Development and Implementation of Integrated Science Learning Learning Devices for 2013 Curriculum Susan Loucks-Horsley Model

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Abstract: This study aims to develop a model learning tool for Susan Loucks-Horsley that is suitable to be used for Integrated science learning in junior high school grade VII semester 1, investigating the validity, practicality and effectiveness of learning tools in improving student learning outcomes of science materials. Research uses the method of Development Research four D models (definition, design, development, desimination). Learning tools developed in the form of Learning Implementation Plans, Student Learner Worksheets and Assessment Sheets.Data collection uses a validation sheet for learning tools for assessment of Learning Plans,Student Worksheets and Sheets Assessment., Assessment Sheet by experts and users; questionnaire to find out the practicality; observation sheets to observe student activities, and test learning outcomes to determine the effectiveness of the device. Data analysis was performed with quantitative descriptive techniques and different tests. The research was carried out only until the definition stage and design development of the Model Susan Loucks-Horsley learning tool in VII grade junior high school science in energy systems in living systems

Keywords: Integrated Middle School Model, Model Susan Loucks-Horsley, 2013 Curriculum

1. Introduction

Science is a collection of knowledge that is arranged systematically, and in its general use is limited to natural symptoms. Further scientific development is not only marked by a collection of facts, but also the emergence of scientific methods that are realized through a series of working scientifically.scientific attitudes) (Depdikbud, 2013) In line with this understanding, science is a series of interrelated concepts with charts concepts that have developed as a result of experimentation and observation, and then will be useful for experimentation and further observation. The connection between various concepts is interwoven between the science family, namely Biology, Physics and Chemistry.

Learning science in junior high school in 2013 Curriculum requires integration in accordance with the guidelines of the 2013 Junior High School Curriculum. The integration referred to in

the 2013 Junior High School Science Curriculum is shown in Core Competencies and Basic Competencies of science learning, that is in one Basic Competence has integrated scientific concepts from the field of biological sciences, physics , and chemistry. Science learning is oriented to applicative abilities, developing thinking skills, learning abilities, curiosity, and developing caring and responsible attitudes towards the social and natural environment. Science is also intended for the introduction of the surrounding biological and natural environment, as well as the introduction of various advantages of the Nusantara region.

A teacher is required to have the ability to create a conducive learning climate, the ability to develop strategies and learning management, have the ability to feedback and strengthen, and have the ability to improve themselves. The way of packaging the learning experience designed by the teacher greatly influences the meaningfulness of the experience for the students. A learning experience that more shows the connection between conceptual elements will make the learning process more effective. Conceptual linkages that are studied with the relevant field of science study will form a cognitive scheme, so that students gain integrity and unanimity of knowledge. The acquisition of the integrity of learning science, as well as the unanimity of views about life, the real world and natural phenomena can only be reflected through integrated learning. Through integrated science learning, students are expected to be able to build their knowledge through scientific work, working together in groups, learning to interact and communicate, and being scientific. However, in general schools the available teachers consist of teachers of disciplines such as Physics, Chemistry, and Biology. Teachers with this background are certainly difficult to adapt to the integration of the field of science studies, because those with a physical background do not have optimal abilities in Chemistry and Biology, and vice versa.

Various problems faced by junior high school science teachers in their learning related to the problem of integrating learning material for each Basic Competency. This is what researchers found when guiding students from Field Experience Practices in Junior High Schools in the City of Pekanbaru and also the recognition of many junior high school science teachers that only the intended Integrated Teachers are biology education background may teach physics or chemistry, and vice versa. This is also evident when becoming an instructor for teachers who are taking part in the Teacher Professional Training Education for Junior High School Science Teachers, they tend to develop learning tools and practice them according to their education in S1, without trying to integrate them. The results of research from Fatimatu Zahroh (2012) in the Ministry of Education and Culture (2016) also strengthened this problem which was obtained: 1) the teacher's planning difficulties in describing Basic Competence became an indicator for Integrated science, 2) the implementation of the teacher had difficulty in choosing methods, learning resources and media learning, 3) the implementation of teacher's assessment of difficulties in providing psychomotor evaluation of integrated science while junior high school science teachers are required to be able to prepare such learning tools Learning Plans, Student

