

## Local Wisdom-Based Science Learning Model In Indonesia (Meta-Analysis)

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**Abstract**— This paper aims to summarize the research findings related to local wisdom-based science learning in Indonesia from 2013 to 2022. In order to get insight into the knowledge of the local wisdom-based science learning model in Indonesia; So, the researcher decided to present this paper on several points. They are the objective of the learning model, research methodology, the data collection instruments, and also the sample investigated. Besides, several learning models such as field trips, inquiry, PBL, PjBL, ELSII, and 7E are also presented in this paper. The research finding shows that PBL gives more contribution (85,8%) to the development of the science learning model. Further, local wisdom-based science learning can be developed by producing learning modules, worksheets, and lesson plans, and also can be incorporated into the assessment and remedial process. Additionally, the development of local wisdom-based science learning has several objectives to help students' independent learning, increase students' learning results, develop students' character and problem-solving skills, increase students' social constructive relationships, and group work, and also improve students' knowledge about local culture.

**Keywords**—meta-analysis; science learning; local wisdom

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## I. INTRODUCTION

The function of education is to empower human potential in order to inherit, develop and build the culture and future civilization. It also means preserving cultural values and creating for better and more innovative life. (Budhisantoso, 1992) state that education has double functions. With these functions, it is hoped that the native culture of the particular region has to take a role in the development of the educational and cultural system. Thus, this double function is also in line with the design of curriculum 2013 in which the design of this curriculum is based on the character of the culture that includes civilization and competence as its basis. The aim of curriculum 2013 is to create productive, creative, innovative, and effective human capital through the empowerment of attitude, skill, and integrated knowledge. Sa'ud (2015) state that the innovation of curriculum will be a great help in the implementation of learning rules of basic education. This statement is in accordance with the objective of curriculum 2013 which aims to improve the competitiveness and the ability of the human life of Indonesia that can contribute to the country itself.

The main factor that determines the success of the learning process is influenced by the teacher's ability. It is also true in the Science subject. As stated by Mulyasa (2002) cited in Hadi (2015), the official curriculum is not the main thing in determining the success of the teaching and learning process but it mainly depends on what the teacher and students do in the classroom (actual process). Science teaching as part of the educational process has a big role in creating individuals. In this era, Science teaching is aimed to prepare the students to have better skills and competencies that have critical thinking, innovation, critical, problem-solving, communication, collaboration, ICT literacy, and strong leadership (National Science Teacher Association, 2006). It means that the success of the teaching and learning process is mainly determined by the teacher which includes the teacher's knowledge of the teaching and learning model and also the learning tools such as lesson plans, modules, and student's worksheets.

The development of teaching and learning models and their tools must be justified by their use. For example, it can be based on its geographical factors, ethnographic and the character of its particular region. Therefore, the materials used in the classroom should be developed based on their local wisdom in which teachers can include the local wisdom values into the learning which in turn can preserve the knowledge of that local wisdom as to assist the learners in learning science and apply them in the real life.

Local wisdom derives from two words; they are local and wisdom. Local means something that exists in a certain area and wisdom means the quality or state of being wise. In another word

it can be said that local wisdom means ideas, values, norms and characteristics of a certain area that is wise, full of wisdom that belongs to that area practiced by the member of the society.

The local wisdom that conceives of traditional knowledge as the environmental savior has been studied by many experts. The utilization of local wisdom can improve student learning outcomes (Tomi et al., 2018). The development of local wisdom-based learning models that is unique to a nation. Local knowledge-based learning models will introduce local culture which is the result of advances in science and technology to the younger generation (Toharudin & Kurniawan, 2017). Local wisdom can be used as a knowledge base in innovating biology learning in schools (Alimah, 2019).

The local wisdom-based science learning model is done through reconstructing the indigenous science which is gathered from observation of the cultural values that exist in the society. The process of reconstructing this indigenous science is done by translating the indigenous science into scientific science concepts. Therefore, the local wisdom-based learning model is derived from indigenous knowledge of certain societies which comes from the noble values of cultural tradition to regulate the life of the community in order to achieve the improvement of the community welfare. This is in accordance with Khusniati who states that the value of culture has been rooted in the life of the society and this value is very beneficial for human life (Khusniati, 2014).

