from the internet and quoted from books that are left to use, just buy, instant, and without the effort of planning to prepare and compose yourself. In addition, thematic learning or linking learning with environmental events has not yet been fully implemented. For the application of the thematic model, it has never been tried to apply. According to the resource person, the obstacle is that apart from an educational background that is not science, it makes it difficult for the teacher, especially since learning is carried out through the zoom application with the method used, namely lectures.

Effective learning in development research is related to the assessment of the quality of the learning tools developed. The hope is that the existence of independent learning-based learning tools can increase the creativity of teachers and students who take part in the learning process and is effectively adjusted to the characteristics of learning materials that try to bridge between the material in the classroom and the situation outside the classroom regarding technological and social developments, will provide direct experience to students through the scientific process by utilizing technology products, namely through social media such as WhaatsAap, Facebook, Google Classroom etc. It

will demand that students be included in information search, goal setting, planning, implementation and evaluation of learning. (Kapubau V. Y, 2019). So that the implementation of the pollution theme learning device will be easier to accept and understand by students, in building understanding, scientific concepts and student insights and by using social media positively for learning activities during the Covid-19 pandemic which requires the learning process to be carried out online.

Learning device is a plan that is used in the learning process. Therefore, (Kunandar, 2014: 6) explains that "Every teacher in the education unit is obliged to compile a complete, systematic learning tool so that learning can take place interactively, inspiring, fun, challenging, motivating students to participate actively".

Learning device are things that must be prepared by a teacher before carrying out learning. In the Big Indonesian Dictionary (2007:17) devices are tools or equipment, while learning is a process or way of making people learn. The task of the teacher before teaching should be to prepare himself for everything for learning activities. A teacher before teaching needs to prepare learning tools. However, in this case, the teacher must have competence or the ability to carry out something he has obtained through learning. This must be done because learning is the first and foremost task of the teacher, so it should be planned and implemented as well as possible. Ibrahim (Kunandar, 2014) states that "the learning tools needed in managing the teaching and learning process can be in the form of Annual Programs (*Program Tahunan*), Semester Programs (*Program Semester*), Syllabus, RPP, Student Activity Sheets (LKPD, *Lembar Kerja Peserta Didik*), Evaluation Instruments or Learning Outcomes Tests (THB, *Tes Hasil Belajar*), and Media Props learning". So, Learning Devices can be interpreted as completeness tools used to assist learning.

In its implementation, the learning device consists of various components depending on the needs of each person (teacher). However, in this study, the learning tools in question are: Annual Programs, Semester Programs, Syllabus, Lesson Plans (RPP) and Student Worksheets (LKPD) and Learning Outcomes Tests (THB).

Annual Programs

The annual program is a plan for determining the allocation of time for one academic year to achieve the objectives of the competency standards and basic competencies that have been set. The annual program is part of the learning program. The annual program contains an allocation of time for one academic year in achieving the learning objectives contained in the basic competency (KD) competency standards as planned.

Semester Programs

The semester program is a description of the annual program. If the annual program is structured to determine the number of hours needed to achieve basic competencies, then in the semester program it is directed to answer how many weeks or when learning to achieve basic competencies is carried out.

Semester Program is a description of the annual program which contains the things to be achieved in that semester. Semester program is a formulation of teaching and learning activities for one semester whose activities are made based on the consideration of the available time allocation, the number of subjects in the semester and the frequency of examinations adjusted to the educational calendar. The semester program will make it easier for teachers to allocate time to teach the material that must be achieved in the semester

Syllabus

The syllabus is a learning plan for a particular subject and or group of subjects that includes competency standards, basic competencies, subject/learning materials, learning activities, and competency achievement indicators for assessment. The syllabus is more applicable than prota and promissory notes, but for the preparation of the syllabus the teacher does not need to make it again because it is already in their respective textbooks (Kunandar, 2011: 244). The syllabus is one part of the learning tools which is the development of competency standards and basic competencies that have been stated in the annual program and semester program.

Lesson Plans (RPP)

The Lesson Plans must be owned by the teacher as part of the teaching tool. RPP becomes a guideline for class teachers and subject teachers in carrying out learning in accordance with predetermined signs. RPP is a short plan to estimate all activities that will be carried out by students and teachers in learning activities. Mulyasa, (in Mulyani *et al* 2012) [3]. states that "RPP is a plan that describes learning procedures and management to achieve one or more basic competencies set out in the content standards and described in the syllabus".

