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***Research paper***



# Problem Solving in Learning Mathematics through ILMo Model

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**Abstract**

The education in Indonesia is currently focused on integrating science and religion. Therefore, the researchers develop Integrated Learning Model (ILMo) for Student Problems as the answer to the challenges of curriculum in Indonesia and to the development of industry 4.0. The novelty of the ILMo Model being developed in this study contributes positively in helping students' learning process scientifically that enables them to solve problems independently based on literacy which is grounded from the themes' development. The ILMo Model aims to provide a practical knowledge in conducting independent, measurable, and literary study that is relevant to the current problems, especially in mathematics subject at the primary level so that the students will be able to obtain a comprehensive understanding in seeing the problems in terms of knowledge (science) and the student's character building. The results of this study show that the ILMo Model can improve the learning in mathematics subject which its implementation has been integrated between science and the character values inculcation that is obtained from the results of the test scores and students' portfolio. The ILMo model in the mathematics subject runs very well since this model provides the students with an extensive space to conduct in depth scientific literacy and Islamic character values studies through various literacy such as web, e-book, e-library so students can solve problems independently with the teacher guidance and it is justifiable.

***Keywords:*** *problem solving, ILMo model*

## 1. Introduction

Education cannot go forward without the integration among teachers, students, and policymakers. [1] [2] The problem solving in mathematics subject by using ILMo Model, employs Webbed approach which states that integration patterns can bind learning activities both in certain subjects and in across subjects. [3]
The purpose of ILMo Model development is to stimulate students to solve problems independently [4] by integrating science and character values, to prevent any scientific dichotomy during the learning process. [5]
ILMo model aims to integrate the students' cognitive and the character values. [6] [7] The integrating process comprises the value of honesty, the value of independence, as well as the value of justice in the learning process, as a means to create a more meaningful and useful learning to answer various problems in everyday life. [8]
Thus, both teacher and student can perform a cooperative learning, [9] ILMo model provides a synergy between knowledge and value inculcation thoroughly to the students regarding to the unity of science and the character values inculcation. [10][11][12]

## 2. Method

This study applied the RnD method. [13] The consideration of using this system was because the stages implemented during the study will form certain measurable schemes and targets. The enforcement category for each aspect or overall aspects of ILMo Model was determined based on the categorization criteria adapted from Bloom, [14] [15] Furthermore, the observation sheets reliability of ILMo Model implementation was calculated by using percentages of agreements formula. [16]

## 3. Results and Discussions

### 3.1. Data Analysis on ILMo Model Practicality

In order to observe its practicality, the learning process was performed by following the ILMo Model syntax [17] and using ILMo Model supporting learning tools. Thus, the observation of ILMo Model practicality was intended to the implementation of model component and supporting system (learning devices) component. [2]
One of the ways to develop problem solving skills is to treat students as young scientists [18] during the learning activities. [19] The students' active involvement during the learning activities both physically and mentally will have an influence on the formation of their action patterns which are always based on scientific matters. [20][21]
That is can be concluded that one of the factors that causes students' poor scientific thinking [22] and problem solving [18][23] abilities is that the learning model implemented by teachers does not provide students with the opportunity to engage creatively during the learning activities just as scientists. [24]
The ILMo model was developed based on the constructivism views. Furthermore, the ILMo model development was built by referring to the learning theories developed by: Bruner, Piaget,

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Vygotsky, Ausubel, and Gagne. [20][25] The ILMo model has several novelties compared to discovery learning and inquiry models. [26] One of those is to enhance students' problem-solving skills which are constructed from Islamic values. [27]
Independence and creative thinking are the keys to prepare students to face the world of industry 4.0. [28] The novelty of the ILMo model is to deal with various changes in the next curriculum. One of those is understanding and applying knowledge (factual, conceptual and procedural) based on student's curiosity about science, technology, social-religious values, art, culture related to phenomena and visible events that are contained in the regulation of the minister of education and culture no. 58 of 2014.[29][30]

### 3.2. ILMo Model Components

ILMo model has five main components; 1) sytanx, 2) social system, 3) reaction principle, 4) supporting system, (5) surrounding and instructional impacts. [17]
Syntaxs: The learning activities by using ILMo model is performed through five main steps, namely 1) invitating, 2) formulating hypothesis, 3) hypothesis testing, 4) applying concepts in real life, 5) concepts strengthening.
Further descriptions about ILMo model syntaxs are shown in table 1.