Worksheets and Sheets Assessment. and assessment sheets.Efforts to anticipate and respond to the changes that are and will occur in the future are improving the quality of education. One that determines the quality of education is the learning process. The Horsley Model Susan Loucks is very suitable to be applied in the Integrated science learning process that builds and reflects the continuity between the quality of science and technology simultaneously. Model Susan Loucks Horsley has 4 learning stages, namely invite; explore discover, create; propose explanation and solutions and taking action (McCormack, 1992). In addition, the Susan Loucks-Horsley model is consistent with the science education taxonomy consisting of five domains (knowledge domains, process of science domains, creativity domains, attitudinal domains,

application and connection domains) that are expected to enhance competencies to answer the challenges of the XXI century and understanding on the nature of science as a form of implementation of the 2013 Curriculum. The results of Jumadi et al. (2014) showed that the Integrated Science Learning Model Susan Loucks-Horsley was effective in improving attitudes towards Science, Science process skills and mastery of students' material. Therefore, researchers are interested in conducting this research to overcome problems regarding Integrated science learning in junior high schools and implement them.

The problems that will be solved through this research can be formulated: How is the validity, practicality and effectiveness of the science learning tool Susan Loucks-Horsley Integrated Model Middle School 2013 curriculum developed?

Outcomes / benefits expected from this research are: Guidebook for Learning Implementation Plans Learning Plans, Student Worksheets and Sheets Assessment., Evaluation of 2013 Susan Loucks-Horsley Model Learning Integrated Learning Tools for Junior High School 2013 as a reference for junior high school science teachers in developing 2013 Curriculum-oriented learning tools. .

Science is the result of human activities in the form of knowledge, ideas, and organized concepts about the natural surroundings that are obtained through a series of scientific processes. Because actually science is the science of nature, both about living things and inanimate things. Many experts talk about the meaning of science. Ministry of National Education (2004) states that science is: 1) as a collection of scientific knowledge that has been arranged logically and systematically, 2) as a method that has certain steps which are deductive and inductive thinking patterns, 3) as a tool for master and nurture nature and develop production for human welfare, 4) as a major factor influencing human beliefs, thought patterns and attitudes towards the universe.

Science is a field of study that has the essence as a body of knowledge, a way of thinking and a way of investigation (Zuhdan, 2008). As a body of knowledge, Science is a field of study that contains concepts, principles and laws, as a way of thinking, learning science must be done by means of scientific thinking, and as a way of investigation in learning Science Students must can be directly involved in finding physical concepts through a scientific work.

Science learning in junior high school in the 2013 curriculum (Kemendikbud, 2016) there are several changes between the concepts of learning developed as subjects of integrative science or "Integrated Science" not as disciplinary education. The concept of integration is shown in Core Competencies and Basic Competencies in science learning, namely that in one Basic Competency already integrates scientific concepts from the fields of biology, physics, and earth and space science. Through integrated science learning, students can gain direct experience, so that they can add strength to accept, store, and apply the concepts they have learned. Thus, trained students can find their own concepts that are studied holistically, meaningfully, authentically and actively.

In the 2013 Curriculum, the Basic Competencies of science subjects has combined concepts from the aspects of physics, chemical biology and earth space science, but not all aspects of science are due to the fact that not all aspects of science can be included in a science topic. There are several models that have the potential to be applied in integrated science learning, including connected, webbed, shared, and integrated. The four models are chosen because the

concepts in science learning have different characteristics, so they need an appropriate model to provide optimal integration results.

Learning Science in junior high school as natural science is not only in the form of mastery of knowledge collection in the form of facts, concepts, principles, laws or theories but also the discovery process, then learning Science must reflect scientific attitude competencies, scientific thinking, and scientific work skills. One learning model that can be applied in accordance with the above problems is a learning model developed by Susan Loucks Horsley. (Widayanti, 2015) This learning model has four stages, namely invited where students are invited to learn, Explore and Discover where students have the opportunity to answer their own questions through observation, measurement, or experimentation, Propose Explanations and Solution where students prepare explanations and solutions and carry out what they have learned, and Taking Action where students have the opportunity to search for their findings and apply them from what they has been learned in everyday life.

