Interactive Lecture Demonstrations (ILD) Model to Improve Students Understanding and Attitude towards Physics

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Interactive Lecture Demonstrations (ILD) Model to Improve Students Understanding and Attitude towards Physics

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Abstract
ILD learning design has been implemented to get an overview of improving in learning heat of understanding and the changing of attitude towards physics to student between a class that implemented ILD model with assisted science magic and a class that implemented ILD model without assisted science magic. The research method used was quasi experiment with nonequivalent pretest-posttest control group design. Two class of tenth grade were involved in this research 28, 26 students respectively experiment class and control class. The improvement of learning heat of understanding was calculated by the formula N gain based on the test data on the adaptation of Hake normalized and the changing of attitude towards physics by using CLASS questionnaire. The result show that gain average normalized < g > on experiment class got 0,55 while on control class got 0,31. Based on different test the average on experiment class and control class at 95% confidence level (significant 0,05) this result show that ILD model with assisted science magic (SM) significantly improve materials of student understanding better than ILD model without assisted science magic. Based on student questionnaire, we found that the implementation of ILD model with assisted science magic result the changing of attitude towards physics better than ILD model without assisted science magic. Further research recommendations are expected that there are models other than ILD using SM.

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INTRODUCTION

Physics is one part of the Natural Sciences (IPA) held in order to develop the thinking skills to solve problems related to the events around, both qualitatively and quantitatively, and to develop the skills and a confident attitude. This is in accordance with the nature of learning physics in SMA / MA contained in the physics curriculum in 2013 that learning is a process of creating conditions and opportunities for students to construct knowledge, skills and scientific attitude. One of the capabilities that must be owned by the students to be able to master the concept is the ability to understand. According to National Research Council (1996) to develop the ability to understand, students are required to actively use scientific thinking and have a lot of direct experience with nature all around, because understanding the science intimated to each individual to understand the structure of a complex of several types of knowledge, including scientific thought, the relationship between the frame of mind, the reason for some of the relationships used to describe and predict some phenomena, and how to apply it on several occasions.

In addition to understanding the concept, this study also analysis the scientific attitude of students, especially in learning physics. Scientific attitude needs to be developed at the upper secondary level students, because in the process of learning physics is not just cognitive, affective aspect is also an important part of the planning, delivery, and evaluation of learning. Carin and Sund (1997) argues that science, especially physics education should generate an attitude and scientific value. The fact that students can be successful in science lessons if they have an attitude towards science (Erdemir, 2009), especially in a better direction. Attitudes and interests play a major role in determining the student's learning process (Normah and Salleh, 2006). Especially students who have a positive attitude towards physics will be enthusiastic to study physics. This is in line with research by Rohandi and Nurul (2010), that a positive attitude towards science, especially physics bring a positive and influential commitment to students' interest in physics. In short, students who have a good attitude towards physics will have an impact on their interest in studying physics and improve students' perceptions of physics so far. This interest will also have a positive impact on their learning outcomes, especially in the cognitive realm of understanding concept.

So that the learning process of science can be more meaningful, the learning process should be directed to lead the students to learn with intuitive thinking and analytical thinking and fostering confidence in the ability of self. So the concepts that have been learned can be remembered by the students as a more meaningful concept (Nasution, 2005). Given such a vital role, we need a proper physics teaching model can provide guidance to students in order to improve students' understanding of the concept and attitude towards physics with a pleasant learning model through a series of learning activities that make students active.

But the fact is happening on the ground, still found the learning process of physics that does not comply with the demands of the ideal. This is supported by the results of *field study* ever conducted in one of the MA located in Pandeglang. In this *field study,* there were four findings that: 1) the observation of physics learning in the classroom implementation which did not facilitate the learning process of students to build concept independently, some students still passive in participating in learning; 2) the results of interviews with teachers of physics, namely learning methods are most frequently used are lectures, discussions, and question and answer. While the experiments and demonstration activities are rarely done, and if done still verification; 3) the results of questionnaire to students that most students do not like physics because the methods taught unattractive, boring, and contains a set of complex materials. While 75% of students admitted to preferring the implementation of demonstration which raises curiosity, excitement and enthusiasm as well as events that surprising with the scientifically proven in physics learning; and 4) the results of the data recapitulation average value on Semester Middle Exam each year in caloric material that is 63.95 under KKM schools.

