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# The effectiveness of physics learning materials using problem-based learning model integrated with local wisdom

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**Abstract.** Preliminary studies show that many students have difficulty mastering the concept physics. Most students do not understand the physical material contained in the students' books. The implementation of learning is not related to the environmental conditions and the daily activities of the students. One model learning that can improve student competence is PBL model integrated with local wisdom. The learning materials that are implemented are student's book by using PBL model integrated with local wisdom. This study aims to determine the effectiveness of physics learning materials using PBL model that integrated local wisdom. The research method is quasi experiment with pretest-posttest one-group design. The research instruments are attitude observation sheet, achievement test, skill assessment sheet and student responses to learning implementation. The result of the research showed that physics learning materials using PBL model integrated with local wisdom was effective to improve the student's competence, in the case of (1) mastery learning of physics has been achieved by majority of students, (2) improvement the students competency including high category, (3) the average score of students responses to the learning implementation is very good category, this means that most students can implement physics learning materials using PBL model integrated with local wisdom.

## 1. Introduction

The progress of science and technology in the 21st century is growing very rapidly. To be able to adjust and compete with these developments required quality human resources and character. Education is a container that serves as a tool to build quality human resources. Therefore, the expansion of learning opportunities and the improvement of the quality of education should always be improved. One of the learning innovations that needs to be done is to update the learning resources according to the needs and characteristics of today's learners. With adequate teaching materials, learners can learn and discuss teaching materials before learning begins. In addition, teaching materials are also able to provide clear guidance on the competence to be achieved by learners. The availability of teaching materials of physics is now a lot, but most of the existing teaching materials physics, is still less able to be digested by learners, especially in schools that are located outside the



city or suburbs. This is because the style of language is too complicated, the issues raised are never experienced or known by learners, the images shown are less clear and tend to the pictures are still foreign to students digesting.

In learning physics teachers should strive to master the material to be taught so as not to cause misconception in the students themselves. Physics teachers must continue to develop themselves by studying the concept of physics in depth. The 2017 revised curriculum of 2013 requires an educator to apply literacy, 4C, HOTS and strengthening character education in physics learning. In addition, learning also uses a scientific approach and apply learning models in accordance with the characteristics of competence that must be controlled learners. One of the instructional models that government recommends is problem-based learning) which start its learning with phenomenon / problems that exist in nature and around learners.

The development of the material also needs to pay attention to compulsory textbooks and other sources, so that teachers can describe materials that are essential (essential) material that must be mastered by learners and development materials or applied materials as enrichment materials to add insight. Student book is a book of learning resources for learners. Science students' books are developed and used as a source of information in which there are facts relating to the concept of learning needed to enhance the creativity and skills of learners in order to form learners who are characterized [1]. The preparation of textbooks with the 2013 curriculum must be in accordance with predetermined rules or principles[2]. In addition, if possible, teachers can develop materials related to local wisdom, both contemporary / environmental material. The integration of physical materials with the identity or local wisdom surrounding the place where the learners live, not only aims to make it easier for learners to understand the material of physics but also to be more familiar with the surrounding culture that may begin to be replaced with the outside culture.

Based on the results of observations and interviews with teachers and learners who have done in SMA Negeri 1 Dua Koto, physics learning applied in schools has not been successful. This is caused by several factors including the methods used are still commonly used, the learning tends to teacher center, the lack of experimental activities and teaching materials used are in the form of textbooks that are less well understood by learners. Learners difficulties in connecting the concept of physics with the problems that exist in everyday life so that learning feels less meaningful. The unavailability of books that relate physics learning materials to local wisdom, as well as physics learning in the classroom is still in the context of only the provision of material only, not too stressed on the development of characters in accordance with local character. This is very influential on the achievement of the competence of learners. The average mastery of the students of X IA in academic year 2017/2018 in SMA Negeri 1 Dua Koto is 40.97%. This means that the majority of learners have not met the minimum criteria of teacher learning (KKM) that is 76.

