Validity of physics module nuanced model of process oriented guided inquiry learning (POGIL) to improve scientific literacy at 10th grade senior high school

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Abstract. The module should be able to make students to learn independently and actively in learning such as demands in the curriculum 2013. But the facts found in the field that the module that is used has not contained the learning model recommended in the curriculum 2013 and still not linked to the concrete concept in the daily life of participants educated, so the students are still less active and unable to learn independently. This type of research carried out in the form of research and development using revess a model that consists of four phases: problem analysis, solution, iterative testing and refinement phase, implementation. This study aims to determine the validity of Physics model modules nuanced Process Oriented Guided Inquiry Learning (POGIL) to improve scientific literacy. This subject is a student of grade X SMAN 1 2x11 Kayutanam. Based on the validity of the analysis, data from the Process Oriented Guided Inquiry Learning (POGIL) module obtained results, the validity of the contents in the average category 0.89, the construct validity of 0.84, the validity of the language with 0.875, and the graphics with 0.9. Furthermore, the results of Physics module nuanced model Process Oriented Guided Inquiry Learning (POGIL) are categorized by valid criteria.

1. Introduction
The development of education in Indonesia so far is still not encouraging. This is indicated by the low outcome of the Program for International Student Assessment (PISA) of Indonesian children from time to time. The 2012 PISA results state that the Literacy of Science of Indonesian children is ranked 64th out of 65 participating countries. Literacy of science is closely related to various problems in everyday life and uses scientific knowledge based on facts that exist in understanding the universe. Indonesian students received a score of 382 scientific literacy scores with an average score of all participating countries is 500. According to an analysis conducted by the Organization for Economic Cooperation and Development (OECD), the scientific literacy score in the range between 335 ≤ 409 points is included in the level 1 or lower than that. Skills of learners at this level have limited science knowledge and can only be applied to some situations. Learners at this level can only provide easy scientific explanations and follow explicit evidence provided [1]. It illustrates in general the ability of learners in Indonesia is still low and far from expectations that cause the quality of education in Indonesia is still not optimal.
In order to improve the quality of education in Indonesia required a proper learning plan. To improve the quality of education, it is necessary efforts of various parties, in order to create active, systematic, competitive generation in the development of science and technology (IPTEK) so as to compete in the world of work. Efforts to improve the quality of human self can not be separated from the education process. Education can shape human beings with character according to educational goals and national goals of the nation. national education functions to develop the ability and form the character and civilization of a dignified nation [2]. The definition of education in the Law of the Republic of Indonesia Number 20 Year 2003 materialized when the learning process is implemented in accordance with the applicable curriculum.

The curriculum is one of the most strategic components of education because it is a set of plans and arrangements concerning objectives, content, and instructional materials and ways used as guidelines for the implementation of learning activities to achieve specific educational goals [3]. The 2013 curriculum is designed to provide the widest learning experience for learners in developing the ability to be attitude, knowledge, and action. In the 2013 curriculum used a scientific approach, which is described by the term 5M: to observe, ask, reason, tries, communicate. Teachers should be able to understand well the demands of the curriculum and can implement in learning, especially in physics learning. Competencies that must be possessed by students in studying physics one of them is showing scientific behavior (have curiosity, objective, honest, meticulous, diligent, careful, responsible, open, critical, creative, innovative, and cares environment) in activity everyday as a form of implementation of attitude in conducting experiments and discussions [4]. In order for physics learning is created properly should teachers prepare good teaching materials also in accordance with the curriculum 2013. However, the reality that occurred in the field based on the results of interviews physics field study at SMAN 1 2x11 Kayutanam states that teachers do not use the materials in accordance with the curriculum of 2013 where the teaching materials used do not contain the steps of the scientific approach and also have not used the model recommended by the curriculum 2013. This is also due to the implementation of the curriculum 2013 is also new in the school. Teaching materials used are in the form of modules designed by the teacher himself, although there are still many shortcomings contained in the module.

The module is a book written with the aim that learners can learn independently without or with teacher guidance [5]. The components of the module include three parts: (a) the opening section consists of: (1) title, table of contents, information map, list of competency objectives, preliminary tests, (b) core parts include: (1) relationships with other materials when the material is available on modules, material descriptions, assignments, summaries, (c) coverings include: glossary, final test, index. In fact the teacher-only module only focuses on the material and the questions are not as expected in the 2013 curriculum that puts forward the scientific approach. It affects the weak understanding of students about the concepts of physics that should be observed through the symptoms in everyday life or phenomena that occur in nature. As a result, have an impact on the low achievement of learners in Indonesia. In order for the learning of physics is created properly should teachers prepare good teaching materials also in accordance with the curriculum 2013. Learners should have good knowledge and understanding and able to solve problems in order to live harmoniously with modern environment. A knowledge gained by learners will be very meaningful if the knowledge is applied to solve problems in everyday life. In addition, if learners build a culture of scientific literacy will give birth to learners who are able to understand the development of science of the future.

