Development of Guided Inquiry Learning Tools using Socio-Scientific Issue to Train Critical Thinking Ability and Care for The Environment of Students

Fitria Wahyu Wulansari[1], Novi Ratna Dewi[1*]

[1]Department of Integrated Science, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, Semarang, Indonesia 50229

Article Info

*Corresponding author:
Novi Ratna Dewi
Universitas Negeri Semarang
E-mail: noviratnadewi@mail.unnes.ac.id

Abstract

Learning cannot be separated from the existence of learning tools. Learning devices are components that are used as a reference for implementing the learning process. The learning process requires appropriate models and strategies to train students' knowledge and attitudes. This study aims to determine the characteristics and feasibility of guided inquiry learning tools using the socio-scientific issue (SSI) to train critical thinking skills and care for the environment of students. The learning tools developed consist of a syllabus, lesson plans, student worksheets, and evaluation tools for question sheets. The characteristics of the learning tools are (1) containing guided inquiry (2) containing socio-scientific issues (SSI), (3) training critical thinking skills, and (4) training environmental care. The research model used is ADDIE (analyze, design, development, implementation, and evaluations) which is modified by using 4 of the 5 stages of ADDIE. The results of the feasibility analysis of the learning device components from the validation results and the teacher/student readability questionnaire obtained very feasible criteria and the evaluation tool of the question sheet was valid. The results obtained indicate that the development of guided inquiry learning tools using the socio-scientific issue (SSI) is feasible to use in the learning process.

INTRODUCTION

Education is a teaching and learning process in order to think more wisely and wisely so that it is the most important part of the means in realizing the ideals of the nation (Alfian, 2011). Education as something that is systematic, planned, and sustainable seeks to achieve the goal of being able to play a role in nation building and human development (Anggareni et al., 2013).

The purpose of education cannot be separated from the curriculum. The curriculum is a tool to achieve goals as well as a guide in the implementation of education (Hidayati, 2014). The curriculum used today is the 2013 curriculum. The 2013 curriculum shows that knowledge alone is not enough, but also must have the ability to think critically (H et al., 2013). Critical thinking ability is thinking that is curious in looking for existing information to achieve a deep understanding (Yustyan et al., 2015).

Critical thinking skills are important to be taught because there are reasons, namely critical thinking emphasizes creativity and authenticity in choosing a solution strategy or creating a solution to a problem (Samihah & Savitri, 2021). Critical thinking skills are also used to interpret solutions and determine the quality of a decision or argument and involve prior knowledge, reasoning, and cognitive strategies to generalize, prove or evaluate unfamiliar situations in a reflective way (Rahmawati & Patmin, 2021). Dewi & Setyaningsih (2016) stated that critical thinking skills are expected to be the capital of each individual to overcome increasingly complicated problems in life. Critical thinking is also one of the reasons behind the formation of the 2013 curriculum.

The 2013 curriculum is expected to be implemented in 21st century learning. 21st century skills include three categories, namely (1) learning and innovation skills such as critical thinking and problem solving (expert thinking), communication and collaboration (complex communicating) and creativity and imagination (applied imagination and imagination). invention), (2) Information, media and technology skills, (3) Life and career skills. The 2013 curriculum does not only require students to achieve knowledge competence but also to achieve attitude competence (Huril, 2014).

One of the attitudes that must be built is an attitude of caring for the environment. The attitude of caring for the environment is important because it has the aim of encouraging the habit of managing the environment, avoiding the nature of damaging the environment, fostering sensitivity to the environment, instilling a caring spirit and responsibility for the environment and students can be examples of environmental saviors when they are (Purwanti, 2017). Taufiq et al., (2014) stated that to create a young generation who cares about the environment, junior high school students need to be equipped with knowledge about the environment. Attitudes towards the environment must continue to be cultivated because the environment is a part of human life (Puspitasari et al., 2016).

Knowledge that is close and is a part of human life is found in learning natural science. Good natural science learning is related to students' daily lives. Students are given the opportunity to ask questions, generate ideas and build curiosity about something in their environment (Samatowa, 2011). Science learning is a means to study oneself and the natural surroundings and its application in solving problems encountered in everyday life (Khasanah, 2015). H et al., (2013) stated that learning learning sciences should develop thinking skills (thinking skills in science), the ability to learn and build care for the natural environment, but these expectations are not in accordance with the existing reality.

The results of observations made at junior high school 23 Semarang and the results of daily tests showed that students' critical thinking skills were still low. The data obtained were as many as 20 of 32 students experienced remedial (improvement) or only about 37% of students who completed the minimum completeness criteria. Students in the learning process have not been emphasized as the center of learning such as not being given the opportunity to seek their own knowledge and not relating it to the problems of everyday life so that learning is only rote which will have an impact on the lack of critical thinking skills.

Low critical thinking ability is evidenced by the lack of students' ability to master several indicators of critical thinking skills found during the learning process. Indicators that have not been mastered by students so that they affect the results of test scores include not being able to give their own arguments in answering the questions given, lack of understanding in answering questions that require their logical abilities, not yet mastering asking or answering

high-level questions (C4-C6) and students still unable to find solutions or actions for the problems given according to their own ideas. The learning process that does not train a sense of caring for the environment causes students to care for the environment too low.

