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Problem Solving Model for Science Learning

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Abstract. This research aims to develop problem solving model for science learning in junior high school. The learning model was developed using the ADDIE model. An analysis phase includes curriculum analysis, analysis of students of SMP Kota Padang, analysis of SMP science teachers, learning analysis, as well as the literature review. The design phase includes product planning a science-learning problem-solving model, which consists of syntax, reaction principle, social system, support system, instructional impact and support. Implementation of problem-solving model in science learning to improve students' science process skills. The development stage consists of three steps: a) designing a prototype, b) performing a formative evaluation and c) a prototype revision. Implementation stage is done through a limited trial. A limited trial was conducted on 24 and 26 August 2015 in Class VII 2 SMPN 12 Padang. The evaluation phase was conducted in the form of experiments at SMPN 1 Padang, SMPN 12 Padang and SMP National Padang. Based on the development research done, the syntax model problem solving for science learning at junior high school consists of the introduction, observation, initial problems, data collection, data organization, data analysis/generalization, and communicating.

1. Introduction

Science is the knowledge gained through the collection of experimental data, observations and deductions to produce an explanation of natural phenomena that can be trusted. According to Carin and Sund [1] there are three principles in Science, the first, science is the accumulation of knowledge organized systematically, in the second science as an attitude and lastly science as the scientific method, while Rustaman [2] states Science contains four things: content or products, processes or methods, attitudes,



and technology. Students in learning science, not just learn science product, but also processes, attitudes and technology, so that science fully understood.

Learning science should be designed to enable the activity of learning in students. Learning activities important to establish a learning experience. The student learning experience derived from the activities it does, not from the activities of the teacher. Science learning activities undertaken by students should provide a learning experience about the discovery of a concept. Teachers should be able to design learning activities that provide a learning experience about the process of science and science products. The learning experience gained through applied learning model the teacher in the classroom.

The problem of education in Indonesia today is a weak learning process. School learning do not encourage students to develop thinking skills. The lesson is mainly directed so that students are able to remember as much fact and information as possible so the child must memorize, without understanding what is memorized [3]. Weak learning process occurs almost in all educational units at every level.

The same is true with science learning. Results of research conducted TIMSS 2011, shows the average score of science grade VIII students in Indonesia is 433. This score indicates that the average science ability of Indonesian students is in the category of Low International Benchmark. Students who are in this category mean only being able to recognize some basic facts but have not been able to communicate and associate various science topics; has not been able to apply complex concepts and abstract; has not been able to combine the information to draw a conclusion, interpret information in diagrams, graphs and charts to solve problems; has not been able to give a brief explanation that contain scientific knowledge and causality; and not able to understand the basics of scientific investigation; can not provide a written explanation to convey scientific knowledge [4].

The results of TIMSS researchers show that science learning has prioritized the mastery of procedural, factual and conceptual knowledge. Learning science more oriented to science as a product, so that students tend to memorize the concepts, principles, laws and theories [5, 6]. Science has three dimensions: first scientific attitude such as a high curiosity, critical, creative, honest, loving environment, recognizing the regularity of nature as creatures of God Almighty. The second dimension is the scientific process which deals with problem-solving procedures with scientific methods such as problem identification, hypotheses / predictions, analyze the data, draw conclusions. Third, science as a scientific product in the form of knowledge, whether it is factual, procedural or conceptual knowledge in the form of principles, law, and theory.

IPA as the process include the ability to apply the scientific method in the form of a set of skills required scientists to conduct scientific investigations known to science process skills [7]. Further Rustaman [7] says that one of the science process skills is a problem solving knowledge and skills. Essential problem-solving skills are owned by students as they relate to the ability to apply concepts- the concept of science to solve problems encountered in everyday life (life skill). Solving problems is a skill, it needs to be trained on students. Learning science in Indonesia today is less train problem solving

skills to students. Learning needs to familiarize the problem solving, so that students have the process science skills.