Student Worksheets (LKPD)

Student Worksheets (LKPD) are printed teaching materials in the form of sheets containing tasks with steps so that students can study independently or with a companion (teacher). In the general guidelines for developing teaching materials (Prastowo, 2015) that Student Activity Sheets are sheets containing assignments that must be done by students. Activity sheets are usually in the form of instructions or steps to complete a task. And the task must be clear the basic competition to be achieved.

Learning Outcomes Tests (THB)

Assessment of student learning outcomes is very important in teaching and learning activities. With the assessment of learning outcomes, it can be seen how much success students have mastered the competencies or materials that have been taught by the teacher. Through the assessment can also be used as a reference to see the level of success or effectiveness of teachers in learning. Therefore, the assessment of learning outcomes must be carried out properly starting from the determination of instruments, analysis of assessment results and follow-up programs for research results.

Theme of Pollution

According to Prabowo (2002), integrated learning (thematic) is a learning process involving or associated with various fields of study. Integrated is also a learning learning approach that involves several studies. Integrated learning, is a teaching and learning approach that pays attention to and adapts to the level of development of students. Prastowo (2013: 223) integrated thematic learning is a learning approach that integrates various competencies from various

subjects into various themes. Mulyasa (2013:170) integrated thematic learning is learning that is applied at the basic education level that presents a learning process based on themes to be combined with other subjects. certain themes, this learning can make the process of learning more effective and efficient. Environmental pollution is defined as changes in abiotic factors due to activities that exceed the tolerance threshold of biotic ecosystems. For example, the use of motorized vehicles or raw material processing equipment which sometimes does not comply with environmental standards. There are two types of materials in pollution Environmental pollution is caused by various factors, namely pollution caused by humans and nature. However, the biggest factor is people. Consciously or not, we have contributed to the process of environmental pollution. Starting from the uncontrolled increase in population, the many sources of polluting substances so that nature is unable to neutralize it.

Materials and Methods

Types of materials in environmental pollution caused by nature, for example, disasters. The northern arm of Sulawesi is one area that has a very high level of seismicity when compared to other areas on the island of Sulawesi. Taunauma. A, *et al*. (2015). Disaster can be understood as an event or series of events caused by nature, humans and/or both that result in victims of human suffering, loss of property, damage to the environment, damage to infrastructure and public facilities as well as causing disruption to life and livelihoods. Integrated science learning can summarize several competency standards from the science field as a whole in the form of a single unit. This can avoid the delivery of material repeatedly with several materials that can actually be studied at one time. So this can increase efficiency and effectiveness in learning.

The number of disaster-prone areas and the lack of public awareness of environmental quality in Indonesia is a strong foundation for the Indonesian people to jointly carry out these efforts in an integrated and directed manner. As educators, the research team will contribute to increasing public understanding of disasters and maintaining environmental quality through integrated learning in several subjects in primary and secondary education. Therefore, researchers are interested in developing learning tools based on independent learning with the concept of the theme as shown in Figure 1. below:

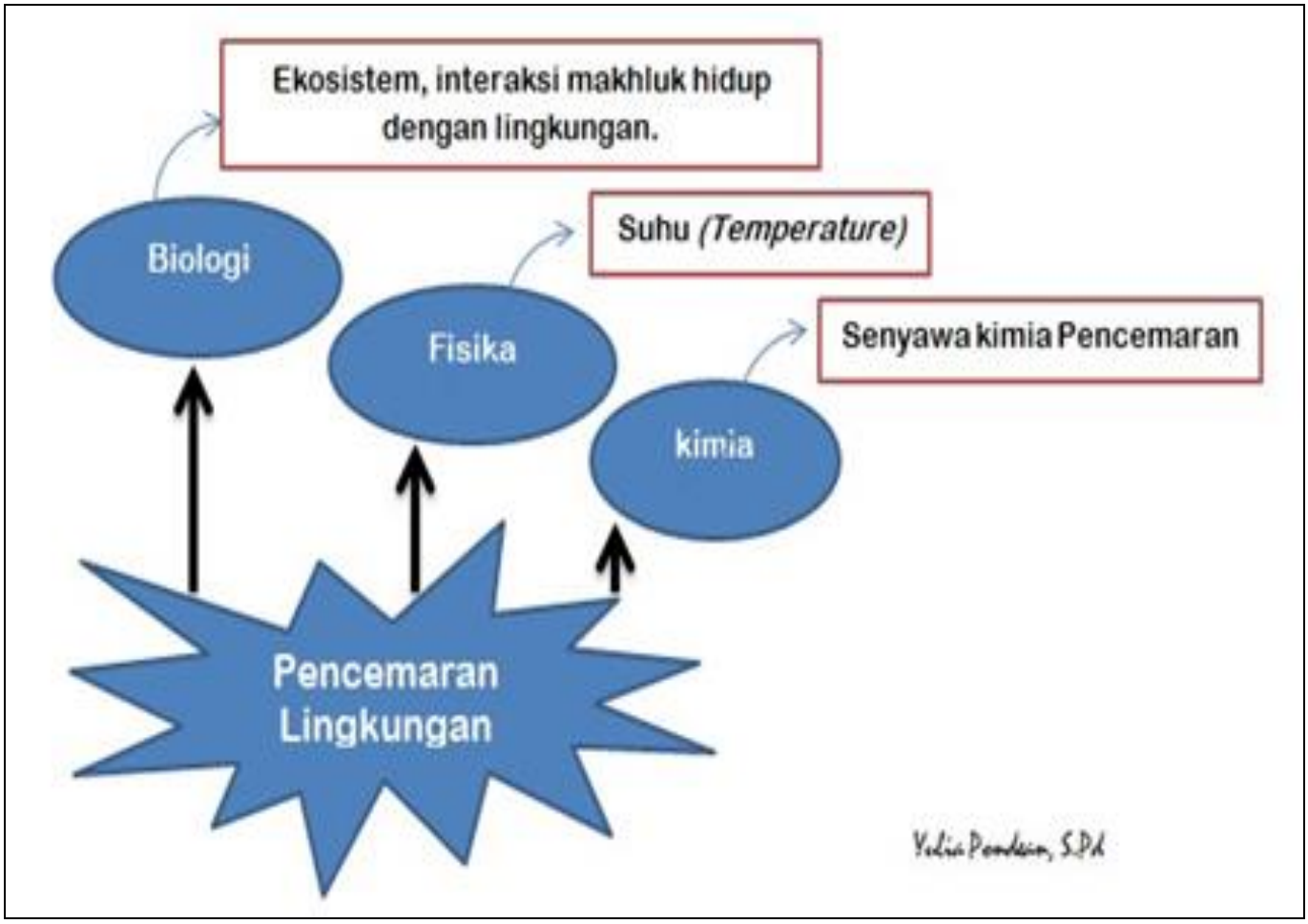


Fig 1: The Concept of Connectedness

This research is development research. which were developed in this study were: Learning Devices consisting of: Annual Programs, Semester Programs, Syllabus, Lesson Plans (RPP), Student Worksheet (LKPD), and Learning Outcomes Tests (THB) on the Pollution Theme for grade VII students of Public Junior High School 3 Tondano This study uses research and development methods or "research and development" (R & D) following the stages of development research according to Brog and Gall which was revised by Palilingan (2014) [4] with the following steps:

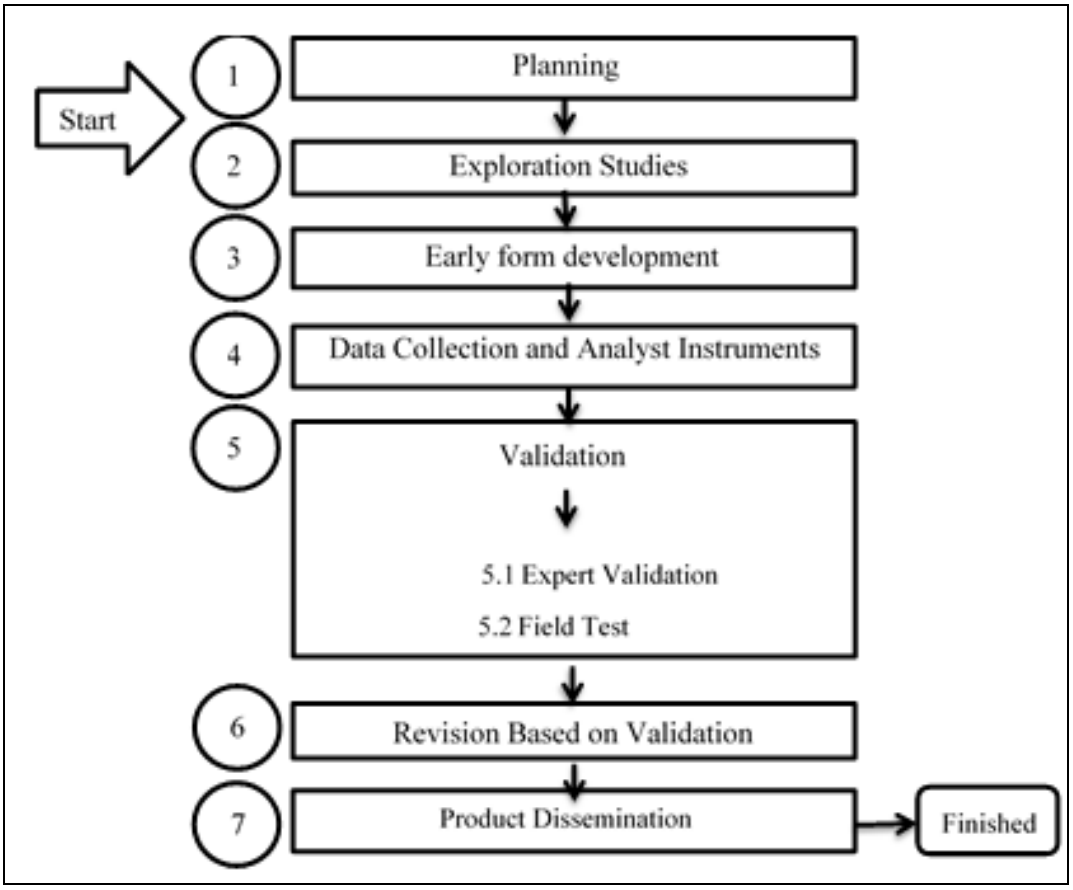


Fig 2: Stages of R & D Research

Learning Device Development Procedure

Planning: The main activities in the planning step include, a) Formulation of objectives to be achieved, b) Determination of success criteria and types of instruments to be used, c) Designing initial product development activities and field tests carried out

Exploration Studies

The stages of an exploratory study include two parts, namely identification and observation.

Early form development

The activity in this step is in the form of designing a learning device product that will produce the desired initial form. This activity requires support for improvements made based on the results of reviews by experts. At this stage the researcher makes the initial learning device product, after the learning device product has been designed and made, the researcher brings it to a reviewer or experts accompanied by the provision of an assessment instrument in the form of a questionnaire to be checked, filled out and analyzed for the feasibility of the learning device product. The instruments used in this research are: 1) Questionnaire Sheet. Questionnaires or questionnaires are a number of written questions that are used to obtain information from respondents in terms of reports about their personalities or things that are known (Arikunto, 2006). The Questionnaire Sheets needed in this study are: a) Questionnaire responses from Learning Material Experts b) Questionnaire responses from Media Experts c) Questionnaire responses from teachers and students to online learning activities. The results of this assessment are used as the basis for improving each teaching material and learning material as well as student responses. 2) Test, Test is a technique or method used in carrying out measurement activities, in which there are various questions, statements or a series of tasks that must be carried out by students (Zainal, 2011). The test used is the Pre-test given before learning and Post-test after the learning process. The purpose of the Pre-Test and Post-Test is to find out the average student learning outcomes before and after the learning process. The subject of the assessment is the students of Public Junior High School 3 Tondano with a total sample of 50. The data analysis technique applied in this research and development is by collecting data through instruments that have been discussed in research instruments, then carried out in accordance with development research procedures. 1) Analysis of the Validity of Learning Devices to test the feasibility of the Learning Devices developed, validation sheets of learning device experts and material experts in learning tools are used. After getting an assessment from the validator, then the value obtained is analyzed. The data on the assessment of science learning tools on the theme of environmental pollution was analyzed. 2) Test device analysis. The device developed was analyzed through the measurement data of student learning outcomes. The achievement of learning outcomes is directed at individual achievement. Students are said to be successful (completed) if they get a value greater than or equal to the KKM value (≥KKM value). Student learning outcomes will be assessed before using the learning tools in the form of giving a 20 number test (Pre-test) and giving 20 number questions (Post-test) after using the developed learning tools. Determination of student learning outcomes based on the score obtained is calculated using the formula:

$$N = \frac{w}{n} x\ 100\%$$

Validation

a. Expert Validation Expert Validation is carried out by experts or experts in the product field which is useful for reviewing the initial product. In this stage the researcher validates through discussions about product improvement by experts. Various inputs from experts in the framework of the product will be better which can be used in research. The subject of the assessment is an experienced person in the field of material and media development.