Low environmental care is shown by not fulfilling several environmental care indicators according to Widayat et al., (2017) Indicators that are not met during observation activities include students still littering with trash found in desk drawers and classrooms, doodling on school facilities. such as tables, chairs and walls, letting plants fall unkempt, disposing of garbage that is not according to its type (organic/non-organic), not carrying out the picket that has been made, not being responsible when finished using the toilet and not cleaning the practicum tools and not washing hands when finished practicum.

This problem is not only because the teacher does not explore students, but also because the learning tools used have not emphasized the ability to think critically and care about the environment for students. Learning tools such as syllabus, lesson plans, student worksheets and evaluation tools in the form of question sheets have not emphasized students as subjects in learning which will affect the results obtained. Learning devices that have not emphasized the aspects of critical thinking skills and care for the environment cause the value of students' critical thinking skills and care for the environment is still low.

Efforts that can be made to overcome these problems are by developing learning tools. Learning tools are an important part in determining student progress in understanding a material (Dewi & Akhlis, 2016). Learning tools developed must use appropriate learning models. The selection of learning models affects student success (Pratiwi et al., 2019). The learning model that fits this goal is inquiry. Inquiry that is suitable to be applied to junior high school students is guided inquiry because junior high school students still need teacher guidance in the learning process (Astuti & Setiawan, 2013).

The guided inquiry learning model is student-centered learning. This learning model makes students more active in the learning process that has been conditioned by the teacher, so that they can explore all concepts themselves to take the initiative in problem solving and train students' critical thinking (Puspita & Jatmiko, 2013). The development of

guided inquiry learning tools is very important before applying them in learning (Pariatna et al., 2015).

Learning science in addition to choosing the right model should also deal with real problems that exist in the student's environment so that it will shape students' knowledge, values or attitudes. A potential learning strategy is learning using Socio-Scientific Issues (SSI) (H et al., 2013). SSI is learning that presents science material in the context of social issues by involving moral and ethical components that are closely related to science (Rohmawati et al., 2018).

Science learning that includes SSI will create opportunities for students to emphasize critical reasoning, enable students to critically evaluate, discuss and debate competing scientific claims, and promote students' character and moral sensitivity (Karisan & Ziedler, 2017). SSI can be found in a global context on environmental issues such as global warming and climate change (Andryani et al., 2016).

Global warming has become an international issue since several decades ago which has a very large impact on the world's climate and sea level rise (Waryono, 2011). Global warming in the 2013 curriculum in junior high school is a science material for class VII. Global warming material is considered important because it is very close to students' lives so it is easier to study. Global warming can also be scientifically proven and discussed when learning science and educating teenagers who are strategic elements of society to increase knowledge and useful behavior in the future (Wildan et al., 2019). These problems and ideas need to be researched with the title "Development of Guided Inquiry Learning Tools Using Socio-Scientific Issues (SSI) to Train Students' Critical Thinking Skills and Care for the Environment".

METHOD

The method used in this research is Research and Development (RnD). RnD research (Research and Development) is a research method used to produce certain products and test the effectiveness of these products (Sugiyono, 2014: 307). The steps in this study use 4 of the 5 stages of the ADDIE model

ADDIE consists of five stages, namely analyze (analyze), design (design), development (develop), implementation (apply), and evaluation (evaluate) but in this research did not use implementation stage. The

implementation stage was omitted due to the Covid-19 pandemic constraint so that the development that had been made was only to know the characteristics and feasibility of learning devices.

The instruments used in this study were: (1) validation sheets, to determine the characteristics and feasibility of the developed learning devices and (2) readability questionnaires, to determine the level of readability of learning devices.

RESULT AND DISCUSSION

Analysis

The analysis stage is by making observations at Junior High School 23 Semarang to find out the problems that exist in the school. The results obtained based on observations show that students are passive in the learning process, teachers in the learning process do not give examples of social issues close to students' lives that should be discussed scientifically or scientifically, the questions given are still simple with category questions considering and understand or C1 and C2 in Bloom's taxonomy and have not used questions with higher-order thinking skills that cause students' critical thinking skills to be low.

The low critical thinking ability of students is evidenced by the results of daily test scores as many as 20 out of 32 students have improved or only about 37% of students have completed the minimum completeness criteria, students still tend to memorize textbooks and material explained by the teacher and are still confused about giving ideas when given a problem. or deep problems that require logic and reason in the learning process.

The learning process that does not train a sense of environmental care causes students to care for the environment is also still low. The low level of concern for the environment of students is indicated by the number of students who damage school facilities such as scribbling on tables, chairs or walls, still throwing trash in the classroom or stored in desk drawers. This attitude is very unfortunate because based on observations, the facilities at Junior High School 23 Semarang are quite complete, such as provided trash bins and cleaning equipment in each classroom, daily pickets and rules for maintaining class cleanliness are also provided.

The next process at this stage is to analyze the material to be used according to the problems obtained, namely the low ability to think critically and care about the environment. The material that is considered relevant to the problem is global warming. Factors that support the global warming material considered relevant in this study are students' concern for the environment is still relatively low and they still do not apply the material to everyday life and global warming is indirectly felt by students.