**Table 1:** Syntax of ILMo Model [27][31]

| Phase | Teacher's Attitude | Student's Attitude |
|---|---|---|
| **Phase 1:** | a. Teacher invites the students to reveal the problems they want to know from the subject materials which are related to their daily social-religious environment. | a. Identify problems and issues related to count operation of time unit. |
| **Inviting** | b. Motivate students to courageously ask questions, record their daily events or problems related to the count operation of time unit of their surroundings. | b. Reveal the questions related to the subject matter. |
| **Phase 2:** | a. Teacher provides opportunities for learners to identify the problem agendas as many as possible which are relevant to the material. Then, one of them is selected and formulated in the hypothesis form (temporary answer to the question of the problem). | a. Students perform a group discussion to formulate the hypothesis. |
| **Formulating Hypothesis** | b. Teacher also gives students the opportunity to collect information as much as possible which are relevant to prove whether the hypothesis is correct or not. | b. Students are given a chance to gather various information (*collection*) which are relevant, read the literature, observe the object, do an interview, conduct their own trials, and etc |
| | c. Give the students tasks in which they could obtain enough information from reading, observation, interview, discussion, or working on Student Worksheets. | |
| **Phase 3:** | a. Teacher gives the students an opportunity to find a concept, theory, rule, or understanding through the examples that he/she encountered in his/her life. | a. Make a report about the result of the activities which has an impact to their life |
| **Hypothesis Testing** | b. Guide the students' discussion. | |
| **Phase 4:** | a. Teachers offer additional information if the thhings being presented by students are still lacking and also assign a correction and reinforcement to the students' results. | a. Pay attention to the teacher's explanation |
| **Concept Strengthening** | | b. Compile a report |

The development of ILMo Model is illustrated in figure 1.

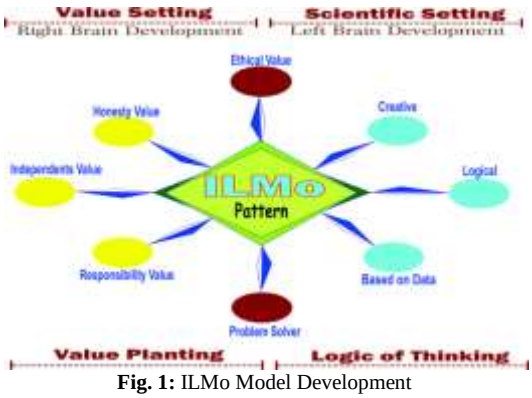



**Fig. 1:** ILMo Model Development

This model offers the students with an opportunity to gather relevant information and conduct independent trials, then teachers guide the students to process the obtained information so that they can solve the problems independently.
In accordance with the statement mentioned above, introduces 4 steps in solving a problem called as Heuristics, namely 1) understanding the problem, 2) planning a solution, 3) implementing the plan and 4) looking back. [32][8] The result of Heuristics implementation in this study is presented in figure 2.

