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Development of INoSIT Learning Model to Improve Scientific Literacy Competencies

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Abstract:- The aim of the study was to examine the feasibility of the INoSIT learning model (Integrated Nature of Science Inquiry with Help Technology) to improve the Scientific Literacy competency of junior high school students. This research is part of the development research (R & D) at the limited stage in class IX$_B$ SMP Negeri 5 Kendari Sulawesi Tenggara. Through the design of one group pretest and posttest involving one science teacher as a model teacher and two natural science teachers as observers conducted at an odd semester of the school year 2017/2018. Data collection using the validation model assessment sheet, implementation model and activity of students, scientific literacy tests and student response questionnaires. The results of the validation of the INoSIT learning model indicate that the validator's assessment of the content validity and construct validity models have met valid and reliable criteria. In addition, the results of the model implementation analysis were obtained: (1) the INoSIT model included a practical category based on several aspects, namely, the implementation of the model phase tended to average increase with a good category, improved student activity towards the highest percentage of observation experiment aspects (19.3%), and the positive response of students to teaching and learning activities (KBM) showed that interest in the learning component was quite high (56.8%), (2) the INoSIT learning model was effective in improving students' scientific literacy competencies when viewed from the increase in the normal-gain average of 0.55 which is already in the moderate category and the results of hypothesis testing indicate there are significant differences between students' scientific literacy competencies through pretest and posttest. Conclusion, the INoSIT learning model developed has fulfilled the valid, practical and effective elements so that it is worthy of being used as an alternative to improve junior high school and equivalent scientific literacy competencies.

Keywords:- *Validity, Practical, Effective INoSIT Model, Scientific Literacy, Middle School Students*

I. INTRODUCTION

Progress in the field of science and technology now has a positive impact as well as negative impacts on human life. Positive impact arises because of various facilities that can improve the quality of human life, while ethical problems, moral and global issues, reduced energy sources or the emergence of various forms of pollution are negative impacts [1]. To overcome the negative effects due to the advancement of science and technology, we need someone who is literate science (scientific literacy).

Leigh [2] gives two reasons for the importance of scientific literacy, namely: (1) the world today is highly dependent on science and technology, and (2) every citizen understands the potential for abuse of science. Someone is said to be literate if they have two abilities, namely: (1) can understand the relationship between the universe, science and technology, and (2) can apply science knowledge and skills individually to make decisions and analyze social issues [3].

One of the keys to 21st century competence is the need to consider scientific literacy for people who have the ability to access, read and understand the global world with science and technology, then make judgments, and use that evaluation to inform and make decisions every day [4]. Therefore, scientific literacy is increasingly needed at this time so that people can live in the midst of modern society [5].

In order to achieve the objectives of science education in the 21st century, the role of the teacher becomes very important to help students develop sufficient conceptions of the nature of science (nature of science, NoS) and scientific inquiry (SI) as indicators of scientific literacy. Wenning [6] also explains that someone who is a NoS literate will have content and history knowledge of at least one field of science, plus knowledge related to science nomenclature, intellectuals in process skills, rules of scientific evidence, science postulates, science dispositions, and major misconceptions about the nature of science.

Scientific Literacy focuses on building students' knowledge using meaningful scientific concepts, thinking critically and making balanced and adequate decisions on problems that have relevance to students' lives. NRC explains the emphasis on scientific literacy not only on mastering knowledge and understanding of scientific concepts and processes, but also on how to enable someone to make a decision and get involved in community life based on their knowledge and understanding of science [7]. Thus scientific literacy will make a concrete contribution to the formation of life skills [8]. Furthermore, PISA 2015 defines scientific literacy as the ability to engage with issues related to science, scientific ideas and as reflective citizens. Someone who is literate in science will be willing to be involved in reasoning about the discourse of science and technology which has three competencies, namely explaining scientific phenomena, evaluating and designing scientific investigations and interpreting data and scientific evidence [9].

Science or Science subjects taught in schools are a collection of systematically arranged knowledge whose use is limited to natural symptoms [10]. This means that science is not only characterized by a collection of facts, but also the emergence of scientific methods that are realized through a series of scientific work, scientific values and attitudes that will train students to be literate science.