Design

The results obtained from the analysis stage are then obtained solutions to overcome these problems. The researcher's solution to overcome these problems is to develop learning tools. Learning tools are important to use because they are a teacher's reference before being implemented. The learning tools developed in this study were the syllabus, learning implementation plans, student worksheets and question sheets.

The learning tools developed are expected to train students' critical thinking skills and care for the environment. The learning tools developed in this study were the syllabus, learning implementation plans, student worksheets and question sheets. Learning tools are very important to use because they determine the goals to be achieved (Irmawati et al., 2019). Learning tools are also one of the guidelines for a teacher in implementing learning in the classroom so that in developing learning tools they must be in accordance with the model and characteristics of students who will be given learning (Nababan & Henra Saputra Tanjung, 2020).

The learning model that fits this goal is inquiry. Inquiry that is suitable to be applied to junior high school students is guided inquiry because junior high school students still need teacher guidance in the learning process (Astuti & Setiawan, 2013). Learning science in addition to choosing the right model should also deal with real problems that exist in the student's environment so that it will shape students' knowledge, values or attitudes. A potential learning strategy is learning using socio-scientific issues (SSI) (H et al., 2013).

Statements from several experts are used as a reference in obtaining solutions to overcome the problem of low critical thinking skills and environmental care for students. The solution to overcome these problems is to develop guided inquiry learning tools using the socio-scientific issue (SSI) to train students' critical thinking

skills and care for the environment on global warming material.

The device is designed based on Ministerial Regulation and Culture Year 2016 Number. 22 concerning the standard of primary and secondary education processes, circular letter number 14 of 2019 concerning simplification of learning implementation plans as well as additional information from books or scientific articles with characteristics on the device containing guided inquiry, socio-scientific issues (SSI), critical thinking skills and caring for the environment by collecting KD and determining global warming indicators and materials that students must master.

Development

The purpose of this stage is to obtain the results of learning tools in the form of a syllabus, lesson plans, student worksheets and question sheets based on the designs that have been made. The development of learning tools is made in accordance with a literature study whose contents refer to the steps of guided inquiry activities, characteristics of the socio-scientific issue (SSI), training critical thinking skills and training in environmental care as well as basic competencies and indicators in global warming material. The device that has been developed is then validated by 5 validators consisting of 2 lecturers of the Faculty of Mathematics and Natural Sciences UNNES and 3 junior high school science teachers to be given input and suggestions so that the developed device is suitable for use.

Learning devices that were declared feasible by the validator were then tested for their readability through a readability questionnaire that was assessed by 3 teachers and 20 students. The teacher assesses all components of the device from the syllabus, lesson plan, student worksheets and evaluation tool sheet questions while students only assess student worksheets and evaluation tools.

Evaluation

The evaluation stage aims to see and know the processes that occur in each stage of development. Evaluation is obtained based on measurements and improvements at each stage of development from the analysis, design, development and implementation stages so that the devices developed are in accordance with government regulations and have been declared suitable for use in the learning process.

Characteristics of Learning Devices

The learning tools developed have characteristics that distinguish pre-existing learning devices. The characteristics of the learning devices in this study are as follows.
(1) load guided inquiry;
(2) load the characteristics of the socio-scientific issue (SSI);
(3) train critical thinking skills;
(4) train environmental care.

The learning tools developed were based on data collected from 3 schools and previous studies, but with due observance of the rules for making learning tools based on the 2016 Ministry of Education and Culture Regulation No. 22 concerning the standard of primary and secondary education processes, circular letter number 14 of 2019 concerning the simplification of learning implementation plans as well as additional information from books or scientific articles. Learning devices that have been developed based on their characteristics are then tested for validity to be declared feasible or not yet used in the learning process. The results of the assessment of the characteristics of learning devices from the validation results are shown in Table 1:

Table 1. Results of Learning Device Characteristics

Characteristics	Achievements (%)			
	Syllabus	lesson plan	student worksheet	Evalution tool
Loading guided inquiry	95	95	90	-
Loading Socio-Scientific Issue(SSI)	95	90	85	85
Train critical thinking skills	95	90	90	90
Train to care for the environment	95	95	100	-

The results of the assessment of the characteristics of learning devices developed based on the results of the validation are shown in table 1 with very good criteria for each indicator. Characteristics containing guided inquiry obtained an average of 93%, containing socio-scientific issues obtaining 88.75%, practicing critical thinking skills 91.25% and training environmental care 95, 67%. The average achievement obtained on each of these indicators is in very good criteria. The average achievement obtained on each of these indicators is in very good criteria. This

achievement is in very good criteria because the validator provides input and suggestions before the assessment so that when the assessment is carried out the maximum value is obtained.

Guided inquiry is carried out at each meeting of the learning process contained in the syllabus, lesson plans and student worksheets. SSI on the components of the syllabus and learning implementation plans are in observing and asking questions. SSI on student worksheets is in orientation activities and questions given to students are questions in the form of social issues that can be explained scientifically.

Questions to practice critical thinking skills in this study were found in all components of the device from the syllabus, lesson plans, student worksheets and evaluation tools in the form of question sheets with a final score of 91.25% with a very good category. The critical thinking ability used in this study is in accordance with the 12 indicators of critical thinking ability from Ennis (2011) and with the level of critical thinking ability in Bloom's taxonomy which is in the cognitive domains of C4 (analysis), C5 (evaluation) and C6 (creation).

