



Development of Learning Instrument Experiential Model Exploring the Surrounding Nature to Improve Science Generic Skills of Junior High School Students

Siti Evita Rhama Dania^{1*}, Muhamad Taufiq²

¹Science Education Study Program, Faculty of Mathematics and Natural Sciences,
Universitas Negeri Semarang, Semarang, Indonesia 50229

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*Corresponding author:

Siti Evita Rhama Dania

Universitas Negeri Semarang

E-mail: дания.эвита71@gmail.com

Abstract

This study aims to analyze the feasibility and readability of the Experiential Model Exploring the Surrounding Nature (E-JAS) learning instrument. This type of research is development research which refers to the ADDIE development model. However, this research is limited to only using 4 stages of development, namely: Analysis, Design, Development, and Evaluation. This was due to the conditions and circumstances of the Covid-19 pandemic. Data collection techniques using the method of observation, documentation, and questionnaires. The data collection instruments used validation sheets, student and teacher readability questionnaires. The results of the research that have been done are: Validation of the syllabus obtained a score of 0.85. The validation of the learning implementation plan obtained a score of 0.78. Validation of student worksheets obtained a score of 0.85. The validation of the evaluation questions obtained a score of 0.86. The readability of students towards learning instruments is 80% in the good category and the readability of the teacher for learning devices is 83.4% in the very good category. It is concluded that the E-JAS learning instrument developed is declared very feasible with an average validation percentage of 0.83 and an average readability of 81.7% so it is very feasible to be used to support learning activities.

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INTRODUCTION

Science learning is one of the implementation models of the 2013 curriculum. The 2013 curriculum aims to prepare Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative, innovative and affective and able to contribute to society, the nation and the State and world civilization (Kemendikbud, 2018).

Efforts that can be made to increase the efficiency and effectiveness of the achievement of graduation competencies require learning planning, implementation of learning and assessment of the learning process in accordance with process standards through a learning device. With this demand for professional competence, every teacher in an education unit is obliged to compile a complete and systematic learning device so that learning takes place interactively, inspires, fun, challenges and motivates students to participate, and provides sufficient space for creativity initiatives in accordance with talents, interests, and physical and psychological development of students (Tanjung & Nababan, 2018).

According to Alimah & Susilo (2016), science learning so far is still centered on cognitive achievement and does not provide direct experience or interaction of students with natural science learning objects directly which are actually very close to students. Natural Science learning objects directly, namely in the form of phenomena that occur and the natural environment around them. Along with the complexity of existing science problems, learning activities in schools also need to prioritize skills development, especially students' generic science skills.

Science Generic Skills are skills that can be used to learn various concepts and solve various scientific problems, to understand abstract concepts in general, high reasoning skills are needed, and to achieve high reasoning abilities students must be familiarized with learning methods. which demands the use of reasoning. Students must be trained to use their reasoning in understanding concepts so that students not only use empirical experience but also get used to understanding concepts through their reasoning (Agustina et al., 2016).

Based on the results of preliminary observations at SMP Negeri 32 Semarang, it shows that the learning activities and learning instruments owned by the teacher are complete and in accordance with the 2013 curriculum, but the learning instruments owned by the teacher are learning instruments made jointly with the IPA MGMP group. learning instruments developed by the teacher. This causes the

learning instruments made by the teacher to be less relevant to the needs of students. The learning model used by the teacher is relatively the same in every meeting, causing students to become bored while participating in learning activities. Classroom management is carried out conventionally so that it does not allow interaction between students, the learning resource used by the teacher is in the form of student books which only contain a summary of material that is theoretical in which the book only contains a summary of learning material and the questions do not contain activities that are can be done by students to gain an experience of getting other learning resources.

Learning activities in the classroom also have not been seen to facilitate students to improve generic science skills. Lack of learning facilities that accommodate practicum activities or conducting an experiment results in low Science Generic Skills of students.

The outbreak of the Covid-19 Virus in all countries in the world, including Indonesia, has resulted in learning that was initially carried out directly and face-to-face in the classroom, now being transferred to distance learning or online learning (Darmawan, 2020). This was done to prevent the spread of the Covid-19 virus. The Minister of Education and Culture of the Republic of Indonesia through Permendikbud No. 4 of 2020 provides a policy on a series of lessons learned in an emergency situation of the spread of Covid-19. (Mauly, 2020).