The description of the quality of science learning in Indonesia, especially in children aged 15 years can be seen from the achievements of scientific literacy obtained through an international survey Program for International Student Assessment (PISA). Of the six PISA surveys (2000; 2003; 2006; 2009; 2012 and 2015) the scientific literacy skills of Indonesian students are still low. Although in the last PISA survey in 2015 the ranking did increase slightly from 2012 to 64 from 69 participating countries, student performance was still relatively low with literacy levels still at level 1 [11]. This means that the average ability of scientific literacy of Indonesian students has only arrived at the ability to recognize basic facts and has not been able to communicate and associate the abilities possessed with various scientific topics especially to the application of abstract and complex scientific concepts.

Problems with scientific literacy achievement are similar to those experienced by junior high school students in Kendari City, Southeast Sulawesi. From the results of the preliminary study conducted on class IX students, it was found that the level of scientific literacy was still low with an average achievement ranging only from 28.3% to 48.5%. The lowest indicator of achievement (28.3%) is on how to design the study and the impact of the conclusion with the sub-indicator identifying the strengths and weaknesses of the research design, sample size, randomization, and controlling the experimental variables. In addition, indicators make graphical representations, read and interpret table and graph representations of data [12]. From the results of observations on the management of learning conducted by SMPN science teachers in Kendari City, it was obtained: (1) laboratory equipment owned by schools in general did not meet BSNP standards, and (2) science teachers also experienced difficulties in integrating ICT in learning especially to teach abstract concepts. As a result, science teachers in managing their learning rarely carry out scientific inquiry activities to familiarize and train students to become literate science.

In an effort to improve the achievement of scientific literacy as a goal of science education in schools, it is necessary to develop a lifelong learning model with the use of information and communication technology (ICT). This is in accordance with the Graduates' Competency Standards (SKL) and Content Standards (SI) which provide direction on the principle of learning that is used related to scientific literacy is learning that prioritizes civilization and empowerment of students as lifelong learners and through the use of ICTs to improve learning efficiency and effectiveness [13].

To overcome the weaknesses of the learning model to teach Scientific Literacy in schools, one alternative solution is to develop an integrated learning model of inquiry and the nature of science that is information and communication technology (ICT) assistance or the term integrated nature of science (NoS) and inquiry with help Technology (INoSIT). The INoSIT model can teach scientific literacy both on concrete concepts and on abstract concepts. By adding multi-representation which includes symbols, objects, images, and mathematical equations such as ICT-assisted physics models will help teach NoS explicitly that will enrich the development of understanding scientific literacy. Through the help of media technology in the form of a virtual laboratory it is possible to conduct scientific investigations through interactive simulations, and other representations that emerge from practical implementation through hands-on during activities that are together from cognitive abilities and information processing [14]

Some of the results of modern studies show that methodologies using ICT in teaching have a major influence on students' level of scientific literacy [15]. In addition, Al-Rsa'I, M.Sc., [16], the design of ICT-based PEA learning models and teaching strategies are useful in science teaching through a context with precision to build positive trends, seek knowledge and improve scientific literacy in schools and universities. The virtual use of STEM-based labs as alternative practicum media is effective in improving students' scientific literacy [17]. Luthfia [18], learning devices use a technological pedagogical and content knowledge (TPaCK) approach with discovery learning models that have good feasibility and high validity can improve scientific literacy in the reaction rate material. The application of STEM-based student worksheets effectively increases scientific literacy with n-Gain in the medium category [19].

II. METHOD

This research is part of developmental research (Research and Development) which refers to the Borg & Gall [4] model with a focus on the third stage of model testing, especially at the limited test stage. The limited test of the INoSIT model on electrical and electrical technology material in the environment was carried out for five meetings (12x40 minutes) in class IX_B SMP Negeri 5 Kendari at odd semester 2017/2018. Management of learning during a limited test was carried out by a science teacher as a model teacher, while two other science teachers acted as observers. The technique used in the limited test is to use the one group pretest-posttest experimental research design [20].