In recent decades, the process of learning physics not only emphasizes the understanding and skills but the main thing is about attitude *(attitude)* students to the physics lesson. In other words, in their learning process, students are not only expected to acquire scientific concepts and skills, but also develop a positive attitude toward science. However, research has shown that students' attitudes toward science often turns increasingly negative, especially in secondary schools (Lin et al, 2014). Based on the statement above, the teaching of physics need to be designed such with innovative learning models so that the material provided can be controlled well and give a positive attitude towards learning. In addition, differences in the characteristics of student learning styles should be taken so that it allows teachers to use a variety of methods in the learning activities. The involvement of students in the learning process can be achieved by active learning than passive learning.

One model of learning that can solve the problem is the learning model *Interactive Lecture Demonstrations* (ILD). *Interactive* Learning *Lecture Demonstrations* (ILD) is one of the constructive learning so that students are actively thinking of its conception and allows students to build their own understanding of the main concepts through demonstrations and discussions with his colleagues (Zimrot and Askenazi, 2007 in Mazzolini et al, 2012). With active learning, students will be faced with a situation where they have to associate a new conception of the object. According to Ashkenazi and Weaver (2007) in Wattanakasiwich et al (2012) *Interactive Lecture Demonstrations* (ILD) has several advantages including: helping students to improve understanding of the basic concepts of physics through real experiments, stimulating the interest of students with given flexibility to predict and write the answers on the every demonstration, and provide meaningful learning opportunities with a group of scientific explanation. While the effectiveness of the weaknesses in the form of a limited time. This can be aided by the *magic of science* activities in the learning model measures *Interactive Lecture Demonstrations* (ILD).

Through the *magic of science* will complete the application of learning models *Interactive Lecture Demonstrations* (ILD), which not only improve students' understanding of the concept, but growing interest in physics and change their perception towards a positive attitude toward physics. The attitude of the students will be positively correlated with cognitive ability, especially their understanding of the concept (Zanaton and Lilia, 2006). The revised Bloom's taxonomy, are known seven aspects on indicators of understanding: (1) *Interpreting,* (2) *Exemplifying,* (3) *Classifying,* (4) *summarizing,* (5) *inferring,* (6) *Comparing,* and (7) *Explaining* (Anderson and Krathwohl, 2001). In this study the aspects to be measured in the learning aspect is *interpreting*, *inferring*, *comparing* (compare), and *explaining*. Selection of measured aspect is adapted to adaptation measures learning model *Interactive Lecture Demonstration* (ILD) aided *Science Magic* (SM). The novelty of this research compared to previous research is the use of the ICARE aided *Science Magic* (SM) all indicators of cognitive understanding. Similarly, SM combined with the application of the ICARE model on temperature and heat materials abilities and attitudes towards physics better (Asri, 2016).

The urgency and importance of this research for the development of education today is that combining SM with several learning models will be more interesting not only as an entertainment, but also as an educational tool based on activities, scientific principles and knowledge. Meanwhile in the future, there will be more research on attitudes towards subjects, especially physics itself. Based on the background of the problems noted previously, the proposed formulation of the problem, namely how to increase retention of heat material students and profiles attitude MA students of the physics of getting learning model of *the Interactive Lecture Demonstration* (ILD) aided *Science Magic* (SM) compared with students who had learning *Interactive* models *Lecture Demonstrations* (ILD) without assisted *Science Magic* (SM)?

METHODS

The method used in this research is quasi-experimental research methods *(quasi experiment)* and descriptive. Quasi-experimental research aimed to obtain information that is an estimate that can be obtained by actual experiment in a state that does not allow control or manipulate all relevant variables. In descriptive research activity, researcher only photographing what happens to objects or ideas studied by focusing on actual problems as in the time of the study. Research will be conducted using *non-equivalent pre-test post-test* *control group design* in two classes consist of one experimental class and the control class (Sugiyono, 2015). The populations in this study were all students of class X IPA MA in Pandeglang in the academic year 2016/2017. Samples were students of class X IPA 2 is as the experimental class with the number 28 consist of male 10 and female 18 and the class X IPA 1 is as the control class with the number 26 consist of male 6 and female 20 whom are selected using *purposive sampling technique.* This technique is carried out with several considerations, for example the reason for the limited time, energy, and funds so that it cannot take large and distant samples (Arikunto, 2013).