b. Field Test. The field test is a test of the use of the product on the subject of the research target in class VII SMP Negeri 3 Tondano with the theme of Pollution of Environmental Pollution.

Product Revision based on Validation Results

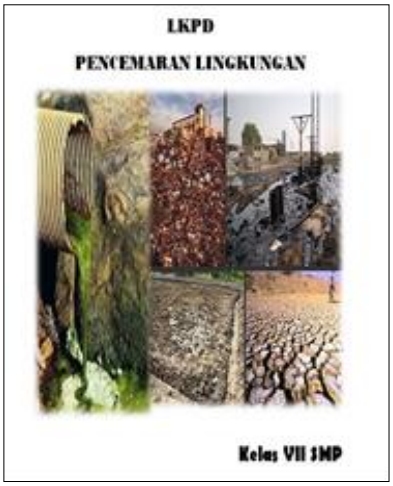
This stage is the final revision stage of the resulting product. The product produced at this stage is a product that is ready to be disseminated. The revision was made based on the input from the operational field test results in the previous step.

Product Dissemination

This step is a step to report products that have been produced at scientific meetings and or scientific journals.

Results and Discussion

The Main Display of the results of the initial form of product development for the Annual Program, Semester Program, Syllabus, RPP in the form of a draft adopted from the internet following the learning tool in the form of independent learning and for more details, it can be seen in Figure 4.1 below:



PROGRAM TAHUNAN

Satuan Pendidikan	:	SMP Negeri 2 Muara Uya
Mata pelajaran	:	BAHASA INDONESIA (K.13)
Kelas	:	IX
Tahun Pelajaran	:	2017/2018

SEMESTER	MATERI POKOK/ STANDAR KOMPETENSI	ALOKASI WAKTU	KETERANGAN
1	1 Pengembangan Literasi KD 3.13, 4.13, 3.14, 4.14	21	
	2 Laporan Percobaan KD 3.9, 4.9, 3.10, 4.10	21	
	3 Pidato Persuasif KD 3.3, 4.3, 3.4, 4.4	21	
	4 Teks Cerpen KD 3.5, 4.5, 3.6, 4.6	21	
	5 Teks Tanggapan KD 3.7, 4.7, 3.8, 4.8	21	
	6 ULANGAN HARIAN	8	
	JUMLAH	113	
2	1 Pengembangan Literasi KD 3.13, 4.13, 3.14, 4.14	21	
	2 Teks Diskusi KD 3.1, 4.1, 3.2, 4.2	21	
	3 Cerita Inspiratif KD 3.11, 4.11, 3.12, 4.12	21	
	9 ULANGAN HARIAN	8	
	JUMLAH	71	

Fig 3: Product Development Display

Media Expert Validation

Media Expert Test that assesses this product is a lecturer in the Department of Science Education who is an expert in the field of learning media. She is also a lecturer at the Unima Science Postgraduate Program. The data collected from the input, suggestions comments and The results of the validation and assessment of media experts regarding the Independent Learning-based Learning Tool for each aspect are presented in table 1.