Data collection uses a conservation sheet of model validity and model implementation, observation of student activities, scientific literacy tests and student response questionnaires to learning. Data analysis was conducted in a qualitative descriptive manner in the form of percentages and categories, while inferential analysis was used to test the hypothesis. Reliability analysis of the validity and observation of the implementation phase of the INoSIT model is based on the inter-observer agreement obtained from the percentage of agreement (R) according to Borich [21] with the equation; $R = \left[1 - \frac{A-B}{A+B}\right] \times 100\%$ where R is the reliability coefficient; A is the frequency of observed aspects of behavior, which gives the highest score; and B is the frequency of observed behavioral aspects, which gives the lowest score. Observation instruments are categorized as good if the reliability coefficient (R) is > 75%. Furthermore, the analysis of the implementation of the INoSIT model based on minimum criteria is in the range of scores with valid categories [22].

Increasing scientific literacy competence of students after a limited test of the INoSIT model will be analyzed by the normalized gain score test based on the formulation of Hake [23]: $\langle g \rangle = \left(\frac{S_{post} - S_{pre}}{S_{max} - S_{pre}}\right)$; with <g> the mean normalized gain, S_{post} and S_{pre} is the average posttest and pretest. The normalized gain criteria, if it means high category; medium category; and if the category is low.

To test the effectiveness of the INoSIT model, inferential analysis is carried out by testing the hypotheses that have been proposed using the student distribution test "paired t-test" with the help of SPSS. 22.

III. DISCUSSION

A. Description of the Validity of the INoSIT Learning Model

The results of the validation of the INoSIT learning model (hypothetical model) were carried out in the activities of Focus Group Discussion (FGD) carried out at the Department of Physics FMIPA Malang State University with a number of validators of three people who were experts in Science-Physics education. The purpose of the FGD is to validate the hypothetical model developed in terms of content validity that describes the needs and novelty of the contents of the model, while the construct validity model reflects the consistency of the model with supporting theories and consistency between the model components. The results of the validator's assessment can be presented in Table 1 and Table 2.

No.	**Assessment Aspect**	$\bar{V}$	**VC**	**RCoef. (%)**	**RC**
1.	Model INoSIT development based on the needs *(needed)*	14.3 (3.6)	Very Valid	89.3	Rel
2.	Model development INoSIT based on the latest knowledge *(state of the art)*	24.7 (3.5)	Very Valid	91.8	Rel

Table 1:- Content Validity Assessment *(Content Validity)* INoSIT Learning Model

Table 1, shows that the average score given by three validators in each aspect of the assessment of *content validity* of component INoSIT learning model showed that the model development aspects heeds *(needed)* obtained a mean score of 3.6 with a reliability coefficient of 89.3% already in the category of very valid (VV) and reliable , and on aspects of the knowledge aspect of the model *(state of the art)* obtained a mean score of 3.5 and reliability coefficient of 91.8% with a very valid category (VV) and also reliable . This means that the components of the content validity of the INoSIT learning model have met the criteria for *content validity* that has been determined . Based on the testing criteria given by Arikunto [22] that if the average score is in the range $3{,}25 \le SR \le 4{,}00$ means included in the very valid category (VV) so that it can be used with small revisions . Table 1 also shows that the reliability coefficient of *inter-observer agreement* (R) is obtained either at needs aspects of model development, and other aspects of the latest knowledge models is greater than 75%. This is in accordance with the provisions given by Borich [21], an observation i instrument is considered good if me have a reliability coefficient (R)> 75%.