The need for an innovation in the development of learning instruments which is expected to be able to improve students' SHN during online learning so that students are able to be more involved in learning. One of the learning models that can optimize the KGS of students is the E-JAS learning model. The novelty of the learning instruments that will be developed, namely the learning activities in the E-JAS model developed are carried out online but are still integrated with the environment around students as a learning resource. This is in accordance with research from Oktavian & Aldya (2020) which states that the use of online learning will be very effective if it fulfills the essential components in learning, namely discursive, adaptive, interactive and reflective with elements that will be very well integrated with the learning environment so that it can become online learning that is integrated with the environment or fulfills the components of the digital learning ecosystem because it can accommodate learning styles, flexibility and learning experiences of students so that it can generate positive feelings.

Based on the problems that have been described, the solution to these problems is to develop an Experiential Model Exploring the

Surrounding Nature (E-JAS) to Improve the Science Generic Skillsof Junior High School Students..

METHOD

Research Design & Participants

This study uses the ADDIE development model. But in this study it is limited to only using 4 stages of development, namely: Analysis, Design, Development, and Evaluation. This is due to the conditions and circumstances of the Covid-19 pandemic where learning is carried out online and learning time is less than before the pandemic.

This study involved experts (teachers and lecturers) as well as one class class IX student at SMP N 32 Semarang.

Research Instruments

The research instrument is in the form of a validation sheet to measure the appropriateness of the learning device, a readability questionnaire sheet to determine the readability of the learning device.

Feasibility Analysis of Learning Devices

The appropriateness of the learning instruments was measured based on the validation results of five validators. The results of the validation were then analyzed using a formula in equation 1

$$V = \frac{\sum s}{n(c-1)} \tag{1}$$

Information:

S : r - lo

Lo :the lowest number of validity assessments (in this study the lowest number is 1)

C :the highest number of validity assessments (in this study the highest number is 4)

R : number given by the validator

N : number of validators

The results of the scores obtained were then converted into the validity criteria listed in Table 1.

Tabel 1 Expert Validation Assessment Criteria

No	Score	Criteria
1	0,81 - 1,00	Very worthy
2	0,61 - 0,80	Worth it
3	0,41 - 0,60	Enough
4	0,21 - 0,40	Less worthy
5	0,00 - 0,20	No worthy

(Rahmat & Irfan, 2019)

Analysis of the Readability of Learning Devices

The results of the student readability questionnaire were classically measured using the equation 1:

$$P = \frac{f}{N} \times 100\% \tag{1}$$

Information:

P : percentage of score obtained

f : total score obtained

N : maximum number of scores

The results of the percentage of students' readability questionnaires were then converted into the assessment criteria based on Table 2.

Table 2 Criteria for Students' Readability Questionnaire Assessment

Percentage	Criteria
81,25% < skor ≤ 100%	Very Appropriate
62,50% < skor ≤ 81,25%	Appropriate
43,75% < skor ≤ 62,50%	Rather Appropriate
25,00% < skor ≤ 43,75%	Not Appropriate

RESULT AND DISCUSSION

Analysis

Based on the results of preliminary observations at SMP Negeri 32 Semarang, it shows that the learning activities and learning instruments owned by the teacher are complete and in accordance with the 2013 curriculum, but the learning instruments owned by the teacher are learning instruments made jointly with the IPA MGMP group. learning instruments developed by the teacher. This causes the learning instruments made by the teacher to be less relevant to the needs of students. The learning model used by the teacher is relatively the same in every meeting, causing students to become bored while participating in learning activities. Classroom management is carried out conventionally so that it does not allow interaction between students, the learning resource used by the teacher is in the form of student books which only contain a summary of material that is theoretical in which the book only contains a summary of learning material and the questions do not contain activities that are can be done by students to gain an experience of getting other learning resources.

Learning activities in the classroom also have not been seen to facilitate students to improve

generic science skills. Lack of learning facilities that accommodate practicum activities or conducting an experiment results in low Science Generic Skills of students.

Next analysis is competency analysis. Environmental pollution material is used as material in this study because this material is closely related to the environment of students. Environmental pollution material is very appropriate when taught using the E-JAS model, because the E-JAS model provides direct experience in the learning process of students through an investigative process by means of exploration by interacting directly with learning objects in the environment around students as the main learning resource. Those with a learning process both indoors and outdoors to gain knowledge, skills, and attitudes as a result of their learning through their 5 phases, namely exploration, interaction, communication, reflection and evaluation (Alimah & Marianti, 2016: 40).

Design

After conducting the analysis, then the preparation of learning device designs that will be developed includes (Syllabus, Learning Implementation Plan, Student Worksheets and evaluation tools) based on the E-JAS model, expert validation sheets and teacher readability questionnaires and learners. The design stage includes several planning for the development of learning instruments, namely: (1) basic competency selection (2) initial planning for learning instruments based on competency in subjects (3) designing learning scenarios or learning activities, (4) designing learning instruments and learning evaluation tools with the E-JAS approach.