Researchers implement *science of magic* to the model of *the Interactive Lecture Demonstrations* (ILD) is in a second step, namely the students to predict what will happen and write the answers on a sheet of prediction. In this step will strengthen the student in understanding the concepts and theories based on the phenomena that interest them. By understanding the theory is based on the phenomenon that the theory will apply for longer in the minds of students. The importance of the implementation of *Interactive Lecture Demonstrations* (ILD) to the *science of magic* is to make students active because they have to communicate with the group, developing the ability to analysis because students must explain the scientific principles of the phenomenon, and students do not immediately learn the theory but they are given a stimulus to foster an interest and change their perceptions of physics that had been boring for them.

Table 1 shows steps of *Lecture Demonstrations Interactive* Model (ILD) assisted *Science Magic* (SM) on teacher and student activity. This steps was by researcher by adapting the developing steps of ILD from Sokoloff and Thornton (1997).

Table 1. Steps of *Lecture Demonstrations Interactive* Model (ILD) assisted *Science Magic* (SM)

No	Steps of Model Interactive Lecture Demonstrations (ILD) Assisted Science Magic (SM)	
	Teacher activity	Student activity
1	The teacher explains the design class demonstration and what will be done.	Students pay attention to the teacher's explanation about the demonstration to be carried out.
2	Master displays the phenomenon of science magic on class and asked a few questions predictions of what will happen.	Students predict what will happen and write the answers on a sheet of prediction.
3	Teacher demonstrations and note which prediction proved correct.	Students pay attention to the demonstration by the teacher and record the results on the result sheet to be saved.
4	Master displays the correct answer to the observation accompanied by a scientific explanation.	Students pay attention to the answers presented by teacher observation.
5	Teachers discuss the results of the demonstration in accordance with scientific explanations so that students can understand clearly.	Students discuss to discuss the results of the demonstration.

Research Procedures

This research was conducted by four stages which covered: preparation, planning and preparation of instruments, implementation, and the final stage. Research procedure is presented at Figure 1.

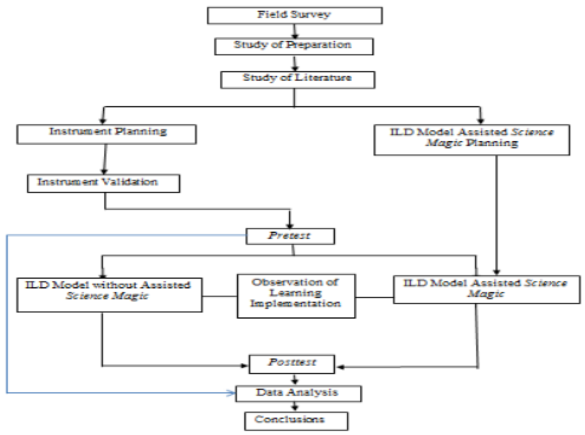

Figure 1. Flow chart of research procedures

Research Instruments and Data Analysis

Collecting data in this study is done by using several instruments, among them are: 1) The observation sheet of learning implementation in activities teachers and students. The date obtained from the learning implementation observation sheet is quantitative data which will be analyzed descriptively by calculating the percentage. The steps: counting the number of "yes" and "no" answers that the observer fills in the format, calculating the percentage using a descriptive equation, and the score obtained in percent form is then matched with the table. ; 2) Test the heat retention of material. To find out the increase in students' understanding of the heat material, the n-gain normalized gain value was calculated. The N-gain obtained on the measurement of understanding of heat material shows the category of increasing students' understanding of heat material understanding. Furthermore, the date were analyzed through several tests, namely normality test, homogeneity test, and hypothesis testing.; and 3) CLASS *test* by attitude category. In the CLASS questionnaire, each student was asked to answer a statement with the following answers: strongly agree (ss), agree (s), disagree (ts), and strongly disagree (sts). Each answer has a value of ss = 4, s = 3, ts = 2, and sts = 1. The CLASS scores were previously classified based on 6 attitude items in the CLASS questionnaire, namely relationships with the real world, personal interest, effort, applying conceptual understanding, self-confidende problem solving, and experience problem solving. This is done to describe the profile of students' attitudes towards MA physics by presenting the average results after being given treatment.