No.	Assessment Aspect	$\overline{V}$	VC	RCoef (%)	RC
1.	Learning Model Overview INoSIT	14.2 (3.5)	Very Valid	89.3	Rel
2.	A location for the implementation time of the INoSIT learning model	6.3 (3.2)	Valid	92.9	Rel
3.	Theoretical and empirical support to the model INoSIT	19 (3,8)	Very Valid	91.4	Rel
4.	Planning Leraning Model INoSIT	10.3 (3.4)	Very Valid	85.7	Rel
5.	P ime Frame models Learning Model INoSIT	17.7 (3.5)	Very Valid	85.7	Rel
6.	Managing the INoSIT Learning Model Environment	8 (4.0)	Very Valid	90.5	Rel
7.	Assessment and Evaluation of the INoSIT Model	7.7 (3.8)	Very Valid	9.8	Rel

Table 2:- Constructs Validity Assessment *(Construct Validity)* INoSIT Learning Model

Table 2, shows the score results from model construct validation *(construct validity)* in each aspect of the evaluation of the INoSIT model component provided by three validators, the average score (AS) was obtained with a range from 3.2 - 4.0 in the category of valid (V) and very valid (VV). This shows that the construct validity of the INoSIT model has met the criteria testing provided by Arikunto [22], if the average score is in the range $2{,}50 \leq SR < 3{,}25$ and $3{,}25 \leq SR \leq 4{,}00$; means that it is included in the valid (V) category which can be used with a slight revision and a very valid category (VV) that can be used without revision. In addition, in Table 2 the reliability coefficient (R) is obtained from 90%-95%, means that all aspects are in the good and reliable category based on the provisions given by Borich [21].

Thus, the INoSIT learning model developed has fulfilled *content validity* and construct validity (*construct validity*) so that it can be said to have good model characteristics, namely the existence of conformity with needs (*need*) and novelty (*state-of-the art*). This is in line with the opinion [24] , a good learning model if supported by relevant theories and consistency between components of the model.

B. Description of the Practicality of INoSIT Learning Models

The practicality of the INoSIT learning model developed in this study can be seen from the aspect of phase implementation, student activities and student responses to learning during the trial are limited.

➢ *Implementation of INoSIT Learning Model*

To assess how the implementation of learning during a limited test of the INoSIT model conducted by one model teacher and observed by two teacher observers , can be seen from the implementation of the phase (syntax) consisting of 5, namely: (1) *eliciting*; (2) *hypothesis formulation*; (3) *hypothesis testings*; (4) *elucidation;* and (5) *reflection*. The profile keterlaksanaan INoSIT model learning can be seen from keterlaksanaan phase in learning activities (KBM) for a limited test can be seen in Table 3.

No.	Phase	Meeting									
		1		2		3		4		5	
		$\overline{P}$	C	$\overline{P}$	C	$\overline{P}$	C	$\overline{P}$	C	$\overline{P}$	c
1.	*Eliciting*	3.1	G	3.2	G	3, 3	G	3, 4	VG	3.5	G
2.	*Hypothesis Formulation*	2.6	GE	2.8	GE	3.0	G	3.1	G	3.3	G
3.	*Hypothesis Testing*	2.5	GE	2.9	GE	3.0	G	3.2	G	3.3	G
4.	*Elucidation*	3.0	G	3.3	G	3.3	G	3.3	G	3.4	G
5.	*Reflection*	3.0	G	3.2	G	3.3	G	3.3	G	3.5	G
Average		**2.8**	**GE**	**3.1**	**G**	**3.2**	**G**	**3.2**	**G**	**3.4**	G
Reliability		97.8%		99.7%		96.6%		97.4%		98.4%	
Ket: $\overline{P}$: average score ; GE: Good enough; G *: Good; VG : very good*											

Table 3:- Implementation of INoSIT Model Phase in Limited Stage

When the trial was limited to students of class $IX_{B\ of}$ SMPN 5 Kendari, as shown in Table 3, the first meeting found that the implementation of the five phases of the INoSIT model was still in the fairly good category (GE) with a reliability coefficient (R) of 97.98, then in the second meeting until the fifth meeting already in the good category (G) with the reliability coefficient (R) greater than 75%. At the first and to the meeting two especially in the

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second and third phases namely formulating hypotheses and testing hypotheses, quality of implementation is still categorized as good enough (GE) compared to other phases. Furthermore, at the third, fourth and fifth meetings the implementation of all phases is in the good (G) and very good (VG) category. Furthermore, the percentage of INoSIT model phase implementation in the test i limited from the first meeting to the fifth meeting can be seen in Figure 1.