Development

Stage of development in the form of validation testing activities learning device E-JAS. Validation is done by expert validators. The input provided by the experts is used as a reference for revising the product. Revisions are made based on the suggestions given by the validator. The revision process is carried out repeatedly in order to obtain learning device products that are declared feasible and valid by the validators so that the learning devices are ready for use.

Learning Instrument Validation Results

Syllabus

The syllabus developed is an E-JAS based syllabus on environmental pollution material. In this syllabus there is an E-JAS model syntax which is then adjusted to learning activities on environmental pollution material. In this environmental pollution material students are more emphasized to explore their surroundings. This aims to find their own learning resources so that students are not fixated on the material in their books. This is in accordance with the research of Alimah (2016) which states that exploration of the biology learning design with the E-JAS model requires students to be able to design and develop their ideas or experiences through the process of investigating the environment for the problems they face and to find solutions to problems, it is necessary to apply metacognition processes.

Table 3 Results of Syllabus Validation

No	Rated aspect	Result	Explanation
1.	Contents suitability	0.86	Very worthy
2.	Depth of material	0.73	Worthy
3.	Learning activities according E-JAS	1	Very worthy
4.	Learning activities facilitate KGS	0.93	Very worthy
5.	Online learning activities	1	Very worthy
6.	Assessment Techniques	0.66	Worthy
7.	Learning Resources	0.86	Very worthy
8.	Language	0.8	Worthy
Average Category		0.85	Very worthy

Based on table 2, the average validation results by experts on the syllabus is 0.85 and falls into the very feasible category. The aspect that received the highest assessment was learning activities that had been compiled online and were in accordance with the syntax of the E-JAS model. Meanwhile, the aspect that received the lowest score was the assessment technique. Improvements made are by adjusting the assessment techniques used with the learning indicators that will be achieved at each meeting. In accordance with research from Zubaidi (2015) which states that an assessment to measure the

competence of students is arranged based on the indicators to be achieved in the material being taught. After repairs are made, the syllabus is declared valid and feasible by the validator.

Leasson Plan

The leasson plan format was developed in accordance with the Ministry of Education and Culture circular letter number 14 of 2019 concerning the simplification of the learning implementation plan which is carried out on the principle of being efficient, effective and student-oriented and only consists of learning objectives, activity steps) learning and learning assessment (assessment).

The lesson plan developed in this study is the lesson plan with the E-JAS model which is then adjusted to learning activities on environmental pollution material. The lesson plans developed therein contain several aspects, namely: the identity of the lesson plans, KD, learning objectives, indicators of completeness achievement, assessment, learning activities, the learning media used and the learning resources of students.

Learning activities designed in the lesson plan are expected to be able to improve students' generic science skills. because in this lesson plan emphasizes on finding learning resources by students through their surroundings and allows them to make observations either directly or indirectly using their five senses. This is in accordance with research by Ratnasari&Risti (2018) which states that at the exploration stage, students are given the opportunity to make the most of their five senses in interacting with the environment through activities such as practicum, analyzing articles, discussing natural phenomena, observing natural phenomena or social behavior, and others.

Alimah's previous research (2014) also stated that learning activities in the form of designing activities to explore learning resources in the surrounding environment in accordance with the exploration phase in the EJAS model were able to train students to: (1) identify variables in the surrounding environment, (2) explain the relationship of variables -variables selected, (3) formulate hypotheses based on problems encountered during observations, (4) design exploration activities based on the results of problems that exist in their learning environment, (5) carry out exploration, (6) process information on exploration results in the field , (7) mastering knowledge / concepts based

on exploration results, (8) being scientific, (9) thinking strategically, (10) communicating scientifically, (11) using technology, and (12) being critical and rational. The results of the assessment of the feasibility of the leasson plan based on the validation of several experts are presented in Table 4.