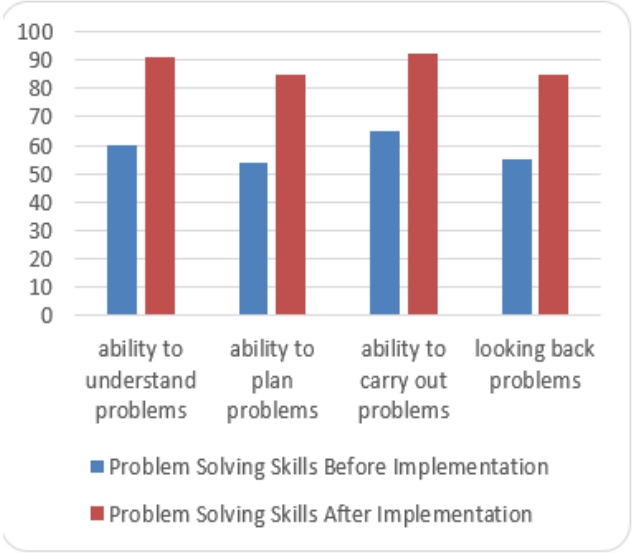



**Fig.2:** Percentage of Heuristic application results

According to the graph 1, it can be seen that the comparison of before and after the ILMo Model implementation indicates many significant changes involving the ability to understad the problem, 2) the ability to plan solutions, 3) the ability to implement the plan and 4) the ability to look back. The ILMo model also develops a comprehensive integrated learning by combining core competencies in the 2013 curriculum in form of students' values and characters into scientific-based learning. Hence, learning can be comprehensively understood both in terms of the material content and the character value to be achieved, as can be seen in table 2.
Therefore, the result of ILMo model different test (T Test), can be seen in table 3.
The mean or average value in the table 3, the difference between the pretest and posttest of the problem solving abilities indicates that the mean value obtained in the pretest is 64.82 while the mean value in the posttest is 96.96. Since the p-value of the t test is 0.026 which means that it is (<0.05), it can be concluded that Ho is rejected and Ha is accepted. This means that there is a significant influence on the average scores in the pretest and posttest.

**Table 2:** Expert Assessment Results

| No. | Assessed Aspects | Expert Assessment | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| 1 | **Content Eligibility** | | | |
| | Standard of Competencies are implicitly listed | 100 | 100 | 100 |
| | Basic Competenciesare implicitly listed | 96 | 100 | 98 |
| | Compatibility of the bookcontent with the standard of competencies and the basic competencies. | 100 | 96 | 100 |
| | Material completeness in line with the learning objectives | 100 | 100 | 100 |
| 2 | **Material** | | | |
| | Content authenticity(facts, concepts, principles, laws, scientific theories and processes) | 100 | 100 | 100 |
| | Content update | 95 | 100 | 97 |
| | Paying attention to the interrelation of Islamic values inculcation and science | 100 | 96 | 100 |
| | Systematic in line with the scientific structure | 100 | 100 | 100 |
| 3 | **Language** | | | |
| | Readability of the language or the suitability of language with the students' age level | 100 | 100 | 100 |
| | Using good and appropriate language | 95 | 100 | 96 |
| | The terms and symbols being used are accurate and understandable | 100 | 97 | 100 |
| | Using the terms and symbols continuously | 100 | 100 | 100 |
| 4 | **Presentation** | | | |
| | Generating motivation / interest / curiosity | 100 | 100 | 100 |
| | Suitable with students' thinkinglevel and reading ability | 100 | 95 | 100 |
| | Interesting and fun | 92 | 100 | 95 |
| 5 | **Assessment of ILMo Model in terms of innovation** | | | |
| | Compatibility with the curriculum | 100 | 100 | 100 |
| | Emphasizing the real world or everyday lifeapplications | 96 | 100 | 96 |
| | Supporting the learning process which is focused on the PBM-PIIS model implementation | 100 | 100 | 100 |
| | Supporting the implementation of the innovative learning process | 95 | 100 | 100 |
| | Make thelearning outcomes evaluation becomes easier | 100 | 100 | 100 |

**Table 3:** Pretest dan Posttest Result

Paired Samples Statistics

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | Pretest | 64,8214 | 28 | 12,20824 | 2,30714 |
| | Posttest | 96,9643 | 28 | 5,50072 | 1,03954 |

| | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | Pretest & Posttest | 28 | ,419 | ,026 |

The Table 4 shows that there is a significant improvement on students' mean scores after receiving a new treatment which is ILMo Model implementation. The learning outcomes in the form of problem solving skills in mathematics subject also affecting the learning effectiveness as the learning criterias is claimed to be effective if the student's learning values or results fit the Minimum Criteria of Mastery Learning.

**Table 4:** Paired Samples Test

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | Pretest - Posttest | -32,14286 | 11,09125 | 2,09505 | -36,44360 | -27,84212 | -15,335 | 27 | ,000 |

This is clarifies that the ILMo Model implementation is effective in improving students' problem solving skills in mathematics subject since it allows students to think critically, enables them to solve problems in their daily life, and enhances their learning outcomes.

## 4. Conclusion

The given of Trichoderma sp. as much 5 , 10 , 15 , 20 cc on compost for the cayenne pepper which planted in polybags showed the plant growth, such as plant height, number of leaves, number of flowers and number of fruit, then the best one was on the plant with 20 cc of compost.

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