To determine the cause of low physics competence, given questionnaires to learners about the learning process. Based on the questionnaire, it is known that physics learning is still centered on teachers, learners have not been actively involved in finding facts, concepts, and principles applied to solved physics problems in everyday life. Most learners have difficulty learning physics and performing tasks assigned by the teacher. The book the teacher uses is an existing book, not a book developed by the teacher. Although the book has been designed in accordance with the Curriculum 2013 and equipped with character values but the book is not in accordance with the recommended book structure. Judging from the content feasibility component, the book has included core competencies, basic competencies, and achievement indicators of competence, but has not stated the learning objectives to be achieved by learners. In addition, the concept map contained in the book has no relationship between material in the form of facts, concepts, principles, and procedures with competence. While in terms of presentation, the book already contains a scientific step, but the steps are only found on the worksheet and have not been able to motivate learners to learn independently.

To solve the problem in physics learning, one of the learning models that can be used is the problem based learning model integrated with local wisdom. Problem-based learning is a learning model that presents contextual problems that stimulate learners to learn. Problem-based learning is a

learning that challenges learners to think more in learning and to work cooperatively in groups to find solutions to problems. PBL is well suited to helping students become active learners because it situates learning in real-world problems and makes students responsible for their learning [3]. This given problem is used to tie learners to curiosity on the intended learning. Problems are given to learners, before learners learn concepts or materials relating to problems to be solved. Principles of PBL to be considered in their use include basic concepts, problem definition, independent learning, knowledge exchange and assessment. Problem Based Learning (PBL) is a learning model designed to get learners important knowledge, which make them proficient in solving problems, and have their own learning model and have the ability to participate in the team. The learning process uses a systemic approach to solving problems or facing the challenges that will be needed in everyday life. To apply this model there is a syntax or learning stage model that should be followed as follows: (1) orienting learners to the problem, (2) organizing learners to learn, (3) guiding individual and group investigations, (4) developing and presenting results works and (5) analyzes and evaluates the problem-solving process.

In addition, the government recommends to identify materials related to local wisdom / environment. Local Wisdom is conveyed to equip learners with the attitude, knowledge, and skills to: (1) recognize and love the natural, social, cultural, and spiritual environment of the area; (2) to preserve and develop the advantages and wisdom of the area that is useful for themselves and (3) the environment in order to support the national development. The local wisdom delivered in the lessons is adapted to the characteristics of KD-KI 3 and / or KD-KI 4 as well as the learning materials associated with the present / environment matter. Present / environmental material, is material that is being a topic of conversation or related to the environment and relevant to the subject matter or subject matter competence can be taught. Local wisdom-based education is the education which is based more on the enrichment of cultural value [4].

PBL learning model is an effective learning to improve students' understanding and competence, learners generate ideas, and discuss their ideas. The effectiveness of PBL models integrated with local wisdom depends on how the teacher implements the learning model. If there is a difference between prediction and observation, the teacher should be able to help learners to reconcile inconsistencies between predictive learners and observation.

Based on the physics learning conditions that have been explained then conducted research on the effectiveness of physics teaching materials using the model problem-based learning integrated local wisdom in improving the competence of learners. Research problem formulated as follows: How the effectiveness of teaching materials physics using model Problem-based learning integrated local wisdom to improve competence learners?

## 2. Material and Method

This research uses quasi-experimental with pre-test post-test of one group design [5]. The subject of research is class X IA 1 at *SMAN 1 Dua Koto* academic year 2017/2018 with number of 33 students. The research stage is: (1) conducting preliminary observation, (2) developing physics learning book using PBL model integrated with local wisdom, (3) validating instructional book, (4) developing research instrument, (5) testing learning book and research instrument, (6) analyzing data, (7) providing pre-test, (8) implementing learning using integrated local Wisdom PBL model (9) providing post-test, (10) analyzing data and interpreting the results. The research instrument uses observation sheets, learning result test, performance appraisal sheet and questionnaire of students' responses to the application of learning. Observation sheets are used in conducting preliminary surveys. The effectiveness of the implementation of learning materials is the result of learning from aspects of spiritual attitudes, social attitudes, aspects of knowledge and skills aspects. Improved learning outcomes of learners were analyzed with normalized gain scores from pre-test and post-test scores,  $N\text{-Gain} <g> = (\text{post-test score} - \text{pre-test score}) / (100 - \text{pre-test score})$  [6 ].

## 3. Results and Discussion

The effectiveness of the application of physics learning materials using PBL model integrated local wisdom in improving the competence of learners is based on: (1) mastery learners learn, (2) improvement of competence learners, (3) learner's response to the implementation of learning. Further analyze each of these aspects to determine the effectiveness of the implementation of textbooks.