Preliminary test results on the process science skills as a description of the problem solving ability of grade VII students of SMP Kota Padang showed an average below 50%. Observation skills, and designing experiments, respectively 47% and 39%. Predicting, asking questions and composing hypotheses of 18%, 40% and 27% respectively. Deducing, perform inference, applying the idea of the new situation and classify 40%, 34%, 44% and 34%, respectively. The ability of a high enough is to use simple equipment and take measurements 84% 61%. This result shows from 10 students, then 3 or 4 people who already have problem solving ability. Stenberg in [8] states the basis for implementing discovery / inquiry-based learning is problem solving. According to Carin [9] problem solving, critical thinking and creative thinking include high-order thinking skills. Carin further stated the purpose of science learning is to help students change perceptions, images, concepts to spur skills development in problem solving. Therefore it is understandable The National Curriculum recommends to use problem solving model.

The problem solving model recommended in the National Curriculum is Creative Problem Solving. *Creative Problem Solving is suitable for common problems related to everyday life*. In addition students are free to express opinions in accordance with background knowledge and interests. But Creative Problem Solving is difficult to do for problems that are not related to everyday life. Creative Problem Solving is good for students who have been accustomed to learning with problem solving model.

Carin [9] proposes the following problem solving steps: (1) planning, (2) collecting data, (3) organizing data, (4) data analysis, (5) generalization, (6) drawing conclusions. Planning stages from identifying problems, formulating problems, planning activities to solve problems. But the steps of problem solving is not in accordance with the scope of scientific work of the National Curriculum for junior high level. The problem solving steps that are not suited is planning the activity. Planning activities is a learning step that is suitable for high school level. Planning activities is a competency that must be achieved by high school students as stated in the scope of scientific work and work safety, consisting of: formulating problems, submitting hypotheses, determining variables, designing and conducting experiments, collect and process data systematically, draw conclusions, and communicate results oral and written experiments. While the steps problem solving for SMP as follows: formulate problems, predict, conduct experiments, collect data accurately, process data systematically, draw conclusions, and communicate the results of experiments orally and in writing. From the scope of science lesson of SMP it can be seen that the problem solving steps as presented by Carin are too high. How problem solving model which is suitable for SMP science?

2. Theory of Support

Learning models need to be applied by teachers in classroom activities. Learning model is a true learning model [10]. The application of a learning model will lead students to acquire information, ideas, skills, and values through the process of thinking and expressing themselves. Implementing a learning model means the teacher teaches how to

learn. Furthermore, it is argued that the most important result of learning is the improvement of students' learning ability in the future to be more effective and easy, because they already have the knowledge and skills acquired through the learning process.

Learning model is different from strategy and learning method. The learning model has its own characteristics. Characteristic of the learning model according to Rusman [11] were: first, have the theoretical basis of certain educational experts. The foundation of this theory is logically arranged by the developer of the model. Second, have a specific mission or educational purpose. The next feature is to be used as a guide to improve learning activities in the classroom. The fourth characteristic is to have a component model: syntax, reaction principles, social systems and support systems. Meanwhile, according to Arends [12] learning model has an attribute that does not have a strategy or method of learning. Attributes of a model is the theoretical basis and teaching behavior and structure of the required classes. Jihad and Aris [13] state that the learning model is a plan or pattern used in preparing the curriculum, organizing the student material, and giving instruction to the teacher in the class in the teaching setting. Meanwhile, according to [10] learning model is built by several components; syntax, social system, reaction principles, support systems and instructional impacts. Syntax or phase, is a sequence of activities in learning. Syntax is used as a guide for teachers in implementing the learning models. Syntax is also a guide for students in learning. Syntax made the difference between models with learning methods.

The second component of the learning model is the social system. The social system is a description of the role and relationship between teachers and students, as well as the underlying rules. The role of teachers in each model is different. In one model the teacher acts as a facilitator of a group, teachers can also act as individual counselors. Joyce, et. al [10] distinguishes the social system into three levels: activity with a high structure, where teachers act as centers of activity, and sources of information. The second level is a moderate structure, the activities of teachers and students are balanced. While the third is a low structure, in this structure students as the center of activity, so that students are free to express and put forward the idea.

The third component of the learning model is the principle of reaction. The principle of reaction according to [10] is the way teachers appreciate, place and respond the student activities. For example, for one model, the teacher rewards after the student shows a particular activity, or on learning that aims to build creativity, the teacher puts himself in the same way as the student, so that the student's self-confidence appears.