PISA defines scientific literacy as the capacity to use scientific knowledge, identify questions and draw conclusions based on existing evidence and data in order to understand and help make decisions about the natural world and human interaction with nature [6]. Literation of science developed into four dimensions:

Content Dimension (Knowledge Science). PISA does not specifically limit the scope of science content only to the knowledge that the school science curriculum, but also the knowledge obtained through other sources of information available. Science content refers to the key concepts of science needed to
understand natural phenomena and the changes made to nature through human activity. In this connection PISA does not specifically restrict the scope of science content only to the knowledge that the school science curriculum provides, but also the knowledge gained through other available sources of information. Aspects of science content include two indicators: knowledge (basic concept basis) and conceptual understanding. The content criteria of science include: (a) relevant to real situations, (b) is an important knowledge so that its use is long term, (c) Combination of knowledge with related science concepts.

**Dimensional Process of Science.** The dimension of the science process refers to the mental processes involved when answering a question or solving a problem, such as identifying and interpreting evidence and explaining the conclusions. These include the types of questions that science can and can not answer, recognize what evidence is required in a science experiment, and recognize conclusions that match the evidence. Indicators of the scientific process include: Explaining the phenomenon scientifically, Identifying scientific questions, Using scientific evidence.

**Dimension of Science Context.** PISA assesses that science knowledge is relevant to the science education curriculum in the participating country without limiting itself to the general aspects of the national curriculum of each country. The PISA assessment is framed in a broader public life situation and is not limited to school life alone. Performance indicators are tailored to the interests and lives of learners. These indicators include applications in the field of physics and other field applications both personally, socially and globally. The performance indicators are focused on situations related to the individual, families and groups of individuals(personal), the community(social), and life cross-country (global) such as health, natural resources, environmental quality, hazards, the latest developments in science and technology.

**Dimensions of Science.** Attitudes Attitude is a representation of learning outcomes to produce learners who have faith and noble strives that are applied in the lives of learners. Measurement tools literacy science learners developed in accordance with the conditions of these learners. The low ability of scientific literacy is due to science learning only emphasize on the mastery of the material, in science learning should learners be more exposed to the facts or facts that exist in their daily lives. The reality in the field students have not too analyze the scientific literacy based on data analysis of students' scientific literacy ability obtained from SMAN 1 2x11 Kayutanam which shows the ability of scientific literacy students are still not optimal [7].

Based on the data in the field of scientific literacy ability of students in SMAN 1 2x11 Kayutanam still not optimal because many students who have not known about scientific literacy. In addition to the ability of scientific literacy is still low learning activities of students who have not been optimal both in terms of modules used are not in accordance with the demands of the curriculum resulted in low physical learning outcomes. Therefore, teachers should have more creativity to facilitate learning resources in learners in order to support the learning process. One of them is by developing the existing module become more interesting and ease the understanding of learners concept in physics learning by making the module which is combined with Learning Process Oriented Guided Inquiry Learning model (POGIL) that is oriented learning using guided inquiry approach. A POGIL learning activity engages students, promotes restructuring of information and knowledge, and helps students develop understanding by employing the learning cycle in guided inquiry activities. The learning cycle consists of five stages or phases: orientation, exploration, concept invention or formation, application and closer [8]. Thus, POGIL learning activities involve learners, promote the restructuring of information and knowledge, and help students develop understanding by using the learning cycle in guided inquiry activities. The learning cycle consists of five stages or phases: orientation, exploration, concept or formation, implementation, and closing.

The advantages of the POGIL model are that learners can process information, critical thinking, problem solving, communication, teamwork, management and self-assessment, while the teacher as a facilitator observes student group work, answers questions, and interventions if necessary. This model can develop the creativity of learners to be able to understand the concept of physics well through the phenomena in everyday life. Therefore, researchers interested in conducting analysis of the
characteristics of learners in the dimension of scientific literacy on to develop Physics Module Nuanced Learning Model Process Oriented Guided Inquiry Learning (POGIL) to increase scientific literacy of learners in grade X SMA. The objective of the research is to develop the Nuanced Physics Module Learning Process Oriented Guided Inquiry Learning (POGIL) model to improve the valid scientific literacy of learners.

2. Research Methods

The type of research conducted in the form of research development (research and development). In this case developed a learning model nuanced model of Process Oriented Guided Inquiry Learning (POGIL) to improve the ability of valid scientific literacy. This development research uses development model Reeves models. This module development process consists of four stages, namely the phase of problem analysis, the solution to the problem (solution), iterative testing and refinement phase, and implementation phase. The instrument used in this research is validity, where the validity questionnaire is arranged according to scale Likert. The research data is collected through module validation by using validation sheet by experts and education practitioners in accordance with the field of study. Validation analysis performed using scale Likert with the following conditions: strongly disagree = 1, disagree = 2, agree = 3, strongly agree = 4. The validity analysis uses Aiken's V formula

\[ V = \frac{\sum r}{n (c - 1)} \]

Description:
- \( s = r - lo \)
- \( lo = \) The lowest validity score (in this case = 1)
- \( c = \) The highest validity score (in this case = 4)
- \( r = \) The number given by an evaluator

The module validity category is based on the final value obtained can be seen in Table 1.

| Achievement Rate | Category |
|------------------|----------|
| \( \geq 0.6 \)   | Valid    |
| <0.6             | Invalid  |

3. Results and Discussion

Research undertaken is Research and Development. In this case developed a Physics module nuanced model of Process Oriented Guided Inquiry Learning (POGIL) to improve literacy ability of students' science. This research refers to the development model Reves.