Tabel 4. Results of Lesson Plan Validation

No	Rated aspect	Result	Explanation
1.	Completeness of components	0.66	Worthy
2.	leasson plan identity	0.73	Worthy
3.	Learning objectives	0.60	Decent enough
4.	Learning activities according E-JAS	0.93	Very worthy
5.	Learning activities facilitate KGS	0.86	Very worthy
6.	Learning sequences	0.80	Worthy
7.	Clarity of learning scenarios	0.80	Worthy
8.	Online learning activities	1	Very worthy
9.	Assessment Techniques	0.60	Decent enough
10.	Completeness of evaluation instruments	0.80	Worthy
11.	Time Allocation	0.73	Worthy
12.	Language	0.86	Very worthy
Average		0.78	
Category			Worthy

Based on table 4 the average score for the assessment of the feasibility of the lesson plans developed is 0.78 and is in the feasible category. The aspects that get the highest assessment are learning activities carried out online and in accordance with the E-JAS syntax. While the aspects that received the lowest assessment were assessment techniques and learning objectives. At first the learning objectives did not have a degree aspect so improvements were made by adding the degree aspect to the learning objectives. By using the ABCD format on

learning objectives, we can see how the ongoing learning process is in accordance with the learning objectives contained in the lesson plan or not (Chairani, 2019). After repairs are made, the syllabus is declared valid and feasible by the validator.

Student Worksheets

Student Worksheets developed in this study are E-JAS-based Student Worksheets. The Student Worksheet designed in this study has scientific steps in accordance with the syntax of the E-JAS model which consists of exploration, interaction, communication and reflection activities. The developed Student Worksheet is expected to be able to develop students' generic science skills.

Student Worksheet is designed to be carried out independently for students considering that currently it is still in the Covid-19 pandemic condition which does not allow students to carry out activities in groups. The activities in the Student Worksheet are more emphasized to do simple experiments that students can do independently at home, this is done so that students are able to hone their generic skills.

Based on table 5, it shows that the average score of the feasibility assessment of the developed student worksheets is 0.85 and is in the very feasible category.

The developed student worksheets are made online but are still integrated with the students' environment as a learning resource. This is in accordance with research from Oktavian&Aldya (2020) which states that the use of online learning will be very effective if it fulfills the essential components in learning, namely discursive, adaptive, interactive and reflective with elements that will be very well integrated with the learning environment so that it can become online learning that is integrated with the environment or fulfills the components of the digital learning ecosystem because it can accommodate learning styles, flexibility and learning experiences of students so that it can generate positive feelings.

The increase in students' Science Generic Skills occurs because students are actively and directly involved in learning activities, such as looking for information about a given problem, conducting experimental activities to prove their hypothesis, and asking the teacher if there are things they do not understand. This causes learning to no longer be teacher-centered, but student-centered (Sungkawaningtyas, 2018).

Syntax of the E-JAS model, namely the exploration stage, it can facilitate students to carry out activities that can improve their KGS. Because the exploration phase gives students the opportunity to develop their ideas and experiences through investigative activities on the environment. Investigating the environment begins with observation activities so that students are able to find problems that originate from the environment. The problems that are formulated are solved / sought for solutions with the help of the five senses through interaction with the learning environment in accordance with the object of the study of the material being studied by students (Alimah, 2016).

This is in accordance with research by Ratnasari&Maulidah (2018) which states that at the exploration stage, students are given the opportunity to make the most of their five senses in interacting with the environment through activities such as practicum, analyzing articles, discussing natural phenomena, observing natural phenomena or social behavior, and others.

Table 5 Results of Student Worksheet Validation

N	Rated aspect	Result	Explanation
1.	Completeness of components	0.66	Worthy
2.	IdentityWorksheets	0.86	Very worthy
3.	Clarity of instructions	0.86	Very worthy
4.	Problems presented by training KGS	0.80	Worthy
5.	Learning activities according E-JAS	0.93	Very worthy
6.	Pictures and illustrations	0.73	Worthy
7.	EBI compliant language	1	Very worthy
8.	Communicative language	0.93	Very worthy
9.	Language according to cognition	0.93	Very worthy
Average Category		0.85	Very worthy

Evaluation Tools

The evaluation tool used in this study was 45 multiple choice questions. The question will then be validated by 5 validators consisting of 2 lecturers and 3 teachers. Problems that are valid with the calculation of aiken v, then the questions are tested on students and analyzed for their reliability, difficulty level and differentiation.

The validation of the evaluation tool in the form of multiple choice test questions by the expert obtained a score of 0.86 with the very feasible category.

Based on the results of the analysis, the 30 best questions were taken to be used for the pretest and posttest.

In these 30 questions, there are generic skill indicators, namely: 3 questions for concept building indicators, 4 questions for indirect observation indicators, 7 questions for logical inference indicators, 4 questions for causal legal indicators, 5 questions for logical framework indicators, 3 questions for the scale awareness indicator and 2 questions for the symbolic language indicator.