Questions on critical thinking skills in the syllabus and lesson plans are given by the teacher to students when the learning process takes place, while in the student worksheet component, questions are available in the student worksheet section which are given and answered after the students conduct the experiment. The question sheet which consists of 10 questions on global warming material also uses indicators of critical thinking skills at the level of C4-C6 questions, namely analyzing, evaluating and creating.

With high-level questions (critical thinking) students are expected to be able to analyze, evaluate, and make inferences and also be able to make good arguments based on valid evidence and accepted by others. Susilowati & Sumaji (2020) in their research obtained the results that on the indicators of ethical thinking students are able to criticize a problem by looking at it from various points of view so that they are able to get valid arguments, it is very possible for students to be able to come up with new ideas or ideas that will be changed. into a new product that he had not previously obtained.

The learning tools developed implicitly train students' environmental care and have a positive impact by making them more sensitive to maintaining cleanliness and protecting the environment. Caring for the environment in the syllabus and lesson plans is implicitly trained when the learning process takes place in each activity such as in the opening activities the teacher checks the cleanliness of the classroom, the core activities of students conduct experiments by utilizing used goods and at the closing stage the teacher reflects on students' environmental care to reduce global warming and reminds them to implement cleanliness picket. Components of student worksheets on environmental care activities are found in experiments using used goods, questions or motivational sentences at the end of student worksheets that can train students' environmental care.

Eligibility of Learning Devices

The feasibility of the learning device was assessed using a validation sheet by 5 expert validators. The expert validators in this study used 2 lecturers and 3 junior high school teachers or equivalent who teach science subjects. Table 2. shows the results of the feasibility assessment of each component of the learning device used developed.

Table 2 shows the results of the assessment of the feasibility of learning tools, namely the syllabus, lesson plan and student worksheets. The syllabus equipment obtained a final average of 91. 25%, lesson plans 90.84% and worksheets 90.5%. The final average obtained by the device is in the very appropriate category for use in the learning process.

The achievements of each learning device are in very decent criteria because prior to the assessment the validator provides input and suggestions to improve the learning device so that when the assessment is carried out the maximum value is obtained.

The last learning device component developed was an evaluation tool in the form of a description question sheet. The questions developed consisted of 10 description questions and to determine the feasibility, a validity test was carried out. The validity test was carried out by five validators or raters. The validator was carried out by two Universitas Negeri Semarang lecturers, two junior high school 23 Semarang teachers and one MTs 'Ushriyyah Purbalingga lecturer who teaches science subjects. The assessment of the items for each item uses a scale of 1-4 and analyzed using Aiken V.

Table 2. Feasibility of Learning Devices

Rated indicators	Achievements (%)		
	Syllabus	Lesson plan	Student worksheet
Component Relevance	85	95	85
between basic competencies, indicators, objectives, materials and learning activities	90	90	-
Characteristics of 21st century learning	90	90	95
Material accuracy	90	90	-
The activity contains the steps of guided inquiry	95	95	85
The activity contains the characteristics of guided inquiry	95	95	90
The material contains the social basis of science	95	90	85
Learning activities train critical thinking skills in Bloom's taxonomy	95	90	90
Learning activities train a sense of environmental care	95	95	100
Effective	85	85	85
Consistency of terms and symbols	85	85	95
Communicative	95	90	95

The criteria in Aiken V used to declare a valid item with 5 raters with a significant level of a = 5% is 0.87 (Aiken, 1985). The results of the validation analysis of each item show that Vcount > Vtable so that the test items are declared valid. The recapitulation of the test sheet validity is shown in table 3.

Table 3 shows that all of the developed items obtained valid criteria with the lowest score of 0.87 in item numbers 2 and 8 and the highest score was found in item number 9 with a score of 0.90.

The results of the validation, even though it has been declared feasible or valid, will still be revised based on suggestions from the validator. These suggestions are used as a reference in the process of repair or revision of learning devices. The learning tools that have been revised based on suggestions from the validator are then tested for their readability through a readability questionnaire that is assessed by teachers and students. The results of the teacher's literacy questionnaire are shown in table 4.

Table 3. Test Results of the Validity of the Evaluation Tool (Table Sheet)

Question Item	$\sum S$	n(c-1)	V	Criteria
1	13,22	15	0,88	Valid
2	13,11	15	0,87	Valid
3	13,33	15	0,88	Valid
4	13,22	15	0,88	Valid
5	13,33	15	0,88	Valid
6	13,22	15	0,88	Valid
7	13,22	15	0,88	Valid
8	13,11	15	0,87	Valid
9	13,55	15	0,90	Valid
10	13,22	15	0,88	Valid

Table 4 shows the results of the teacher's literacy questionnaire on learning tools. The average results of each assessed aspect obtained very good criteria for each component of the device developed.

The teacher in this study assessed all components of the device, from the syllabus, lesson plan, student worksheets to the question sheet evaluation tool, while students only assessed student worksheets and evaluation tools. The results of the student readability questionnaire are shown in table 5.