Based on the explanation above, it is important to do meta-analysis research. According to Glass et al., (1981) meta-analysis is a quantitative analysis that uses several data which apply certain statistical methods. He also states that in meta-analysis research, the statistical method can be used for organizing many kinds of information and data gathered from a big sample size that has a function to accommodate the other aims. In addition, Suryanti et al., (2013) also states that meta-analysis is a technique that is used to summarize various quantitative research findings by determining the effect size value. The Effect size is determined by calculating the mean difference between the experimental class and the control class. Then, these scores are divided by the standard deviation from the control class. Thus, it can be concluded that a meta-analysis is a form of quantitative research that incorporates numbers and statistical methods from various types of research in order to organize and gather information from the data. Then, this information can be used to make a comprehensive conclusion about the research findings. Thus, the educational meta-analysis can help the researchers to save time in conducting their research.

There are many types of research that have been done toward the development of a local wisdom-based Science learning model. That is why it is important to do meta-analysis research to have an understanding of similar research. So, the meta-analysis is done to get a conclusion on local wisdom based on Science learning in Indonesia. This study tries to find out:

- the aims of the research
- the research methodology
- the instrument for collecting the data
- the research subject and sample
- the learning model used in the classroom, local wisdom based on?
- the application of the learning model – local wisdom based
- the improvement of student's achievement in Biology subjects based on local wisdom

## II. RESEARCH METHOD

This study aims to investigate the meta-analysis findings towards local wisdom-based Science learning trends.

The articles about meta-analysis are gathered from various sources: ERIC.gov, portal garuda, and scopus.id. A number of national and international journals chosen are very recent journals. It is done in order to have a comprehensive study of the issue. In the first phase, there are fifty articles that are selected. But, from these articles, there are twenty main journals that are worth studying: ten international journals and fifteen national journals.

## III. RESULT AND DISCUSSION

### The Aims of the research Investigated

As can be seen from table 1, there are sixteen (16) researches that have the objective of developing local wisdom-based Science learning in Indonesia, whereas the rest of them is to find out improvement of student's achievement in local wisdom-based Science learning. Amongst those researches, there are three studies that aim to find out the student's attitudes toward local wisdom-based Biology learning.

Table 1. The aims of the research investigated

Aim	Frequency	Percentage (%)
Developing a science learning model	16	64
Investigating the student's achievement	6	24
Analyzing students attitude	3	12

### The Methodology Investigated

Based on the journal articles, there are four different research methodologies investigated; they are research and development (R&D) (n=16), descriptive research (n=2), descriptive quantitative research (n=2), and qualitative research (n=1), and quasi-experimental research (n=4).

Table 2. The methodology of students attitude

Methodology	Frequency	Percentage (%)
R & D	16	16
Descriptive	2	8
Descriptive quantitative	2	8
Qualitative	1	4
Quasi-experimental	4	16

### **Instrument of Data Collection Investigated**

This part presents the instruments of data collection (see table 3) which will be discussed in more detail.

Table 3. Instrument of data collection investigated

The instrument	Frequency*	Percentage (%)
Questionnaire	7	28
Observation	4	16
Interview	12	13,33
Dokumentation	2	8
Test	9	36

\*the number of the research subject may consist of various subjects

From table 3. It can be seen that there are a number of research that use the test as the instrument for collecting the data (40%). The following is the explanation of each instrument used in the research on local wisdom-based Science learning.

#### ***Questionnaire***

Almost all the research on students' attitudes toward natural resources conservation used the questionnaire by incorporating a Likert scale questionnaire (n=7). The questionnaire that uses the Likert scale is considered to be relatively economic and opens chances for the researchers to collect the data from a big sample size. This questionnaire only requires the research participants to choose or tick the answers. Further, this questionnaire allows researchers to do statistical quantitative analysis.

#### ***Observation***

There are two studies that use observation as the instrument in collecting the data. For example, Hadi (2017) used the observation sheet to investigate what kind of local wisdom that are exist in Sawang, Aceh Selatan.

#### ***Interview***

Almost all the researchers choose interviews as their instrument for data collection. It is because the interview allows researchers to have a more flexible way of describing the questions to the research participants (Ültay & Çalik, 2016). For example: Leksono et al., (2015) did a depth interview with the key person. It is done in order to have more accurate data on participants' local knowledge about biodiversity conservation.

### ***Documentation***

The documentation analysis as an instrument for data collection is used to evaluate the supporting documents from students' attitudes towards local wisdom-based Science learning through textbooks and curriculum.

### ***Sample***

As can be seen in table 4, the research sample about the development of local wisdom-based science learning in Indonesia ranges from elementary school students to university students. But, most of the research focused on senior high school students as their sample.