### 3.1. Student Learning Mastery

Data on the competence of learners in the sphere of attitude gained from the observation of learners during the learning process. Assessment of learners' attitudes is done at each meeting by observers using observation sheets of spiritual attitudes and social attitudes consisting of four aspects of assessment. The result of learner's attitude can be seen in Table 1 and Table 2.

**Table 1.** Student Learning Mastery in the Spiritual Attitudes Domain

Sessions	Average criteria	Learning mastery (%)
1	Good	84.8
2	Good	87.9
3	Good	100

**Table 2.** Student Learning Mastery in the Social Attitudes Domain

Sessions	Average criteria	Learning mastery (%)
1	Good	78.8
2	Good	87.9
3	Good	100

Based on Table 1 and Table 2 it can be seen that the spiritual attitudes and social attitudes of learners have increased based on the average score from the first meeting to the third. From these results it can be concluded that the spiritual attitudes and social attitudes of students classically over 85% are categorized well. It shows that effective learning books to enhance learners' competence on aspects of spiritual attitudes and social attitudes.

Competence aspect of learner's knowledge seen from result of essay test every meeting. The results of the mastery analysis of learners' learning in the knowledge domain can be seen in Table 3. Table 3 shows that each meeting has a percentage of competency achievement of learners. The average value of all three meetings was 80.82 with the average percentage of learning completeness classical learners was 85.83%. From these results, it can be concluded that learners learn mastery over 85%, which states that effective learning book in improving the competence of learners for the knowledge aspect.

**Table 3.** Student Learning Mastery in the Knowledge Domain

Sessions	Average value	Learning mastery (%)
1	75.18	72.7
2	80.21	84.8
3	87.06	100
Average	80.82	85.83

Assessment of the competence of learners on skills aspect is obtained when learners do practice. Assessment of the skills of learners is done at each meeting by teachers using skill assessment sheets. The results of the skills assessment of learners can be seen in Table 4.

**Table 4.** Student Learning Mastery in the Skills Domain

Sessions	Average value	Learning mastery (%)
1	79.29	72.7
2	84.47	87.9
3	88.51	100

Based on Table 4 it can be seen that the skills of learners have increased based on the average value from the first to the third meeting. From these results, it can be concluded that the skills of learners are classically more than 85%. This shows that the learning book is effective in improving the competence of learners in the realm of skills.

### 3.2. Improving Student Competence

Increased competence of learners on the knowledge aspect is analyzed by using a normalized gain score. In Table 5 it can be seen that the competence of learners in the domain of knowledge has increased. The score gain value is in the high category.

**Table 5.** The effectiveness of the learning materials

Mean of Post-Test	Mean of Pre-Test	N-gain	Category
86.36	51.82	0.72	High

Based on the results of data analysis that has been described can be concluded that: (1) mastery learning has been achieved by most learners, (2) Improving the competence of students including high category, (3) the average score of competence learners have increased. Thus, it can be concluded that physics learning materials using PBL model integrated local wisdom is effective to improve the competence of learners.

### 3.3. Student Response to the Implementation of Learning

The results of data analysis of the learners' responses to the implementation of the learning shows that the average score of the learners' responses is 83.06 with the standard deviation of 4.28 and is classified as excellent. The scores categories of learners' responses are based on ideal scores and ideal standard deviations. This indicates that many learners can use the problem-based learning book integrated with local wisdom.

Based on the results of data analysis obtained can be concluded that: (1) mastery learning can be achieved by the majority of learners, (2) improvement of competence of learners including high category, (3) the average score of the responses of learners to the implementation of learning is category is very good. So it can be concluded that the book problem based learning integrated local wisdom is effective to improve the competence of learners.

### 3.4. Discussion

Physics learning goals in SMA / MA that must be owned by students are: 1) understanding the surrounding natural phenomena, based on the results of science learning through the fields of physics; 2) solve the problems faced in his life, especially choosing among the ways that man has known by scientific judgment; 3) recognize and appreciate the role of physics in solving the problems of mankind; and 4) to understand the impact of the development of physics on technological developments and human life in the past, as well as its potential future impacts on himself, others, and the environment.