In Figure 1. shows the percentage of the implementation phase of the INoSIT model starting from the Eliciting phase, the hypothesis formulation phase, the hypothesis testing phase, the elucidation phase and the reflection phase in the limited test from the first meeting to the fifth meeting tend to increase.

The first phase of the INoSIT model is Elicitation, with the main activity being the teacher arousing motivation and directing students to observe an electrical phenomenon either by using electric KIT media also by using technology assistance in the form of *a PhET Simulation virtual laboratory*. The implementation of this phase from the first meeting to the fifth meeting tends to increase.

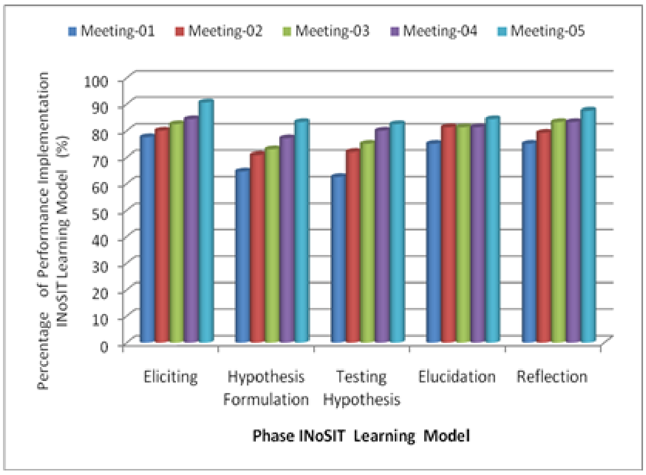

Fig 1:- Percentage of Phase Implementation INoSIT Learning Model

Formulating a hypothesis is the second phase of the INoSIT learning model with the main activity is to guide students to ask questions about the electrical phenomenon that has been presented in the Eliciting phase. From the research questions that have been submitted, a problem statement can be formulated. In a problem statement there is a relationship between two or more variables. Based on the formulation of the problem a hypothesis can be formulated. Another activity is to guide students to identify experimental variables, then to give limits or definitions of experiment variables so that measurements are easily made. The next step is to determine the experimental steps in order to be able to test the hypotheses that have been formulated.

In the third phase, namely hypothesis testing, the main activity is to guide students to carry out experiments based on experimental steps that have been formulated in the second phase. In the INoSIT model the steps in carrying out and carrying out experiments are using the PhET Simulation virtual laboratory media to make it easier and faster to do. The next step is to make observations and fill in the data into the observation table then analyze and test the hypothesis and interpret the data so that it can make inferences.

Based on the results of the observer's assessment, at the first meeting, the allocation of learning time exceeded the set time limit. From the analysis of the quality of enforceability of the second and third phases of paragraph tern remained in good enough category (GE) with implementation percentage remained below 65% (Figure 1). This is due to the fact that the students are just taking the INoSIT model learning for the first time with the activities of students conducting experimental/ scientific inquiry with the help of the PhET Simulation virtual laboratory, so students still feel a bit confused to take part in learning. Some groups of students still have difficulties in formulating hypotheses, defining experimental variables (manipulation, response, and control variables) so that they also experience obstacles in designing and determining experimental steps with the help of PhET Simulation according to LKIS instructions. After the teacher gave maximum guidance to the students/ groups with the help of PhET Simulation technology media, then the next meeting had begun to experience improvement, with implementation reaching 83% at the fifth meeting.

This method is in accordance with Swanson's theory that giving training and effective feedback to teach the process of how students can solve problems [25]. The weakness in collecting data/ experiments is that it takes a lot of time and requires complete tools and facilities, but with the help of Lababotaroy virtual technology, it can save time, costs and risks. In addition, virtual laboratories can also help in collecting data, because students are not required to have experience in experimenting, but are only required to have experience in operating computers only [26].