**Table 4.** The research sampel

<b>Sampel</b>	<b>Frequency*</b>	<b>Percentage (%)</b>
University	6	26,67
Senior high school	13	46,67
Junior high school	4	13,33
Elementary school	2	13,33

### **Local Content Learning Model-Local Wisdom Investigated**

There are numerous studies about the development of the local wisdom-based Science learning model. The following are some of the science learning model that has been included in a number of research:

**Table 5.** The Local wisdom-based Science Learning model

<b>The development models</b>	<b>Frequency</b>
1. Approach:	
Inquiry	1
ELSII	1
PBL	6
PjBL	2
7E	1
Field trip	1
SETS	1
2. Pedagogic ethnography Model	1

<b>The development models</b>	<b>Frequency</b>
3. Lesson Plans	2
4. Worksheets	4
5. Modules	5
6. Assessment & Remedial	1

The implementation of a learning model that fits with the local wisdom values at schools must be supported by the government and other stakeholders. It is done in order to promote the values of society. Besides, tertiary education and society have to take a role in the process of developing the curriculum local wisdom-based learning model. The educational institutions must motivate and encourage the family and society to collaborate and work together in the learning and teaching process both inter and extra activities at schools as well as the activities that focus on the implementation of its local wisdom values (Pornpimon et al., 2014). Cooperative learning has been used in the development process of the local wisdom-based Science learning model (as shown in table 5). Further, the local wisdom-based Science learning model can be developed into the learning modules, students' worksheets, lesson plans, and also in the assessment and remedial process.

The learning model that is developed at school should refer to the inquiry model. This is because the inquiry learning model can initiate the students' problem-solving skills (Arini et al., 2019; Pedaste et al., 2015), PjBL models can improve environmental problem-solving ability (Retnowati et al., 2020). The other learning model such as ELSII can also open the opportunity for the students to achieve the learning target as a way to prepare them to face real life that applies the culture and its local wisdom values (Dewi et al., 2017), learning model cycle 7E (Ati et al., 2013), Field trip (Leksono et al., 2012).

The local wisdom-based learning also can be developed by adopting Problem Based Learning (PBL) model. It can be done by developing lesson plans and worksheets. The worksheets that incorporate the local wisdom approach aim to provide real-life learning and introduce the local wisdom values in the process of learning (Hadi, 2017). In addition to that, the local wisdom worksheets can also be done through the 4D learning model define, design, develop, and disseminate (Lase et al., 2016), ADDIE learning model lesson plans and worksheets local wisdom-based learning in Timor (Ardan, 2016), Dick & Carey learning model (Riyanto & Hindun, 2014) and assessment and remedial (Toharudin & Kurniawan, 2017) and development of local wisdom-based booklets (Melati et al., 2020).

The development of learning based on local wisdom can also be done by developing learning modules with a scientific approach that can improve students' independent learning (Charisun et al., 2013). Development of science learning module based on the local potential of Karimun Jawa

which is oriented to the SETS model (Widiyatmoko et al., 2015). Development of a biology learning model based on Sundanese cultural values by integrating elements of ethno-pedagogy (Toharudin & Kurniawan, 2017).

### **The Objectives of Applying Local Wisdom Based Science Learning Model**

There are several objectives of applying the local wisdom-based science learning model:

- a. ELSII local wisdom-based learning model through the adaptation of environmental conservation values that exist in the society is hoped to be the source of development the problem-solving skills, scientific communication, and good behavior to take care of the environment (Dewi *et al.*, 2017).
- b. Problem-based learning models based on local wisdom can improve students' critical thinking skills (Budiarti & Airlanda, 2019), improve conceptual knowledge and environmental literacy skills (Lubis *et al.*, 2022), and improve high skills and scientific attitudes (Hikmawati *et al.*, 2021).
- c. Project-based learning model based on local wisdom in Bogor is effective in improving students' skills in developing learning media so that they can improve environmental problem-solving skills (Retnowati et al., 2020) and improve creative thinking skills and independent learning (Nurhikmayati & Sunendar, 2020).
- d. Scientific field trips may increase the insight knowledge about local wisdom on biodiversity conservation which later on can be the way to remember the resources explanation during the trip. As such, scientific field trip also has an impact on long-term memory because insight learning can improve students' social skill. In addition to that, scientific field trip also can strengthen affective and cognitive skills to improve the students learning ability (Shakil *et al.*, 2011). The scientific field trips also may increase students' problem-solving skills, enhancing social constructive relationships as well as improving the student's teamwork ability (Dikmenli, 2010).
- e. Pedagogic ethnography model integrates the Sundanese local wisdom values (Toharudin & Kurniawan, 2017). Pedagogic Ethnography is a kind of local wisdom-based educational practice that can be implemented in various domains. It emphasizes on local knowledge as the innovation and skill sources that can empower the local community from where the values are gathered. These values are then preserved, maintained, applied by the society and inherited by the next generation which in turn can work in line with the aim of modernization (Suratno, 2010; Surya, 2011). In addition to that, (Bauto, 2013) and (Zuriah *et al.*, 2016) state that the local wisdom can be the basis of learning development which is used to increase the knowledge, attitude and also character of the students.