Readability Of Learning instruments

In general, the readability aspect relates to things related to ease of reading, namely the ease of language (vocabulary, sentences, paragraphs, and discourse), written form or topography, wide spacing, graphic aspects, the attractiveness of presenting learning instruments according to interests. readers, the density of ideas and information in the reading, the beauty of the writing style, conformity with standard grammar, and the ease of understanding the systematic presentation of the material (Dewi&Arini, 2018).

The readability test of learning devices is carried out by providing a questionnaire for the readability of learning instruments for teachers and students. this readability test was conducted online.

Readability of Learners Against Learning Devices

The readability test of students against the learning instruments developed aims to determine the level of ease and difficulty of students understanding the content of the learning instruments developed, especially on student worksheets, because these student worksheets will be used directly by students during learning activities. The readability test of students was carried out by 15 students.

Table 6 Table of Students' Readability Results

No	Rated aspect	Result	Explanation
1.	The novelty of learning instruments	88	VeryAppropriate
2.	Image display and color worksheets	82	VeryAppropriate
3.	Layout of student worksheets	77	Appropriate
4.	Easily differentiate between sections of the worksheets	84	VeryAppropriate
5.	Straightforward language	73	Appropriate
6.	Clear font & size	83	VeryAppropriate
7.	Commands on worksheets are easy	72	Appropriate
8.	The questions on lkpd are easy to understand	75	Appropriate
9.	There are no writing errors	93	VeryAppropriate
Average Category		80%	VeryAppropriate

Based on the results of the student worksheet readability analysis, the students' readability assessment score was 80% and it was in the good category. In addition, students were also asked to write words that were not understood by students. In line with the research of Yuliana et al (2012) which states that a one-on-one evaluation of the module's readability level aims to analyze the module's readability level by identifying errors in the module, identifying words that are difficult to understand and identifying student reactions to the module at the time.

Based on the results of the students' readability questionnaire, there were several words that were still not understood by students, namely, hypothesis, operculum, and frequency. Therefore, improvements were made by adding a preface that explained the word hypothesis, operculum and frequency so that students could more easily understand the student's worksheet. This is in accordance with the research of Amelia &Fitrihidajati (2018) which states that readability is related to the reader's understanding, this is because every reading that has good readability will have its own charm that allows the reader to immerse himself in reading. The level of readability for

readers depends on the level of difficulty or ease of reading a text at a certain level.

In addition to being asked to assess student worksheets, students are also asked to provide suggestions and input for the student worksheets. The suggestions given by students are: (1) I don't understand some of the words and language used in this LKPD, so the sentences can be clarified again. (2) The language in the student worksheets is not clear, please clarify again so that everyone understands (3) I think the language used is clear and easy to understand. (4) At the beginning of sentences that use numbers are not evenly distributed.

The improvements made by the researcher were by choosing words that were in accordance with the level of understanding of the students, as well as making sentences more concise and not too long so that students could more easily understand the sentences and commands on the student worksheets. This is in line with Fatin's research (2017) which states that longer sentences tend to be more difficult when compared to short sentences. Long sentences tend to have more ideas because they generally don't consist of single sentences, but complex sentences. This complex sentence will certainly affect the memory span of legibility.

Teacher Readability of Learning Devices

The teacher's readability test of the learning instruments developed serves to determine the level of the teacher's readability of the learning instruments developed. The results of the teacher's readability test of the learning devices developed are presented in table 7.

Based on table 7, the teacher's average readability score for learning devices shows the percentage of readability assessment 83.4% is in the very good category and is suitable for use in teaching and learning activities with a slight revision. These results also indicate that the learning instruments developed have legibility when used by the teacher in the learning process.

Table 7 Table of Teacher Readability Questionnaire Results

No	Rated aspect	Result			
		Syllabus	Lesson Plan	Work sheet	Quiz
1.	The novelty of learning instruments	77	77	88	88
2.	Writing form	88	88	88	88
3.	Font size	88	88	88	88
4.	Attractive image illustration	77	88	77	77
5.	Image layout is appropriate	66	77	77	77
6.	Language is easy to understand	88	88	88	88
Average		83.41%			
Category		VeryAppropriate			

CONCLUSION

The E-JAS learning device model to improve the Science Generic Skillsof junior high school students developed was declared very feasible based on the average validation score of 0.83 so that it could be used in science learning in SMP class VII Semester 2 on environmental pollution material.

Students readability of the learning instruments developed was 80% in good category and the teacher's readability of learning instruments was 83.4% in the very good category. The readability of the developed E-JAS learning device for junior high school students was stated to be good with an average readability percentage of 81.7% so that it could be used in science learning in junior high schools. class 7 semester 2 about environmental pollution material

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