Zuhdan (2008) states that Integrated science learning with the model Susan Loucks-Horsley is able to reflect the combination of science and technology simultaneously through four stages, namely: 1) Learners are invited to learn, 2) Students have the opportunity to answer their own questions through observation, measurement, or experiment, 3) Learners prepare explanations and solutions as well as carry out what they have learned, 4) Students have the opportunity to find out the usefulness of their findings and apply them to what they have learned in their daily lives. Mc Cormack. (1992) argue that the Model Susan Loucks-Horsley looks at five taxonomies of science education, namely (1) I-knowing and understanding domains, (2), domain II - Exploring and Discovering, (3) domain III - Imaging and creating, (4) Domain IV - Feeling and Valuing, and (5) Domain V - Using and Applying.

2. Methodology

This research was conducted at the Laboratory of Physics Education FKIP UNRI The research was conducted from June 2018 to November 2018 for 6 (six) months..The object studied in this study was the Integrated Science learning device for the Susan Loucks-Horsley model in 2013 curriculum-oriented class 7 semester 1 consisting of Lesson Plan, Work Sheep, Assessment Sheet for four meetings. Basic Competencies that will be developed about the subject matter of Energy in the Life System. The implementation will be implemented at Pekanbaru 20 Middle School.

Referring to the formulation of the problem that has been raised, this research is classified as development research because it develops the Integrated Science Learning tool modeled on Susan Loucks-Horsley in the implementation of the 2013 Curriculum.
In order to achieve the development research objectives above, in this study data sources from:

a. The validity of the Integrated science learning tool in the seventh grade junior high school science learning in the implementation of the 2013 curriculum that was developed was seen from the content validity and construct validity assessed by experts in the field of assessment and junior high science learning practitioners (teachers).
b. The practicality of the Integrated science learning tool developed in terms of whether guu can apply Integrated science learning in learning activities. Researchers (assisted by observers) observe guu activities in implementing Integrated science learning in the implementation of learning. Assessment is carried out by experts and teachers.

c. The effectiveness of integrated science learning developed. seen from the level of appreciation of students towards the devices developed when applied in learning and characterized by components: 1) learning outcomes of students, 2) activities of students, and 3) responses of students through the implementation of Integrated science learning tools according to the 2013 Curriculum.

Assessment is carried out by experts and teachers and students.
Development of Integrated science learning tools using the Four D Model, proposed by Thiagarajan et al (Sugiyono, 2015). The process of developing Integrated science learning devices consists of four stages, namely define, design, develop, and dessiminate.
To explain the Four-D Model diagram, each stage can be briefly explained as follows:

1. Define
The definition phase aims to establish and define the requirements for developing learning devices. Five steps of the activities in the define phase are front end analysis, student analysis, task analysis, concept analysis, and formulation of assessment indicators.

2. Design
The purpose of this phase is to prepare a grade VII junior high school science learning tool oriented Susan Loucks-Horsley model based on 2013 curriculum. This stage begins after a series of learning indicators are formulated. At this stage consists of three steps which include device setup, format selection and initial device design .

3. Develop
This stage aims to produce a class VII oriented science learning tool for Susan Loucks-Horsley model based on 2013 Curriculum. There are also steps taken at this stage are validation, simulation and trial 1 of the product.

4. Disseminate
Limited Dessimination is the last step and aims to find out the effectiveness by using this Susan Loucks-Horsley-oriented learning model in achieving learning goals. Besides that, we want to know the level of activity of students as well as their response and teacher's response to the learning tools (Learning Plans, Student Worksheets and Sheets Assessment. and Assessment Sheet). Trial 2 was conducted at Pekanbaru 20 Middle School.