Initial phase is done stage problem analysis, is the step of analysis of problem analysis. This stage is done through the initial preliminary analysis, analysis of the characteristics of learners about the ability of scientific literacy, and material analysis. In the material analysis the researcher identifies the essential concepts of business material and energy. Viewed from the material presented from the existing teaching materials learners have difficulty in understanding the concept because learning is only focused on the meteri and the problems alone, thus impacting on the weak understanding and interests of learners on learning Physics. Based on the results of interviews with educators that educators have difficulty in learning because students have low interest in reading, they do not read the material that will be studied previously at home.

The module used has not been able to demand the liveliness of learners in understanding the concept of Physics, especially related to daily life. Therefore, it is needed instructional media one of them module to minimize problem from study of physics. Modules are designed to motivate learners in Physics lessons and facilitate educators in delivering lessons so that learners can solve the Physics problems to form competent, creative, critical, and have good achievements in the field of Physics and in everyday life. While based on the analysis of the characteristics of learners on the ability of
scientific literacy is still low in the realm of knowledge (science content and science context) with the percentage of acquisition of 56.68% and 56.25%, it can be concluded learners can not use the initial knowledge possessed by both as well as learners have not been able to apply science either in the field of physics or other science in everyday life. While in the aspect of science or skill process that is 55% means learners are still minimal learning to use laboratory because the learning that last for only emphasized on mastery of material and educator very rarely do learning activity of laboratory. Furthermore, the dimensions of science attitudes obtained 59% results and classified as low.

The low dimension of science attitude of learners is because learners have not shown the spirit in the learning process, rarely ask about things that are not understood to educators. In addition, learners also do not get used to repeat learning at home, so that in daily learning learners less active and difficult to receive learning quickly. After that done phase solution, at this stage done module design. The components of the module include three parts: (a) the opening section consists of: (1) title, table of contents, information map, list of competency objectives, preliminary tests, (b) core parts include: (1) , relationships with other materials when the material is available on modules, material descriptions, assignments, summaries, (c) coverings include: glossary, final test, index. After the module design stage, furthermore the preparation of research instruments.

The next stage is iterative testing and refinements, at this stage carried out scrutiny of modules that have been designed, assessment and evaluation by experts. Validation module is done by 3 expert validators and 2 practitioners. The experts reviewed the contents, constructs, languages and graphics of the module. Expert advice is used to revise developed modules. During the validation process there are several suggestions from the validator to the modules that have been designed presented in Table 2.

| Table 2. Validator Suggestions |
|--------------------------------|
| **Before Revision** | **After Revision** |
| 1. Note the use of language | 1. use of language has been considered |
| 2. Fix the cover | 2. Already fix the cover |
| 3. Make a scoring rubric on the module | 3. Already added the assessment rubric |
| 4. Put the POGIL model steps on the student activity sheet | 4. Already putting the model steps POGIL on the student activity sheet |
| 5. Match the module with the theory | 5. Already matching the module to the theory review |
This validation activity is conducted to gain input to the entire contents of the material contained in the module design. The validity of the module generated can be determined by validating the module by the validator. Validation results were analyzed to find out modules in terms of content, constructs, languages and graffi ti. Results of processing validator validation sheet validation can be seen in Table 3.

| Validation | Validator Expert | Validator Practitioner | Average V | Category |
|------------|-----------------|------------------------|-----------|----------|
| Content    | 0.9             | 0.875                  | 0.89      | Valid    |
| Construction | 0.87             | 0.814                  | 0.84      | Valid    |
| Language   | 0.875           | 0.875                  | 0.875     | Valid    |
| Graphics   | 0.86             | 0.94                   | 0.9       | Valid    |

Based on Table 3 it can be stated that Physics module nuanced model Process Oriented Guided Inquiry Learning (POGIL) to improving the scientific literacy capability is in a valid category because the V value of all aspects is above 0.6. The results of this validator assessment show that the module has qualified in terms of the feasibility of content, construction, language and graffi ti. Thus the modules developed can be used in school learning. After the stages of validation of the module is finished meal will be continued with the next phase of the phase Implementation, in this phase is done effectiveness module testing so that the module will be produced effectively used in learning.

4. Conclusion
Based on research result of physics module development nuanced model of Process Oriented Guided Inquiry Learning to improve scientific literacy ability of learners obtained average validation is 0.87 which is categorized valid. Thus, the Physics module nuanced model of Process Oriented Guided Inquiry Learning to improve literacy ability of students' science can be used as a learning resource.

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