Table 5 shows the readability questionnaires assessed by students. The average results of each assessed aspect obtained very good criteria for each component (student worksheets and evaluation tools). The results obtained even though the criteria are very good from the teacher or students, there are still suggestions for better learning tools to be developed. Suggestions from 3 teachers and 20 students who assessed the readability questionnaire were then used as a reference for improvement. The description of the feasibility of each component of the learning tools developed is as follows.

Eligibility Syllabus

The syllabus is a reference in preparing the learning framework for each subject study material. The syllabus is developed based on graduate competency standards and content standards for primary and secondary education units according to the learning format in each particular academic year. The syllabus is used as a reference in developing lesson plans (Ministry education adn culture, 2013). The syllabus development in the validation process was revised based on input and suggestions from the validator.

Table 4. Teacher Readability Questionnaire

Rated aspect	Achievements (%)			
	Syllabus	Lesson plan	Students Worksheet	Evaluation tool
Learning tools look new	91, 67	91, 67	100	100
The typeface is clear so it is not difficult when reading	100	100	100	100
The font size is not too small/large so it's easy to read	100	100	100	100
The language used is easy to understand, making it difficult for readers	91, 67	83, 34	91, 67	83, 34
There are no writing errors	91, 67	100	100	91, 67
Display an interesting picture or table so it's not boring	91, 67	100	100	91, 67
The colors used are suitable so they don't interfere with the eyes when reading	100	91, 67	100	91, 67
Nice layout making it easy to read	91, 67	75	91, 67	100
Words/sentences that are considered important are marked so that they attract attention to read	91, 67	91, 67	100	100

Suggestions from the validator include the subject matter in the syllabus must be written clearly not only implied in learning activities. The subject matter is the subject matter that must be studied by students as a medium for achieving basic competencies which will later be assessed using an assessment attachment following the learning assessment indicators. The suggestion from the validator was accepted because according to Nasution et al., (2017) the subject matter, learning activities and assessment indicators in the syllabus are descriptions of competency standards and basic competencies. competency standards and basic competencies in the education unit level curriculum are components in making the syllabus. The next suggestion is that the relationship between basic competencies and indicators, objectives, materials and learning activities must be clearly visible. These suggestions are in accordance with the principle of syllabus development, namely systematic (components in the syllabus are interconnected to achieve competence) and basic competencies, indicators, objectives, materials and learning activities are a must-have part in the preparation of the syllabus (Sholeh, 2007). The last suggestion is that the consistency of the use of the term must be maintained. Consistency which means that it is not easy to change is also a part of the principle in developing the syllabus, while the term according to the Big Indonesian Dictionary is a combination of words that have the meaning of ideas, methods, conditions or special characteristics in certain aspects.

All suggestions from the validator are accepted and used as a reference in the revision so that it can be declared suitable for use in the learning process. The results of table .5 show that the final percentage of the syllabus feasibility assessment developed is 91, 25% with a very decent category. The syllabus that was declared feasible in the validation process was then tested for readability by the teacher and received suggestions for correcting typo/mistyped words. The achievement of the level of readability of the syllabus by the teacher was obtained by 91.46% with a very good category.

Feasibility of the Learning Implementation Plan

Ministerial Regulation and Culture Number 59 of 2014 concerning the 2013 Curriculum for Senior High Schools/Madrasah defines a learning implementation plan as a face-to-face activity plan for one or more meetings. The learning implementation plan is an elaboration of the syllabus to direct student learning activities in an effort to achieve basic competencies. The function of the learning implementation plan is as a reference for teachers to carry out learning to be more directed and run effectively and efficiently (Ernawati & Safitri, 2017). The government's decree in the Minister of National Education Regulation Number 41 of 2007 concerning Process Standards stipulates that teachers are required to have the competence to compose lesson plans.

The learning implementation plan developed was then validated by 5 expert validators to determine whether or not the device developed was feasible. The final result of the validator obtained that the learning implementation plan obtained a percentage of 90, 84% with a very feasible category with revision. Revisions are made based on suggestions given by the validator during the process of validating the learning implementation plan. The suggestions given by the validator to improve the learning implementation plan include: (1) the numbering of indicators should continue according to the ones in the syllabus so as not to be confusing, (2) basic competencies, indicators of competency achievement, learning objectives and learning activities must be closely related.

The first suggestion regarding the numbering of indicators should be continued in accordance with the syllabus, done by revising the table of learning implementation plans for the basic competencies and indicators section. Indicator 3 (developing knowledge skills) and indicator 4 (emphasizing skill skills) which were initially placed in different tables were then revised by combining them into the same table.

The last suggestion is the relationship between basic competencies, indicators of competency achievement, learning objectives and learning activities. This suggestion is in accordance with Anggraeni (2018) which states that teachers must be able to make learning implementation plans based on linkages and integration. The implication is that the learning implementation plan in order to become a complete system and be used as a reference in the learning process must be made based on the linkage of objectives, content, methods, media, learning resources and learning assessment so that it becomes a complete system that can be used as a guide in learning activities.