RESULTS AND DISCUSSION

The Implementation of Learning Activities

The implementation of the previously designed learning model was observed with the help of three observers who were given a teacher and student activity observation sheet. In addition, observers also help evaluate the most important things that must be carried out in each phase of the ILD by filling out the evaluation is intended to determine whether the activities during class learning are carried out based on the lesson plane. While the evaluation of each phase is intended for teacher reflection material on which phase the learning activities carried out are less than optimal.

Based on the results the percentage of enforce ability of the learning activities of teachers and students, it appears that at the first meeting of the study material expansion (length, area and volume) and the second meeting which study material of heat transfer (conduction, convection, and radiation), the implementation of learning in the classroom control and classroom experiments conducted by teachers and students brackish g amounted to 100%. In general, no significant differences in the learning process between these two classes in giving treatment to the criterion of adherence to learning all activities carried out although there are still shortcomings and obstacles.

The Improvement of Students' Heat Materials Understanding

Table 2 shows that there is an improvement of students' heat materials understanding in the medium category both in experiment and control class. Both categorized as average improvement.

Table 2. Gain normalized of students' heat materials understanding

Class	Pre-Test	Post-Test	N-Gain
Experiment	28.00	67.50	0.55 (Average)
Control	27.10	49.70	0.31 (Average)

To determine whether the differences in improvement of the control class and experiment class significant or not, then we used the statistical test analysis to test the hypothesis using T-test. Result of the hypothesis testing presented in table 3 show that the differences categorized as significant;

Table 3. Result of T-test heat materials understanding

Mean Rank of the Control Class (N=26)	Mean Rank of the Experiment Class (N=28)	Sig.	Decision
0.31	0.55	0.000	Significant

The results of statistical hypothesis test parametric T-test values obtained. Sig. (2tailed) or p. value of 0.000 where this value is smaller than the specified significance value (p. 0.000 < α. 0.005) with a 95% confidence level. Thus H_o was rejected, and H_a is accepted that increase heat materials understanding of students in the experiment class was significantly greater than the increase heat materials understanding of students in the control class.

Results in this study that the implementation of ILD model assisted science magic improve understanding of students. Some concepts can be initiated by presenting the phenomena of science through *science magic* in the learning process. In its activities the practice of *science magic* made the development of learning and teaching strategies should be adopted to improve the outcomes of these learning activities. Many researchers have shown that the activities of *science magic* quite effective in teaching science and learning (Arnold et. al, 2014, McBride et al, 2004, Michals et al, 2008, Yakar and Baykara, 2014), because it can generate student interest and encourage them to participate actively in the instructions that have been made. In addition, Hsu et al., (2012) stated that *science magic* is the right strategy to improve students' understanding of concepts through various activities.

This *magic science* Activities will arouse the attention and interest of the students, when inserted into the elements of the learning process, especially in the matter of physics. Students will be able to develop relevant knowledge and skills through observation and manipulation that occurred during the course of *science magic*. According to the study (Lin et al, 2014), stated that active learning by combining *science* with *magic* 5E Instructional Model to develop learning materials on the frictional forces can improve students' attitudes toward science.

The Improvement in the Respective Aspect of Students' Heat Materials Understanding

Table 4 shows that there is average improvement on every aspect of students' heat materials understanding in the medium category (experiment class) and the low category to comparing and explaining (control class). Both categorized as average improvement.

Table 4. The improvement in the respective aspect of students' heat materials understanding

No	Understanding Aspect	Class	Average Score		
			Pre-Test	Post-Test	N-Gain
1	Interpreting	Experiment	1.61	4.18	0.58
		Control	1.73	3.58	0.43
2	Inferring	Experiment	2.75	6.32	0.57
		Control	2.69	5.04	0.37
3	Comparing	Experiment	2.21	4.82	0.54
		Control	1.85	2.73	0.16
4	Explaining	Experiment	1.82	4.93	0.50
		Control	1.85	3.58	0.28

In the experiment class, heat the material aspects of the understanding for *interpreting* is the greatest improve in the amount of 0.58 which is then followed by *inferring*, *comparing*, and *explaining*. In contrast to the control class, the greatest increase understanding of the material that is the aspect of heat for *interpreting* of 0.43 and then *inferring*, *explaining*, and *comparing*.