The fourth phase of the INoSIT model is to interpret, with the main activity being to provide opportunities for students/ groups to carry out experimental activities with the help of *PhET Simulation* media, then the results will be communicated through percentages to other students/ groups or to the teacher, then guiding students to ask questions/ give ideas to the findings of other groups, then students/ groups will formulate conclusions of the experimental results. The percentage of implementation in this phase is 75% to 84 % from the first meeting to meeting fifth with good categories (G).

Reflection activity is the phase to the last five or phases of the INoSIT model with the main activity is to help students check what has been obtained and that has not been obtained during the KBM. According to Reid [27], reflection is a process of reviewing experience by describing, analyzing, evaluating the learning that has been done. Based on the results of the implementation of the reflection phase, it tends to be in the good category (G) starting from the first meeting to the fifth meeting.

Teachers and students jointly review the conclusions made by each group whether they have actually answered the problem/ hypothesis formulation, checking students' understanding through submitting a number of questions related to competency achievement indicators (GPA) and together students and teachers do reflection on the learning process about aspects of scientific literacy competencies that have not been maximally mastered by students.

Learning model application INoSIT models with the help of media *virtual laboratory PhET Simulation* also in accordance with the Regulations Government Number 19 of 2005 concerning the National Education Standards explained that learning must take place interactively, inspiring, fun, challenging, motivating students to participate actively, and provide sufficient space for creativity and independence initiatives in accordance with the talents, interests, and physical and psychological development of students. This is in line with the aim of the INoSIT model is to integrate ICT to train scientific literacy through scientific inquiry activities and to understand the nature of science (NoS) explicitly to improve scientific literacy competencies especially in abstract concepts, such as the concept of electricity.

➢ *Student Activities in INoSIT Model Learning*

Based on the analysis results s against the assessment given by three observers, can be obtained activity profile of the student during the learning activities, as presented in Table 4.

No.	Activities Observed	Percentage of Student Activities per Meeting (%)				
		P 1	P 2	P 3	P 4	P 5
1.	Listen / pay attention to teacher explanations / ICT media shows	8.4	8.8	8.5	8.7	8.9
2.	Formulate problems / questions	8.6	8.7	8.5	8.5	9.4
3.	Formulate a hypothesis	8.5	9.5	9.7	9.1	8.9
4.	Ask the teacher	5.7	5.6	5.8	6.4	5.5
5.	Answering teacher questions	4.4	4.3	4.0	4.1	4.7
6	Conduct observations / experiments	18.8	19.6	19.2	19.6	19.4
7	Work on LKIS	17,1	16.5	17.0	16.5	16.2
8	Discuss in groups	13.9	12.2	14.0	13.2	13.4
9	Presenting observations	7.9	7.2	5.9	7.6	7.7
10	Draw a conclusion	4.2	5.1	5.3	4.4	4.3
11	Behavior is not relevant to Learning Process	2.6	2.5	2.1	2.0	1.7
Coefficient Reliability (R)		*97.1%*	*96.2%*	*96.7%*	*96.0%*	*95.9%*
P_1 ; P2; P_3 ; P_4 ; and P_5 = Meetings 1, 2, 3, 4, and 5						

Table 4:- Activities of Students in Participating in Learning Process on the INoSIT Model Limited Test

Table 4. shows the percentage of student activities in participating in teaching and learning activities during the application of the INoSIT model in a limited test in class IX $_B$ of SMP 5 Kendari. It appears that the activity is mostly done from a ma pert meeting until the meeting to five is m observing/ experimenting, working on the LKIS, and discussing in groups with observation categories included in the category of reliability. A behavioral activity that is rarely done by students is that the activity is not relevant to teaching and learning activities, only around 1.7% to 2.6%. This shows that the learning done by the teacher through the application of the INoSIT model tends to be student-centered, while more teachers tend to act as facilitators and mediators.