Table 5. Student Readability Questionnaire

Rated aspect	Achievements (%)	
	Students Worksheet	Students Worksheet
Learning tools look new	88	86
The typeface is clear so it is not difficult when reading	88	85
The font size is not too small/large so it's easy to read	81	86
The language used is easy to understand, making it difficult for readers	90	91
There are no writing errors	83	87
Display an interesting picture or table so it's not boring	90	88
The colors used are suitable so they don't interfere with the eyes when reading	85	81
Nice layout making it easy to read	88	85
Words/sentences that are considered important are marked so that they attract attention to read	93	93

Improvements are made by reviewing basic competencies, indicators of competency achievement, learning objectives and activities so that they are interrelated. The achievement of the feasibility of the learning implementation plan based on the validation process is 90.84% with very feasible criteria. The lesson plan that has been declared feasible is then tested for readability by the teacher and obtained suggestions, namely in the introduction, the

steps to provide motivation should be combined with the benefits of studying the subject matter. The learning implementation plan was then revised based on suggestions and obtained the final achievement of a readability level of 92.59%.

Eligibility of Student Worksheets

The development of student worksheets supports the process of teaching and learning activities in the world of education. The work of interesting students and prosecutors can support students to learn more individually and together (Fannie & Rohati, 2014). The student worksheet developed contains guided inquiry steps with the design determined by the researcher. The development structure of students' worksheets uses good and correct Indonesian, the use of colors and images that attract students to read and type Times New Roman sizes with the size of each component and size 22 and 18 for the title or important instructions. Components of the student worksheet found in this study are as follows.

Title of student worksheet

The title of the worksheet to attract the reader's attention also aims to describe the contents of the worksheet of the Siswar and facilitate information search. The title of the student worksheet is located at the beginning of the Siswater worksheet in the middle of the top with the type of Times New Roman with a size of 22 and contains the subject's name from the activities to do.

Student Worksheet Identity

The identity of the development of this student worksheet contains group names, classes, education units (school names), subjects and subject matter. The identity of students aims to make it easier for teachers to assess.

The identity of the student worksheet also consists of usage instructions. The use instructions function to explain to the reader how to use the student worksheet, besides that the instructions facilitate and save time because the teacher does not need to explain from the beginning of how the rules or procedures for the activities to be carried out.

Basic competencies

The basic competency formulation aims to demonstrate the ability to be mastered by students after following the material and activities given at the meeting. Basic

competencies listed in the Student Worksheet in accordance with the basic competencies listed in the Syllabus and Learning Implementation Plan.

Learning objectives

The learning objectives listed in the student worksheets are the learning objectives for each sub-material on the student worksheets listed in the syllabus and lesson plans.

Fill in student worksheets

The contents of the student worksheets that were developed are in the form of a guide for students to conduct experiments using guided inquiry, namely directing students to find their own ideas but still under the guidance of the teacher. The guided inquiry step consists of orientation, problem identification, formulating hypotheses, collecting data by conducting experiments, testing hypotheses and drawing conclusions.

This student worksheet begins by exposing students to a daily problem that is close to students' lives, then students formulate problems and determine hypotheses (temporary answers) from the results of problem formulation previously carried out, activities that can guide students to find concepts in order to solve problems, and provide opportunities for students to use their own language in concluding the results of the activities carried out.

The contents of the student worksheets also contain tools and materials, experimental procedures, data tables, and questions related to the sub-materials and an answer area is provided to make it easier for students to write their answers. The list of tools and materials serves to assist students in preparing the tools and materials needed to conduct experiments. The experimental procedure in this student worksheet aims to make it easier for students to carry out experiments sequentially. The questions in the student worksheets also aim to help students achieve the competencies to be achieved. These components are in accordance with Astuti & Setiawan (2013) in their research in developing student worksheets consisting of titles, student identities, basic competencies, learning objectives and content.

The developed student worksheet obtained a percentage of 95% from the validation process, while the readability questionnaire by the teacher was 98.14% and the student was 87.34%. This percentage is in the very decent category with several suggestions, including: 1) pay

attention to the image and text content so that they do not cover each other, revise according to these suggestions by paying attention to the image used again by placing it on the left or right side where there is no writing so that it does not disturb the text but it attracts readers, 2) student worksheets should be equipped with pictures of the arrangement/set of tools in accordance with the activity steps so that they are more communicative (better in the form of photos of a series of tools), based on these suggestions the steps used to carry out experiments are equipped with pictures so that students have a picture when doing the experiment, 3) words that are difficult to understand (can be seen in tables 2 and 3) are replaced with words that are easier for readers to understand, 4) the writing is enlarged and the colors used are not too flashy and 5) change some sentences to make it more interesting. effective according to the advice given.

Feasibility of Evaluation Tool

The evaluation tool used in this study was a test sheet on the description of global warming material. This test question was developed to measure students' critical thinking skills by containing social issues that can provoke students' opinions on these issues that are discussed scientifically. The questions developed require questions and answers with high-level thinking skills so that in developing them, they must pay attention to levels C4-C6 in Bloom's taxonomy. This statement is in accordance with Nugraheni et al., (2013) that critical thinking skills involve cognitive levels from C4 (analyze), C5 (evaluate), and C6 (create) from Bloom's taxonomy.