Based on the input of Trial II (limited dissemination) Revision IV is carried out and results in Draft V or final script. Data obtained in Test II were analyzed for report material
4. Data Collection Techniques,

Data collection techniques used in this study were questionnaires, observations and tests for questionnaire techniques used to assess device validity, teacher and student responses, dsainskai observation techniques to assess students' activities during learning by applying developed tools and ice techniques used for see the learning outcomes of students after applying the science learning tool for class VII oriented junior high school model Susan Loucks-Horsley developed has met the validity criteria.

5. Data Analysis Techniques
Research data were analyzed using descriptive statistical analysis with percentage techniques.
a. Validation of Susan Loucks-Horsley Model Junior High School Integrated Science Learning Devices

Validation of junior high school integrated science learning devices includes
Validation aspects assessed by experts and practitioners are made in the form of a rating scale. The type of scale used is the Likert scale with scores from 1 to 4. Determining the value of validity (Va) for all aspects with formula

$$Va = \frac{(\text{Total score obtained})}{(\text{Total maximum score})} x\ 100\%$$

Criteria for making decisions in the following conditions:

Table 1. Criteria for Validity of 2013 Curriculum-Oriented Integrated Middle School Learning Tools

No	Value Interval Effectiveness (%)	effectiveness category
1	$0.00 \leq E < 25$	Very low
2	$25 \leq E < 50$	Low
3	$50 \leq E < 75$	Medium
4	$75 \leq E \leq 100$	Very High

Criteria state effective learning tools, if the minimum level of effectiveness achieved is high.

3. Results and Discussion

The research carried out is only up to the stage of define and design. The steps that have been taken are

1. Define aims to define and define learning conditions. Five steps of the activities in the define stage are:

a. Front-end-analysis

The aim of the front end analysis is to determine the basic problems needed in the development of SMP integrated science learning tools so that alternative learning tools can be made accordingly. At this stage a review of the curriculum, learning theory, challenges and future demands is carried out.

1) Junior High School Integrated Science of Curriculum 2013

In achieving national education goals and facing the challenges of the 21st century which are characterized by rapid technological development, science is one of the important foundations in nation building. Therefore, science learning is expected to lead students to fulfill the following abilities:

(1) Learning and innovation skills that include critical thinking and being able to solve problems, are creative and innovative, and are able to communicate and collaborate. (2) Skilled for using media, technology, information and communication. (3) The ability to live a life and career, including the ability to adapt, be flexible, take the initiative, be able to develop themselves, have social and cultural abilities, productive, trustworthy, have a leadership spirit, and responsibility (Kemendikbud, 2017). Specific competencies expected in science learning: (1) fostering high religious and social ethics in community life, nation and state; (2) mastering knowledge; (3) have the skills or ability to apply knowledge in order to conduct scientific

investigations, problem solving, and making creative works related to daily life (Kemendikbud, 2017).

2) Learning Theory

Learning theories that underlie integrated science subjects are constructivism learning theories. The essence of this theory is that students are more active in learning through giving direct learning experiences. Learners can understand and apply knowledge, students must work and solve problems, find everything for themselves and their social environment.

3) Challenges and future demands

Challenges and demands of the future in this 21st century era, the Indonesian people are required to have human resources who are skilled, creative, willing to work hard, be independent, and confident. For this reason the Indonesian people must catch up with other nations that have already advanced, relying on their own strength. Thus, students must think critically, creatively, work hard, be independent, confident, and carry out life-long education.

b. Student Analysis

The analysis of students is a study of the characteristics of students which includes the ability, background of knowledge, and the level of students' cognitive development.

Based on the stages of intellectual development of children according to Piaget, students at the junior high school level are in the formal stage, namely students are able to think abstractly. In the formal operation phase (11-15 years) according to Hendro and Jenny (1993), students can already: a) deductive thinking, make hypotheses, b) reflective or evaluative thinking, c) control variables from various possibilities.

The formal operational phase of students begins to be able to think abstractly and can understand the possibilities that will occur.