The highest percentage of student activities is to actively involve themselves in the group to conduct experiments based on students' scientific worksheets (LKIS), conduct discussions to obtain data and present observations. The high activity of students at this stage was because students were very enthusiastic about conducting experiments with the *PhET Simulation* virtual laboratory, and they sometimes had to repeat the same activities several times because they wanted to get the best results. The enthusiasm of these students can be understood as a profitable thing, because the more practice they run *PhET Simulation* students will be more trained to have constructivism thinking patterns, where students can combine initial knowledge with virtual findings from the simulation that is carried out so they can understand scientific literacy in the concept of electricity well. This is in accordance with the results of research conducted by Finkelstein [28], through computer simulations, students have the most superior conceptual understanding and can explain how the actual electrical circuit works.

At the first meeting, students still needed a lot of guidance because they felt that they were still new to learning with a model like this. But in the second and third meetings students are getting used to it and can carry it out in an orderly manner even though they still need guidance. This is in accordance with the theory proposed by Jerome Bruner that students learn through active involvement with concepts and principles, while the teacher plays a role in encouraging students to gain experience and be able to carry out experiments that allow students to find knowledge for themselves [29]. In addition, Dimyati & Mujiono [30] explains, science has advantages such as a process skills approach that gives students a proper understanding of the nature of science which is often called the nature of science (NoS).

➢ *Student Response to INoSIT Model Learning*

For information about how to respond or what students towards the implementation of learning through the application of the model INoSIT to melatihkan scientific literacy junior high school students in the city of Kendari at the time limited test, the students were given a questionnaire in tetutup to be filled individually in order among the students do not know each other how their response towards the management of model teacher learning. Components that will be given a response are learning devices that are used by teacher models in carrying out learning which include: material, student textbooks (BAS), student scientific worksheets (LKIS), teacher teaching methods, learning environments with the help of computer technology , and the stages directed by the teacher in the learning process.

From the results of the analysis of student responses related to the interest in applying the INoSIT learning model in limited tests from the first meeting to the fifth meeting, it was quite high. This shows that the learning component is new for students. The ease of understanding the learning component for students is quite easy (62%) and 34% is very easy. This shows that students respond to learning components quite easily to learn. Furthermore, the interest of students to use the INoSIT learning model was quite interested (52%) and very interested (44%). This indicates that students are interested and interested in participating in teaching and learning activities during the application of the INoSIT learning model.

C. Description of the Effectiveness of INoSIT Learning Models

➢ *Enhancing Scientific Literacy Competence*

To assess the improvement kompetenesi scientific literacy of students during a limited test models INoSIT da lam science lesson on the concept of electricity and technology lisdtrik in the classroom IX_B SMPN 5 Kendari , can be seen from the three competencies , namely: 91) explain scientific phenomena, (2) conduct evaluations and design scientific inquiry, and (3) carry out interpretations of scientific data and evidence. The distribution of achievement levels in each scientific literacy competency based on obtaining normal gain (n-gain) can be seen in Figure 2.

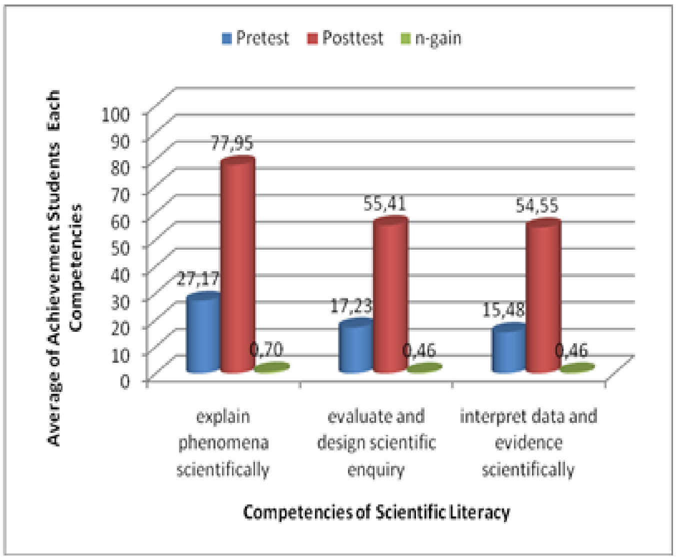

Fig 2:- Profile of Achievement of Scientific Literacy Competencies in the INoSIT Model Limited Test

Based on Figure 2., it can be explained that the achievement of scientific literacy competency at the limited test of the INoSIT model shows that the highest achievement is obtained by students in the competence explaining scientific phenomena. This is also supported by the achievement of n-gain which is already in the high category. In the competence to evaluate and design scientific inquiry and interpretation competence of data and scientific evidence of ignition is still low with the acquisition of a score below 50 with the achievement being in the medium category. This is in accordance with the 2015 PISA results, that the achievement of Indonesian students is still at level 1, meaning that students can only provide easy scientific explanations and follow the evidence provided explicitly [9].