To achieve these objectives, teachers must carry out exploration and experimentation activities. One of the supporting factors for the achievement of objective physics learning is teaching materials. Teaching materials play an important role in the teaching and learning process of physics, by presenting signs and explanations to learners and making learners understand these signs and explanations. Teaching materials provide a great deal of hospitality in the ability of teachers to convey the message to learners accurately, precisely, clearly and understandably, in making abstract knowledge concrete and enabling learners to understand complex ideas through simplification [7]. Teaching materials can facilitate learners to learn independently. Therefore, teaching materials should be developed so that learning can achieve the goal. One of the teaching materials is a learning book. The book is a form of teaching material that is packed intact and systematic that contains a set of learning experiences and is designed to help learners master the learning objectives.

Physics Learning produces learners with the ability to understand and the scientific knowledge required for scientific research [8]. Lessons learned with the various models adopted, learning and teaching strategies and practice assessments stimulate the interest and motivation of learners to learn and behave.

Good learning outcomes demonstrated with a good attitude [9]. Research in physics education focuses on the study of the effects of different types of learning that serve as an alternative to understanding the concepts of learners [10]. Because the interest of student to study physics and achievement in physics is still declining, the current debate is to determine the best way how learners learn physics. Unfortunately, there is no best learning theory that is suitable for all learners and the solution in determining exactly what the educator must do is still vague [11].

PBLs enable learners to better understand science, improve learning achievement and develop the social skills of learners [12]. The ability to solve learners' problems using PBL models is better than using conventional learning [13]. The PBL model in physics teaching can help retain teachers' success and deep learning approaches and improve attitudes toward physics [14]. The use of integrated PBL models of scientific approaches and LKS characters can improve learning outcomes, both in terms of cognitive, psychomotor and character [15]. This definition requires the activeness of learners and with a collaborative or cooperative atmosphere. This involves a large amount of direct learning from learners [16].

Good learning materials are learning materials that match the needs of learners. Physics learning book is used as learning material in learning. Learning materials using integrated PBL model of local wisdom help the implementation of learning process. The effectiveness of learning materials seen from the improvement of competence of learners in aspects of knowledge, skills, spiritual attitudes and social attitudes after using physics learning books. Competence of learners on the knowledge aspect at the first meeting there are still many learners who have not mastered the material they learned. This is because at the first meeting learners are not familiar with the learning model used. They feel confused to follow the learning stage using the integrated PBL model of local wisdom.

In PBL learning, learners are given problems to be solved through hypothesis formulation and tested by experiment. This activity is able to make learners curious to learn more enterprising about the material being studied. In addition, in learning with the PBL model, there are experimental activities, discussions, presentations, and reporting. At the third meeting all learners experience completeness.

The competence of learners on the skill aspect is obtained from the assessment sheet observed by the observer at each meeting. On average there is an increase in the skills of learners at each meeting. At the first meeting of the learners are still difficult in using experimental equipment, reading, and recording experimental results are also not maximized so that the impact on the skills of learners. At the third meeting, there was an increase. In addition, with the integration of local wisdom, learners are motivated to learn because these learning tools are interactive and applied in the life of real-life experiences and situations of learners in teaching [17].

The competence of learners on aspects of spiritual attitudes and social attitudes shows improvement at each meeting. This increase occurs because the use of textbooks can ask learners to

find out for themselves and carry out experiments based on the concepts they have learned. Learners are independent and self-responsible in the learning process in the classroom and in everyday life. Learners are accustomed to discipline in performing tasks. Learners have shown hard work in answering summative questions of evaluation and formative evaluation. Learners learn with the help of textbooks so they can relate problems with learned concepts. Increased competence of learners is the impact of learning using the model of PBL integrated local wisdom. A local wisdom-based learning model that involves the reconstruction process, significantly improves the sustainability of learners towards nature from low to good visibility [18].

Local wisdom means reviving existing traditional knowledge and wisdom, adapting it to established goals, and gradually improving the lives of individuals, families, and communities so that people learn to better manage and understand their lives [19]. Physical learning using the PBL model effectively improves learners' competence in knowledge, skills, spiritual attitudes and social attitudes.

#### 4. Conclusion

The result of the research shows that physics learning materials using PBL model integrated local wisdom effectively to increase the competence of learners, in the case of: (1) learning mastery has been achieved by most of the students, (2) Increasing the competence of learners including high category, (3) the average score of the learners' responses to the implementation of the learning is a very good category means that most learners can implement learning using the integrated PBL model of local wisdom. Suggestions for physics teachers to apply learning using the integrated PBL model of local wisdom.

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