The next component of the learning model is the support system. Support systems are devices that support the implementation of model. Included in the support system is a guide for teachers, student book or modules, LKS / LDS, instructional media, classroom conditions, etc. The support system is crucial to the successful implementation of a learning model. For example in science learning would be better to present the real thing than to display the image as a instructional media.

The last component of the learning model is the instructional impact and impact of the companion. Impacts are distinguished by direct and indirect impacts. The direct impact is the instructional impact, whereas the indirect impact is the impact of companions. For

example, improving competence is a direct impact, but growing the competitiveness is a companion impact of a instructional model.

3. Method

The development procedure carried out follows the ADDIE development model which includes the analysis, design, development, implementation and evaluation phase.

3.1. Analysis phase

In the analysis phase, conducted the needs analysis of the problem solving model for learning science in the field today. Needs analysis includes: (a) A curriculum analysis consisting of analysis of SMP SKL, KI, and KD. The KI and KD analyzed are KI and KD in the 2013 curriculum. (b) Analysis of science teachers as users of developed products. Teacher analysis is done by observing teachers' ability and understanding of scientific approach. The ability of teachers to implement learning with a scientific approach conducted through observation of 97 science teachers of SMP Kota Padang who participated in training and socialization of Curriculum 2013 on 22-26 June 2014. Observations using the observation sheet in Appendix 1. While the teacher's understanding of the scientific approach and problem solving obtained by using a questionnaire as in Appendix 2. (c) Analysis of junior high school students in Padang City, including analysis of students' science process skills. An overview of the students' skills in the science process skills is obtained by providing a science-process exam to junior high school students who have implemented the 2013 Curriculum. Exam on process science skill given to student of SMPN 1 Padang, SMPN 12 Padang and SMP Nasional Padang. (d) Analysis of learning, the result of learning analysis is a description of the implementation of science learning in class VII, such as the model and the approach used by teachers. (e) The literature review is conducted by analyzing theories and concepts related to the research.

3.2. The design phase

The initial stage of R & D research is product planning. This stage includes: (1) the product's objectives, (2) the product's target audience, and (3) a description of the product's components and how they will be used[14]. The product developed in this research is problem solving model for science learning, and the target audience is the science teacher of SMP class VII. The resulting product component is problem solving model for science learning which consists of syntax, reaction principle, social system, support system, instructional impact and support. The use of problem solving model in science learning will improve students' science process skills.

3.3. The development phase

The development stage consists of three steps of activities: a) designing a prototype, b) perform formative evaluations and c) prototype revisions.

a. Designing a prototype

The prototype design activity begins by devising a problem solving model for science learning that is documented in book. This model comes with Student Book, and LKPD.

The preparation of students' books is based on the signs issued by Kemendikbud on the rules of student book writing. Student books are developed to support the implementation of problem solving models in the classroom. Therefore, in the book students are provided

"problem solving corner" which provides an overview of the steps of problem solving for students.

In addition to student books, the model also comes with LKPD. LKPD in detail practice problem solving in students. LKPD is prepared for each meeting. LKPD contains: topic; purpose of activity, discourse, problem formulation, hypothesis / prediction / inference, tools and materials, work steps, observation data, questions, and conclusions. This step produces a draft 1, which then enters the formative evaluation phase.

b. Conduct formative evaluation

The next stage in the development phase is formative evaluation. Borg & Gall [14] call it *as justice expert or expert validity*. Formative evaluation is intended to get feedback from experts as a product revision before use. Formative evaluation in this research is validation test activity by expert. Selection of experts is based on the background of expertise, needs, and object of research.

c. Revision of prototype

The next step in the development stage is the revision of the prototype. After the validity test, a revision is made according to the input received. The revised result is a prototype 2 draft of the problem solving model for science learning that is ready to be tested on a limited basis. Revisions are made based on input from experts. Expert judgment must be in a valid category, and once the product is valid, it is new to use. If the expert recommends improper it will be revised again and the formative evaluation phase will be repeated. If the results of the expert's assessment have declared a valid prototype, then the research continues at the next stage