So students have the ability to analyze, evaluate, and solve the problems they face.

c. Task Analysis

Task analysis includes an understanding of the material and learning objectives in accordance with the subject matter chosen, namely Energy in the Life System. Therefore, based on the revised 2013 SMP curriculum for science subjects, task analysis was obtained, as follows:

Basic competencies

3.5 Analyzing the concepts of energy, various energy sources, and changes in forms of energy in everyday life including photosynthesis.

4.5 Presenting experimental results about changes in energy forms including photosynthesis.

Indicator:

1) Explain the meaning of energy.
2) Describe various energy sources.
3) Explain food as an energy source.
4) Explain energy transformation in cells.
5) Explain cell metabolism.

6) Explain the digestive system
7) Design and present experimental results about changes in energy forms including photosynthesis.
Based on the basic competencies of the integrated science subjects, the tasks carried out by students during learning are translated into four meetings, namely LP1 (Understanding Energy and Various Energy Sources), LP2 (Food As an Energy Source, LP3 (Energy Transformation in Cells),LP4 (Digestive system).

d. Concept Analysis

In the step of concept analysis, the researcher identifies the main concepts of the subject matter of Energy in the Life System that must be taught, and composes these concepts systematically in the form of concept maps.

e. Analysis of Learning Objectives

This analysis intends to convert between task analysis and concept analysis into learning indicators expressed by behavior. This series is the basis for the preparation of the test and design of the Model Susan Loucks-Horsley learning tool in Integrated science

2. Design

This stage begins after a series of learning objectives for Energy and Life Systems are made. At this stage consists of four steps which include, preparation of lesson Plan, Student Worksheets Assessment Sheet, media selection, format selection, and initial prototype design.
a. Preparation of lesson Plan, Student Worksheets, Assessment Sheet

Preparation of lesson Plan, Student Worksheets, Assessment Sheet is a step that bridges the define and design stages.

The type of behavior changes that students expect are cognitive, affective, and psychomotor. Therefore the Model Susan Loucks-Horsley learning tool was designed in Integrated science.

b. Media Selection

In the 2013 science curriculum (Kemendikbud, 2013) stated that "the provision of direct learning experiences is emphasized through the use and development of process skills and scientific attitudes with the aim of understanding concepts and being able to solve problems". To meet the demands of the science curriculum, the media that will be used in learning are developed in the form of a part of the Model Susan Loucks-Horsley learning tool in VII grade junior high school integrated science and other necessary media.

The selection of media for the subject matter of Energy in the Life System that is adjusted to the task analysis, concept analysis, and analysis of students

c. Format Selection

In general, the format selection used in this study was to develop the Model Susan Loucks-Horsley learning tool in VII grade junior high school integrated science using the format of "Physical Science" which was adapted to a number of factors in media selection.

d. Preliminary Design Model learning tool Susan Loucks-Horsley in VII grade junior high school integrated science

Activities in this step focused on the development and writing of the Model Susan Loucks-Horsley learning tool in SMP VII grade VII integrated science, intensive discussions with the research team.

The results of the Model Susan Loucks-Horsley prototype learning design phase in the early VII grade junior high school integrated science are:

1) Learning Implementation L P of the Model Susan Loucks-Horsley learning in Integrated VII grade junior high school science was used by teachers during the teaching and learning activities in 2013 curriculum-oriented activities for Energy in the Life System.

2) Students' Student Activity Sheet is a guide for students to find observational data or new theories for themselves. The components contained in the LKPD include the title of the activity, the purpose of the activity, tools and materials, steps of activities, observation data, questions, conclusions.

3) Tests are tests of learning outcomes for the cognitive domain.

4) Observation sheet is an observation instrument during the teaching and learning activities taking place, which includes psychomotor domain observation sheets and student learning activities.

5) Questionnaire of students' responses to learning through Model Susan Loucks-Horsley learning tools in junior high school VII grade science assessment of affective domains

4. Conclusion

Based on the formulation of the problem and the research question, a research on the development of the 4D Model Susan Loucks-Horsley learning device in the VII grade junior high school integrated science through the creation of a number of prototypes of Energy material learning devices in the Life System consisting of, Learning Plans, Student Worksheets and Sheets Assessment.

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