As many as 10 questions that represent the objectives, competencies and indicators to be achieved in the validation study, different scores are obtained for each assessment indicator. The results of the validation items were then analyzed using Aiken V which can be seen in table 5 with the highest score obtained for item number 9 with a score of 0.90 while the lowest score of 0.87 was obtained on items number 2 and 8. Item number 9 obtained a score the highest because the score on the material and language aspects obtained an average value of a scale of 4 (the highest scale) so that it can be used to measure achievement indicators. Items number 2 and 8 received the lowest score because initially the stimulus and the question were combined into one sentence so that it confused the reader. The score obtained,

although the lowest compared to other items, can be said to be feasible and the suggestions given are still used as a reference in making revisions.

The questions that were developed all obtained valid criteria because the evaluation tools that had been made were in accordance with learning indicators such as the questions given in accordance with Bloom's taxonomy of critical thinking skills, questions to train students' environmental care, the material asked according to the level of junior high school students in class VII, questions asked for given requires unraveled answers, the language used is effective, consistent, communicative and the questions given are in accordance with the grid so that they can be used to measure the achievement of students' critical thinking skills.

Valid questions in the Aiken V analysis process were then tested for readability by teachers and students and obtained an average of 95.37% from teachers while from students 86.89% with very good criteria. The results of the readability questionnaire obtained a very good score because it met the readability indicators such as the learning device looks new, the typeface is clear, the font size is medium (not too small/big), the language used is easy to understand, there are no writing errors, pictures or tables that are used to attract readers, the colors used are not flashy, the layout is good and important words or sentences are marked so that they attract attention to read.

The validation process and the readability test even though it obtained valid and very good criteria, there were also suggestions for improving the developed device. Suggestions obtained in the validation process or readability test include: 1) the stimulus in the question in the form of news should be included in the source, 2) between the stimulus and the question should be separated or into different paragraphs. These suggestions are used as a reference in making revisions, namely by including the source placed at the end of each stimulus and separating the stimulus and questions, 3) simplifying words that are difficult to understand and making the writing more enlarged to make it easier to read.

CONCLUSION

The learning tools developed have characteristics with the following achievements: 1) contains guided inquiry, 2) contains socio-

scientific issues (SSI), 3) trains critical thinking skills and 4) trains environmental care. The results obtained from the validation and readability questionnaires of teachers/students learning devices developed obtained very feasible and valid criteria for use in learning,

The learning device developed in this study was not tested on students because of the pandemic, so that in order to obtain more valid results, it should be tested on students. The learning tools developed are arranged based on the characteristics and problems of the students of junior high school 23 Semarang, if they want to be reproduced, it should be revised according to the characteristics and problems of other users. Guided inquiry learning tools using socio-scientific issues can be used in the learning process. The learning tools developed consist of a syllabus, lesson plans, worksheets and a question sheet evaluation tool.

REFERENCES

Aini, M. H. (2014). Mastery of Environmental Concepts and Environmental Care Attitudes for Adiwiyata Mandiri High School Students in Mojokerto Regency. *Journal of BioEdu Unnes*, 3(3): 479–484.

Alfian, M. (2011). Historical Education and Problems Faced. *Treasures of Education*, 3(2):1–8.

Andryani, F., Djafar, H., & Qaddafi, M. (2016). Application of the SSI (Socio-Scientific Issues) Approach using Power Point Media on Critical Thinking Skills in New Students Class of 2015 Department of Physics Education, Faculty of Tarbiyah and Teacher Training, State Islamic University Alauddin Makassar. *Journal of Physical Education*, 4(2): 64–66.

Anggareni, N. ., Ristiati, N. ., & Widiyanti, N. L. P. . (2013). Implementation of Inquiry Learning Strategy on Critical Thinking Ability and Understanding of Science Concepts for Junior High School Students. *Ganesha University of Education Graduate Program E-Journal*, 3(1): 1–11.

Astuti, Y., & Setiawan, B. (2013). Development of Student Worksheets based on the Guided Inquiry Approach in Cooperative Learning on Heat Material. Indonesian *Journal of Science Education*, 2(1): 88–92.

Dewi, N. R., & Akhlis, I. (2016). Development of Science Learning Devices Based on Multicultural Education Using Games to Develop Student Character. *USEJ - Unnes Science Education Journal*, 5(1): 1098–1108.

Dewi, N. R., & Setyaningsih, N. E. (2016). The Effect of Inquiry-Based Practical Instructions on Critical Thinking Ability and Conservation Character of Students. *Indonesian Journal Of Conservation (IJC)*, 05(01): 51–55.

Ernawati, & Safitri, R. (2017). Analysis of Teacher Difficulties in Designing a Learning Implementation Plan for Physics Subjects Based on the 2013 Curriculum in Banda Aceh City. *Indonesian Journal of Science Education*, 5(2), 50–58.

Fannie, R. D., & Rohati. (2014). Development of Student Worksheets Based on POE (Predict, Observe, Explain) on Linear Program Materials for Class XII Senior High School. *Journal of Science*, 8(1).

Fitriati, M., Sahputra, R., & Lestari, I. (2019). The Effect of Environmental-Based Learning on Environmental Care Attitudes on Environmental Pollution Materials. *Journal of Equatorial Education and Learning*, 8(1): 1–8.

H, P. W., Nurohman, S., & Wibowo, W. S. (2013). Integrated Science Model Based on Socio Scientific Issues to Develop Thinking Skills in Realizing 21st Century Skills. *Journal of Mathematics and Science Education*, 1(2): 158–164.