3.4. Implementation phase

Implementation stage is done through limited trial. A limited trial is a beginning of qualitative evaluation of the product to be produced [14]. A limited trial was conducted on 24 and 26 August 2015 in Class VII 2 SMPN 12 Padang. At the stage of the trial, the researchers asked the teachers to run the model of problem solving to learning science and the use of devices that have been prepared. Researchers follow the learning process and record events during the process. After a limited trial, a discussion was held with the teacher to get feedback on the syntax of the model and learning device used. After a limited trial process, Focus Group Discussion (FGD) was conducted. FGD is product validation by practitioner that is science teacher. FGD purpose is to get feedback on products developed from practitioners in the field. The FGD was held on October 2015 at SMPN 1 Padang.

3.5. Evaluation phase

In accordance with the ADDIE model evaluation stage of which aims to obtain empirical evidence of the results of the model developed in the student, then make a diagnosis and revision according to the diagnosis. At this stage the experiments were expanded in experimental form. The aim is to determine whether the products meet its performance objectives. The expanded trial is done in experimental form.

In this study, field tests used quasi experimental design in the form of Static-Group Comparison Design. Field test model problem solving for science learning, conducted in junior high schools that have implemented the 2013 curriculum. SMP which has

implemented the 2013 curriculum in Padang City is SMPN 1 and SMPN 8 Padang, for schools with good category (high level). SMPN 12 and SMPN 31 Padang for middle level. SMP SIMAK and Junior High National for school with category less (low level). For the field test each school was taken from each category [3] by lottery technique. Selected schools are SMPN 1 Padang, Padang and SMP SMP 12 National Padang. From each school 2 classes are taken for testing. In SMPN 1 Padang was chosen class VII F for experimental class and class VII E for control class. In SMPN 12 Padang was chosen VII 2 class for experimental class and class VII 1 for control class. While in the National Junior High School for class VII there is only one class that serve as experimental class. Implementation of this learning model conducted for 8 weeks (16 times of meetings).

3.6. Research instrument

The instruments used in this study can be grouped into: (1) validation instruments, (2) instruments of practicality consisting of the practicalities of the learning model; the practicability of the device according to the teacher; the practicability of the device according to the students, (3) the instrument of effectiveness includes the instrument of attitude observation; instruments of knowledge aspect assessment; and science process skill assessment instruments.

3.7. Data analysis technique

The data obtained through the instruments that have been expressed previously then analyzed by analytical techniques as follows:

1. Data analysis of validity problem solving model for science learning

Validation results are analyzed descriptively qualitatively by analyzing various inputs to obtain valid problem solving models for science learning. While the results of quantitative data are analyzed descriptively quantitative.

2. Analysis of practicality data model problem solving for science learning

Stages to determine the model's practicality were adopted from Haviz's research [15], where this practical aspect is determined from the implementation of the learning model. The model implementation data in the learning is obtained from the observer by using the observation sheet. Observers are two people. Analysis of learning implementation data is done by following procedure:

$$R = \frac{\sum_{i=1}^n V_{ij}}{nm} \quad (1)$$

While R is the average result of the assessment from the observer, V_{ij} is score of assessment result of observer to-j against criterion i, n is the number of observers who judge and m is the number of criteria assessed.

Table 1. Criteria for the Implementation of Learning

Performance value	Performance Criteria
$T > 3,20$	Everything is done
$2,40 < T \leq 3,20$	Sebagian besar terlaksana
$1,61 < T \leq 2,40$	Mostly done
$0,81 < T \leq 1,60$	A small part is done
$T < 0,80$	Nothing happened

Adopted from [16]

The criteria used to determine the problem solving model for science learning meet the practical aspect seen from the implementation, When the minimum value T is within the criteria largely accomplished. If the value of T does not reach the minimum value, then it needs to be revised, especially on the unattended aspects.

4. Results and Discussion

This research is based on the development stages of ADDIE includes: analyzing, design, develop, implement, evaluate. The results are described as follows.

a. Analyze

In the analysis phase, the need analysis of the problem solving model for science learning in the field at this time. Based on the analysis of KD in KI 2 it can be concluded that science learning in junior high school should train students' scientific attitude like curiosity, objective, honest, meticulous, diligent, responsible, open, critical, creative, innovative and environmental care. A scientific attitude is manifested both in classical learning and collaborative or cooperative as stated at KD 2.2. To achieve KD in KI 2, the problem solving model for science learning is applied with group learning, whereas the expected scientific attitude is achieved honestly, thoroughly and responsibly.