➢ *Testing the Effectiveness of the INoSIT Model for Enhancing Scientific Literacy*

Based on the development research design (Research and Development) of Borg and Gall [30], then testing the effectiveness of the INoSIT learning model to improve students' scientific literacy in stages is through a limited trial carried out in class IX_B on Kendari Senior High School 5 of 37 people. To test the hypothesis whether there is a significant difference between the average *pretest* score before applying the INoSIT model and the average *posttest* score after the application of the INoSIT model, then with the help of SPSS version 22 software, it was obtained: (1) for normality obtained the *pretest* and *posttest scores* on the scientific literacy competency data obtained from *the Shapiro-Wilk test* with a value $Sig = 0{,}127 > 0{,}05$ and, Meaning that the data on the students' Scientific Literacy scores *pretest* and *posttest* in normal distribution; (2) in *test of homogeneity of variances* obtained value $Sig = 0{,}06 > 0{,}05$; means that students' scientific literacy score data at the *pretest* and *posttest* are derived from homogeneous variance. Furthermore, in the analysis of hypothesis testing obtained from *paired samples test* with value ($Sig(2-tailed) = 0{,}000 < 0{,}05$); meaning that there is a significant difference between students' scientific literacy competencies through pretest and students' scientific literacy competencies at the posttest. Based on the results of the analysis, it can be concluded that the INoSIT model is effectively applied in learning to improve the scientific literacy of junior high school students.

Based on the results of the study, it was found that the INoSIT learning model had fulfilled the valid, practical and effective elements, so that it was feasible to be applied in learning to improve scientific literacy in junior high school. This result is in accordance with the research by Adolphus et.al. [31] which states that the use of ICT can help students in science learning by providing access to information, taking measurements and analysis. The use of ICTs in the form of virtual laboratories such as *PhET Simulation* can also stimulate and motivate students in learning because of the novelty and uniqueness of interactions between students and programs [32]. In addition, the implementation of the design of the learning model *Pedagogy, Environment, Altitude* (PEA) ICT-based and teaching strategies are useful in science teaching through a context with precision to build positive trends, seek knowledge and improve scientific literacy at schools and universities. In addition, the ability of students to use ICTs can help them build positive attitudes towards science and environmental issues [16].

IV. CONCLUSION

- INoSIT learning model developed meet the elements of a valid, practical and effectiveness to increase scientific literacy junior high school students. From aspects of adherence to the model in limited testing at all phases tends to increase the quality of the category is quite good (GE) into either category (G) with a percentage enforceability of 70.5% to 85.7%. In that side, existence increasing the percentage of student activity towards better during learning with the highest percentage of activities conducting observations/ experiments so that the tendency of student-centered learning (*students center*); and the positive response of students to learning activities with an interest in the components of learning is quite high.

- INoSIT learning model that was developed to me ningkatkan competence of Scientific Literacy in junior high school students that are already included in the category effective. The highest achievement scientific literacy achieved by students on competence explain scientific phenomena with n-gain at the high category, while the competence to evaluate the design and scientific inquiry and competence to interpret the data and scientific evidence is still low by n-gain in middle category.

- From the attainment of Scientific Literacy has shown a significant increase of the competence of Scientific Literacy of students with a mean *normal-gain* middle category; there was also a significant difference between students' scientific literacy competencies through *pretest* and scientific literacy competencies of students after applying the INoSIT learning model through *posttest* with *"paired t test"* obtained value $(Sig(2-tailed) = 0{,}000 < 0{,}05)$ at the level of confidence of 95%.

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