- f. The main objective of developing local wisdom-based Science learning modules is to assist the learners' independent learning as to implement the individual learning (Charisun *et al.*, 2013).

### **The Students' Learning Result Towards Local Wisdom-Based Learning**

This part presents the result of students learning (see table 5) which will be discussed in more detail on the next page.

**Table 5. The Learning Result**

<b>Development Model</b>	<b>The average score</b>
Field trips	78,75
Biology learning model	76,44
Pedagogical ethnography	75
Comic	80,7
7E learning cycle	82,5
Dick & Carey learning model	74,5
Science learning model	65,12
Model PBL berbasis kearifan lokal	85,8

It can be seen from the table that PBL based on local wisdom can is able to improve students' higher order thinking skills (HOTS) and scientific attitudes with a mean score of 85,8. There are several factors that can explain why the PBL based on local wisdom contribute to the improvement of student's higher-order thinking skills, result:

- a. Problem-based learning model that utilizes the real world as a context for students to conduct investigations so that students become active in building their own knowledge (Lubis *et al.*, 2022). The PBL model has the following learning syntax: (1) orient students to the problem, (2) organize students for study, (3) assist independent and group investigation, (4) develop and present artifacts and exhibits, and (5) analyze and evaluate the problem-solving process (Arends, 2012). The PBL learning syntax emphasizes more on student activities and is student-centered.
- b. PBL models can (a) help students to focus on learning, (b) foster a sense of responsibility and creativity in students, (c) encourage students to develop communication, collaborative, and problem-solving skills, (d) build students' understanding, (e) building positive attitudes and motivation of students, (f) assisting students in growing new knowledge by utilizing existing resources, (g) learning is centered on students in the group, and the teacher acts as a facilitator, and (h) fostering students interest in learning (Ceker & Ozdamli, 2016).
- c. Learning based on local culture or local traditions not only increases mastery of concepts but also soft skills. Soft skills of students that can be developed through culture-based learning are

collaboration skills, critical thinking, nationality, socio-cultural awareness, leadership, environmental awareness, and curiosity. The diversity of Indonesian ethnicity and culture is a challenge that is relevant to the characteristic of students. That is, the obstacles faced by teachers are creativity in integrating concepts about culture in science learning, understanding concepts, time constraints and student and teacher paradigms (Rahmawati *et al.*, 2020).

- d. This PBL model also presents student worksheets (LKS) in learning activities that refer to the stages of the PBL models. LKS can help students learn well because of the steps that can guide students in completing their learning assignments.

The development of the other learning model that can improve students' achievement is by incorporating local wisdom-based comics. It has been done in Jember, East Jawa where certain local wisdom values are included in the science learning through comics which combine with field trips, pedagogic ethnography, and Dick & Carey learning model as well as a science learning model.

#### **IV. CONCLUSION**

Based on the result of the meta-analysis that has been done; there are several points that can be drawn: (1) There are three objectives investigated: (a) sixteen studies aim to develop a Science learning model, (b) six studies intend to see the improvement of students' learning result and (c) three papers that aim to analyze the students' attitude, (2) There are several models can be used to develop local wisdom based learning. It varies starting from cooperative learning, Inquiry, ELSII, PBL, PjBL, Field trip and 7E learning cycle. Further, local wisdom-based learning can be developed through the development of modules, worksheets lesson plans and also through assessment and remedial, (3) The PBL based on Local wisdom can improve students' science learning results with an average score of 85,8 because it can stimulate students to be more responsible and creative, develop communication, collaborative, and problem-solving skills, build students understanding, build positive attitudes and motivation of students, assist students in growing new knowledge by utilizing existing resources, learner-centered learning in groups, and the teacher acts as a facilitator, fostering student interest in learning.

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