Analysis of KD in KI 4 then the science process skills that must be achieved in science learning of SMP is to communicate, and make observations as mentioned in KD 4.1 and 4.2. Another skill is practicum skills in KD 4.1.

Analysis on the KI KD 3 concluded Material Organization System Life has 5 sub subject that cell as a structural and functional unit of life, tissues, organs, organ systems and organisms. Material Changes in Nearby Objects have two sub-subjects: the changes of things that exist in everyday life and the separation of the mixture.

b. Teacher analysis

The analysis of teachers is done because the teacher as a user of model problem solving for science learning in the field. The results of the analysis of science teachers in Padang City are as follows. 1). 35% of science teachers in Padang City understand the steps of problem solving. 2). 41% of science teachers in Padang City understand the role of teachers in learning with problem solving. 3). 91% of IPA teachers of Padang City agree that the problem solving model is appropriate for the Curriculum 2013.4) . 91% of IPA teachers in Padang agree that problem solving skills need to be trained on students. 5). . 66% of science teachers in Padang City understand that one of the goals of science learning is to practice problem solving skills.

This analysis shows that almost half of science teachers of SMP in Padang do not know that problem solving skill is one of science learning objectives in elementary education. Most teachers do not understand the steps of problem solving and the role of the teacher in the learning with problem solving. But almost all science's teachers of Padang City agree that problem solving needs to be trained on students

c. Student analysis

Student analysis is performed to see the characteristics of students, such as age. From the students data, it was revealed that the general student sitting in class VII have ranged between 12-13 years of age. According to Piaget's learning theory, the main characteristic of development at the formal operational stage of age 11 / 12-18 is able to think abstractly, logically, and able to develop a hypothesis. At this age, students are included into the category of individuals who are able to develop their cognitive potential that has been trained in the use of media including teaching materials LKPD.

Another characteristic is the science process skills of students of class VII. Preliminary test results on the science process skills as a description of the problem solving ability of

students class VII Padang showed an average below 50%. Observation skills, and designing experiments respectively 47% and 39%. Predicting, asking questions and preparing hypotheses 18%, 40% and 27%. Compile conclusions, make inferences, apply ideas to new situations and classify 40%, 34%, 44% and 34% respectively. A high enough ability is to use simple equipment 84% and make measurements 61%. This result shows from 10 students, then 3 or 4 people who have problem solving ability.

4. Learning analysis

Analysis of the implementation of learning in class VII implemented with observation techniques. The first observation was conducted on peer-teaching of the 2013 Curriculum Implementation Training on 22-26 June 2014. At the time of application of the scientific approach in the classroom, teachers are generally not problematic in carrying out activities observing, gathering information, and communicate. But almost all teachers have difficulty when implementing the activities of the questioning.

All observed teachers (71 people) used the discovery learning model. The first phase of the discovery learning model is the problem statement. But most teachers are not able to carry out that phase.

b. Design phase

Based on literature studies related to model construction, theoretical basis, and learning activities, the syntax of problem solving model for science learning includes introduction, observation, initial problem, collecting data, organizing data, analyzing / generalizing data, communicating. This syntax is adopted from problem solving activities proposed by Carin [9].

In accordance with science characteristics consisting of science products, science processes and attitudes, then a suitable learning model is a group of information processing models, and social groups. So the problem solving learning model in this research will be developed by modifying the two groups of learning models. Based on literature study related to model construction, theoretical base, and learning activity, the syntax of problem solving model for science learning includes introduction, observation, initial problem, collecting data, organization data, analysis / generalizing data, communicating. This syntax is adopted from problem solving activities proposed by Carin [9].

In the design phase of this study formulated the goal of syntax problem solving model for science learning, description of each syntax, the role of teachers and students, as well as supporting tools. The syntax of problem solving model for science learning begins with the introduction. Introduction is important in learning, therefore it needs to be carefully planned. The thing most students remembered during the lesson is the first 10 minutes and the last ten minutes.