Hidayati, L. (2014). Curriculum 2013 and New Directions for Islamic Religious Education. INSANIA: *Journal of Educational Alternative Thinking*, 19(1): 60–86.

Khasanah, N. (2015). *SETS (Science, Environmental, Technology and Society)* as a Modern Science Learning Approach in the 2013 *Curriculum. National Seminar on Conservation and Utilization of Natural Resources 2015*: 270–277.

Nababan, S. A., & Henra Saputra Tanjung. (2020). Development of Learning Tools Based on Realistic Mathematics Approach to Improve Mathematical Disposition Ability of Senior High School 4 Wira Bangsa Students, West Aceh Regency. *Genta Mulia*, 11(2): 233–243.

Nasution, S., Fahmei Lubis, R., & Harida, E. S. (2017). Analysis of the Conformity of Lecturer Lecture Journals with Tbi Learning Syllabus. *TAZKIR: Research Journal of Social and Islamic Sciences*, 3(1), 105.

Nugraheni, D., Mulyani, S., & Ariani, S. R. D.

(2013). The Effect of Visionary Learning and a Sets Approach on Learning Achievement in terms of Critical Thinking Ability of Class X Students of Sman 2 Sukoharjo on Petroleum Materials for the 2011/2012 Academic Year. *Journal of Chemical Education*, 2(3), 34–41.

Pariatna, I. W. J., Sudria, I. B. N., & Wasono, N. K. (2017). Development of Guided Inquiry Learning Tools on the Topic of Reaction Rate. Forum for Mathematics and Science: *Journal of Mathematics, Science, and Learning*, 9(1): 38-50.

Pratiwi, K. F., Wijayati, N., Mahatmanti, F. W., & Marsudi. (2019). The Effect of Guided Inquiry Learning Model Based on Authentic Assessment on Student Learning Outcomes. *Journal of Chemical Education Innovation*, 13(1).

Puspita, A. T., & Jatmiko, B. (2013). Implementation of the Guided Inquiry Learning Model on Students' Critical Thinking Skills in Class XI Class XI Static Fluid Physics Learning at Junior High School 2 Sidoarjo. *Physics Education Innovation*, 2(3): 121–125.

Puspitasari, E., Sumarmi, & Ach Amirudin. (2016). Integration of Critical Thinking and Environmental Care through Geography Learning in Shaping the Character of High School Students. *Journal of Education: Theory, Research, And Development*, 1(2): 122–126.

Rahmawati, A. A., & Parmin, P. (2021). The Effectiveness of Blended Learning Implementation of E-Module Integrated Science Based on Joyful Learning with Breathing System Theme on Students' Critical Thinking Skills and Learning Independency. *Journal of Environmental and Science Education*, 1(1), 32-41.

Rohmawati, E., Widodo, W., & Agustini, R. (2018). Building Students' Scientific Literacy Ability Through Learning Context of Socio-Scientific Issues Assisted by Weblog Media. *Journal of Science Education Research*, 3(1): 8-14

Samihah, I. M., & Savitri, E. N. (2021). Comparative Study of Critical Thinking Skills on PBL Model Learning with Animated Videos between the Students Using Moodle and Google Classroom. *Journal of Environmental and Science Education*, 1(2), 18-24.

Sholeh, M. (2007). Learning Planning for Senior High School Geography Subjects in the Context of Education Unit Level Curriculum. *Journal of Geography*, 4(2): 129–137.

Sugiyono. (2014). *Educational Research Methods*. Bandung : Alphabeta.

Susilowati, Y., & Sumaji. (2020). Intersection of Critical Thinking with High Order Thinking Skill (HOTS) Based on Bloom's Taxonomy. *Journal of Syllogism*, 5(2): 62–71.

Taufiq, M., Dewi, N. R., & Widiyatmoko, A. (2014). Development of Integrated Science Learning Media with Environmental Care Character The theme "Conservation" has a Science-Edutainment approach. *Indonesian Journal of Science Education*, 3(2): 140–145.

Waryono, T. (2011). *Community Empowerment Efforts in Forest Conservation as a Prevention of Global Warming*. Faculty of Math and Science and Urban Forest Management: University of Indonesia.

Widayat, W., Wiyanto, & Hindarto, N. (2017). Formation of Critical Thinking Skills and Character Care for the Environment Assisted by Scaffolding. *Journal of Innovative Science Education*, 6(1): 85–95.

Wildan, Hakim, A., Laksmiwati, D., & Supriadi. (2019). Socialization of Environmental-Based Learning Tools for Science Teachers at Junior High School in West Lombok in an Effort to Reduce the Rate of Global Warming. *Journal of Chemical Information and Modeling*, 53(9): 1689–1699.

Wulanningsih, S. (2012). The Effect of Guided Inquiry Learning Model on Science Process Skills in terms of Academic Ability of Senior High School 5 Surakarta Students. *Biology Education*, 4(2): 33–43.

Yustyan, S., Widodo, N., & Pantiwati, Y. (2015). Improving Critical Thinking Ability with Learning Based on Scientific Approach for Class X Junior High School Panjura Malang. *Indonesian Journal of Biological Education*, 1(2), 240–254.