Table 1: Media Expert Validation

No	Criteria	Validator
	General Aspect	
1	Media-based Learning Devices Independent learning in science learning is a creative and innovative media development	4
2	This media is easy to understand and uses good and effective language.	3
3	Have advantages in the field of other learning media or in conventional ways.	3
4	These teaching materials can make students happy in learning	3
	Aspects of Learning Presentation	
5	Presentation Systematics	3
6	Serving Confusion	4
7	This teaching material contains a summary of the material	3
8	This teaching material contains questions	4
9	This teaching material contains a bibliography	4
10	This teaching material activates students	3
11	This teaching material contains Science Concept Discovery for students	4
12	These teaching materials can foster critical, creative, innovative thinking, and include thematic learning	4
	Language Eligibility Aspect	
13	The use of language in this teaching material is in accordance with the level of students' intellectual development	3
14	The use of language in this teaching material is in accordance with the level of students' social emotional development	3
15	Message Readability	4
16	The accuracy of the language rules	3
17	Stipulation of Language Rules Coherence and coherence between paragraphs	3
	Aspect of Feasibility of Graphics	
18	The appearance of the layout elements on the cover has a rhythm and unity and is consistent.	3
19	Color Elements of harmonious layout and clarify function	3
20	The letters used are attractive and easy to read	4
21	Don't use too many typeface combinations	4
22	Illustration Cover Learning Devices describe the content / teaching materials and reveal the character of the object	4
23	Complete layout elements (title, illustration, and image description)	3
24	The use of letter variations (Bold, Italic, All Capital, Small Capital) is not excessive.	4

Based on the data obtained, the percentage is calculated by comparing the number of scores achieved with the maximum number of values then multiplied by 100%. The calculation is as follows:

$$\frac{Jumlah\ Skor\ Yang\ dicapai}{Jumlah\ Skor\ Maksimum} x100 = \frac{83}{96} x100 = 86{,}45.$$

The calculation above, obtained a percentage of 86.45. This percentage is included in the very valid category and is suitable for use in the field. (Arikunto, 2010) In the field test conducted at Public Junior High School 3 Tondano taken from 50 students. Field trials were carried out with Pre-test and Post-test after receiving lessons using Products with the theme of environmental pollution to obtain science learning outcomes, then the teacher and student response questionnaire instruments were given. The results of descriptive analysis of pretest and posttest data as well as teacher and student response questionnaires can be seen in The tables below.

Table 2: Summary of Pretest and Posttest Results Data

No	Statistics	Statistical Value	
		Pre-test	***Post-test***
1	Minimum Score	20	60
2	Maximum Score	80	95
3	Sum (Σ)	2575	3725
4	Mean ($\bar{x}$)	51,5	74,5
5	Completeness Percentage	16%	88%

Based on that table, the average pre-test result is 51.5, the lowest score is 20 and the highest score is 80 with a completeness percentage of 16%, while the post-test score achieved by students shows an increase in the average score of 74.5 and the lowest score is 60. and the highest score of 95 with a completeness percentage of 88%. Based on the assessment that has been carried out on the product of the Independent Learning-Based learning device, the following data were obtained.

Table 3: Assessment of the quality of learning device products based on independent learning

s	Validator	Score	Percentage	Category
1	Material Expert 1 (lecturer)	189	82.17	Very High
2	Material Expert 2 (teacher)	195	84.78	Very High

Based on the assessment of the quality of the learning device based on independent learning conducted by material expert 1 (lecturer) it was obtained a score of 189 with a percentage value of 82.17%, where this value was included in the very high category in the assessment of material in the product of learning tools based on independent learning. While the assessment carried out by material expert 2 (teacher) obtained a score of 195 with a percentage value of 84.78%, where this value was included in the very high category in the assessment of material in independent learning-based learning tools. In general, both assessments are included in the very good category.

Based on student response questionnaires distributed to students on the assessment of learning tools based on independent learning in limited trials and large class tests, the following scores were obtained.

Table 4: Assessment of student responses to learning device based on Merdeka Belajar.

No	Reviewer	Percentage %	Category
1	Small Class	67,27%	High
2	Big Class	73 %	High

Based on the teacher's response questionnaire given to the teacher, in order to provide an assessment of the product of learning tools based on independent learning, an average rating of 95% (good category) was obtained. Judging from the student's achievement after using the product, it is said to increase seen from the percentage of completeness in the pre-test which is 16% after the posttest using learning tools, with the percentage of completeness that is 88% and is supported by the teacher's response questionnaire which is at a percentage of 95% and students with category strongly agree by 73%.

Conclusions

The conclusion of this research has been carried out systematically and based on the results of the analysis and discussion, it can be concluded that the results of this study are as follows:

1. Learning tools based on independent learning that were developed in this study are feasible to be developed and suitable for use in science learning activities at SMP Negeri 3 Tondano.
2. Analysis of the research results obtained the fact that the use of learning tools based on independent learning can improve student learning outcomes with an average score of 51.5 pre-test and 16% completeness percentage while post-test to 74.5 with 88% completeness percentage.

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