The observations referred to in this model are the use of one or more sense devices such as sight, listener, smell, touch, and taste for collecting information [17]. Observation is useful to improve students' curiosity so that learning becomes meaningful. The science process skill contained in the observation activity is observed. Observing can be done by reading, listening, listening, watching, watching, etc. with or without tools [18]. In this research, the observation phase is done by reading the discourse that has been prepared in LKPD.

The initial problem is the next phase in the problem solving model for science learning. Formulating the problem is an important activity in problem solving. According to Piaget, problem formulation is one of the most important and creative parts of science that is often overlooked in science education [19] further states today that educators often

advocate "problem solving", but we seldom hear the importance of "problem creation" and ask questions.

Problems are questions that arise from students after observation. Problems can be questions about what they do not understand, or in the form of curiosity to get additional information. Problems can be simple questions. Problems in the problem solving model for science learning, are simple questions that students will answer after learning.

In this research the initial problem phase is done by filling the "problem formulation" column in LKPD. To train the seventh grade students able to formulate the problem then in the column "problem formulation" given the signs to formulate the problem. For example, by guiding students to create questions that begin with one of the questions asked (4W + 1H), what, when, where, why and how. Next gives the question word at the beginning of the problem formulation, students proceed by filling in the prepared points. This also applies to train students to formulate hypotheses (Rezba, TT). Scientific process skills that are trained in this phase are, ask questions, formulate hypotheses, make inferences or make predictions[17].

The next phase is to collect data / information. Collecting data can be through experimental activities in the laboratory, through literature review, observing events, objects or activities and ask the experts. According to Carin [9], this activity serves to improve the students' skills in obtaining information, developing vocabulary, measuring, recording / recording data, using numbers, manipulating materials (utilizing other materials of the same function).

In order for this activity to run smoothly, then the teacher must prepare well. In this study tools, materials and procedures that must be done in student collecting data have been written in LKPD. Scientific process skills that are trained in the phase of collecting data / information is observing and measuring [17]. Activities undertaken by students in the form of exploring, trying, discussing, demonstrating, imitating, conducting experiments, reading sources other than textbooks[18].

Organization data is the activities of grouping data according to certain rules, change the data into graphs, presents data in the form of tables, charts, diagrams. This activity is to train students accustomed to record data well, grouping data, changing data in the form of tables, and graphs. Products generated in this phase are calculations of data, carta, tables, graphs, groups or groups of information, outlines, and disaggregated objects. Scientific process skills trained in this phase is to create data tables.

Phase-6 is the analysis and generalization of data included in this activity is to process the information that has been collected from the results of data collection activities on the experiments as well as the results of observation activities. This activity aims to develop skills in the identification of variables, inference, interpretation of data, develop ideas, develop models, generalize, take conclusions, and predict. To facilitate this activity teachers should prepare LKPD, which helps students develop their reasoning power through questions.

Communicating is the last stage of the problem solving model for science learning. Communicate contains activities of submitting observations and conclusions orally, in writing or other media. In this model communicate is done orally in the form of class discussion.

Communicating has several important goals, firstly improving students' thinking ability[12]. Informing students about something does not necessarily make them understand, but communicating and discussing a topic will help students strengthen and expand their knowledge.

The second goal is to increase student engagement. Communicating activities will increase the student's responsibility for his or her learning and should not be totally

dependent on the teacher. Communicating also aims to help students learn important communication skills and thought processes. Developing honest, meticulous, tolerant, systematic thinking, expressing opinions briefly and clearly, and developing good and correct language skills [9, 12].

The next model component is the social system. The social system describes the role of teachers and students in learning. In accordance with the philosophy of learning that is used as the foundation of progressivism, then the learning on this model centered on students and give greater emphasis on creativity, activity, naturalistic learning, authentic assessment and peer experiences. Students perform learning activities in the form of, observing, measuring, counting, thinking, generalizing and providing assistance to peers in need.

Teachers act as a motivator, with the motivation in students when formulating the problem, when guiding the discussions etc.. The teacher also acts as a facilitator. As a facilitator, teachers prepare all the tools needed for learning, creating an atmosphere that enables the learning activities to run smoothly. Teachers also act as mentors, and reflectors.

The next model component is the reaction principle. Principle of reaction problem solving model on science learning, explaining how teachers appreciate, place and respond to actions undertaken by students. Some activities on the problem solving model, are still relatively new for students, for that teachers need patience in guiding and directing. These activities are identifying problems, formulating problems, formulating questions, formulating hypotheses.

Learning activities in this model use cooperative learning. Cooperative learning is useful for empowering peer roles to provide learning assistance to other friends. Nevertheless, sometimes cooperative learning makes students bored, therefore teachers should be creative in rewarding the most active groups. In addition to group awards, teachers should also reward individuals who exhibit positive activities, such as asking questions, responding to friends' questions, refuting, giving appropriate arguments and so on.

Teachers must be creative in determining which group should present the results of the discussion, if the performing is not all groups. Determination of the group can appear with a variety of games, so the group did not feel forced. Teachers should also reward the group performing. Awards can be stellar images of cardboard, "smile" pictures etc. This drawing card is group collected. The group that gets the most pictures means the most active group. Such awards can help motivate students to learn.

The next model component is a support system. Support system for problem solving model in science learning is model book, student book, and LKPD. The support system provided helps the teacher in applying this model. In the book students have been provided "problem solving corner" which gives an idea to the students how to do problem solving steps.

In addition to student books, the model also comes with LKPD. LKPD more detail to train problem solving in students. LKPD will greatly assist teachers in applying problem solving models to science learning.

The impact of the learning model consists of instructional impact (direct impact) and impact accompaniment (indirect impact). Instructional impact of mastering the concept of science, science process skills and the impact of accompaniment in the form of values and attitudes. Mastery concepts include the concept of Science Objects and Their observations; Classification of Objects; System of Life Organization; Material Changes. The next instructional impact is the science process skill. Scientific process skills include basic science process skills in the form of observation and classification; processing skills

in the form of prediction and inference; integrated science process skills in formulating problems, asking questions, writing procedures, identifying experimental materials, inductive thinking as well as deductive in concluding, identifying variables, interpretation of data.

Impact accompaniment of scientific attitudes and social attitudes. Scientific attitude in the form of: curiosity, thorough, honest, discipline, obey rules, hard work, the ability to apply procedures. While social attitudes of being polite, respecting the opinions of others, the ability to communicate with good and polite language. Impact accompaniment is known through observation during the lesson.

c. Develop phase

The development stage consists of three steps: 1 designing prototype, 2 doing formative evaluation and 3 prototype revisions.

1. Design the prototype

The activities of designing prototypes begins by devising a model problem solving for science learning which is documented in book form, as well as model supporting tools in the form of student books and LKPD.

a. Model book

The problem solving model book for science learning contains four parts: one is rational, part two supporting theory, part three component model problem solving for science learning, part four is the implementation of science learning with problem solving model.

b. Student books

Student books are developed to support the implementation of problem solving models in the classroom, so students' books are provided with the "let's experiment" section that provides an overview of problem solving steps. In this activity students are trained to develop thinking skills and solve problems that are guided by problem solving steps.

In this section there are four columns of varying colors to make it more appealing to students, each column representing a problem solving step. The giving of varied colors aims to increase students' interest and motivation in learning. In the student book there are subject matter that must be mastered by students. On some pages there is a "remember" column that contains important material that students must keep in mind.

c. LKPD

LKPD (Student Activity Sheet) is a student activity sheet that contains problem solving steps consisting of problem formulation, hypothesis, data collecting, data processing, and concluding as solution of problem solving.

Discourse columns in LKPD are useful to guide the implementation of the observation stage in the problem solving model for science learning. In this research, the observation phase is done by reading the discourse that has been prepared in LKPD. Observation is useful to improve students' curiosity so that learning becomes meaningful. The science process skill contained in the observation activity is observed. Observing can be done by reading, listening, scrutinize, take a look at, watching, etc. with or without a tool [18].

5. Conclusion

Based on the development research done, the syntax model problem solving for science learning at junior high school consists of the introduction, observation, initial problems, data collection, data organization, data analysis/ generalization, and communicating.

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