The problem of comparing is a matter that requires the determination of a few ideas, problems, or same in a situation that has not been given. Someone mastered this ability if he can identify a similarities and differences between some of ideas. Most students just memorize equations formula or a mathematical relationship patterns. They often assume that by memorizing formulas or patterns alone is true, why should understand a statement in an idea of the similarities and differences that can be compared. This assumption is found in the field, especially in the control class, proven ability to compare it lower than interpret, deduce and explain.

The effort to present the *science magic* phenomenon causes the concept that grows based on the interrelationships from within the students, so that the ability to interpret the experimental class is much higher than the control class. As Drajat (1985) said that learning outcomes will be more embedded in students if curiosity is grown from memorable learning. This is in line with Subiyanto (2000), interpreting ability to understand material or ideas that are recorded, changed or arranged in other forms.

The phenomenon of the step second of *science magic* able to grow interest and the interest of students in studying physics. Interest and this interest will foster scientific curiosity reasons behind the phenomena *of science magic*. The scientific reason leads students on the ability to explain them. This supports the views expressed by Chiavrina and Vollmer (2005) that the activity of *magic science* is able to change the perception and motivation, so that some aspects of cognitive ability in understanding can be facilitated by either including the ability to explain. The ability to explain even this is fostered through a series of questions on worksheets through looking for a causal relation between one variable to another variable.

The Improvement in the Respective Meeting of Heat Materials Understanding

Table 5 shows that there is average improvement in the respective meeting of heat materials understanding in the medium category (experiment class) and the low category to second meeting (control class). Both categorized as average improvement.

Table 5. The improvement in the respective meeting of heat materials understanding

No	Heat Materials	Class	Average Score		
			Pre-Test	Post-Test	N-Gain
1	Expansion (First Meeting)	Experiment	3.93	7.57	0.60
		Control	3.69	6.04	0.37
2	Heat Transfer (Second Meeting)	Experiment	4.46	12.68	0.53
		Control	4.42	8.88	0.28

Based on Table 5 is obtained *N-gain* control class average on sub material expansion of 0.37 while the *N-gain* average of 0.60 experiment class. *N-gain* control class is average on sub material heat transfer of 0.28 while the *N-gain* average of 0.53 experiment class. The second meeting of control class is evidently the student is still difficult to distinguish the process of heat transfer between conduction, convection, and radiation. Students can specify with either a real example of the third heat transfer, but when asked about the process, there is still a mistake. This proves that the students' knowledge was limited to remember not understand.

Researchers can directly see the enthusiasm and the amount of interest in student learning in the classroom. There are even students who say to apply SM in subsequent learning in that class. The enthusiasm of students in the experimental class can be seen from their expressions when they see new phenomena that are broadcast. They tried to explore these phenomena, especially phenomena they had never seen before. It was once expressed by Joyce et al, (2009) that through interesting phenomena, students are increasingly motivated to explore concepts and understand deeper.

The Percentage of the Average Profile Attitude towards Physics at each Category

Table 6 shows that the percentage of average improvement attitude towards physics category after getting treatment for both class.

Table 6. The percentage of the average profile attitude towards physics at each category

No	Attitude towards Physics Category	Class	Average Score (%)	
			Pre-Test	Post-Test
1	Real Word Connection	Experiment	62.20	78.27
		Control	66.03	73.08
2	Personal Interest	Experiment	67.41	83.93
		Control	69.95	76.92
3	Effort	Experiment	63.79	81.35
		Control	63.89	73.29
4	Applied Conceptual Understanding	Experiment	63.69	82.14
		Control	64.42	73.40
5	Problem Solving Confidence	Experiment	59.04	81.70
		Control	59.74	69.23
6	Problem Solving Sophistication	Experiment	60.57	82.14
		Control	62.34	68.27

The percentage of the profile category of attitudes toward physics experiment class is larger than the control class, in all categories with a significant difference. Seen in one of the categories: personal interest, where the students in the experiment class during the learning process is enthusiastic when shown activity *science magic*. Personal interest they earn create a positive view of physics, not just memorize facts and master at problems solving of the count but build deeper concepts and integrate with the context of their daily life.

The implementation of *science magic* in both classes is not without drawbacks. Some students from the experimental class admitted that every physics lesson were always presented with interesting phenomena like this. It was not only shown through videos but students were directly involved, so learning would be much more fun. Like Johnson et al, (2000) opinion, that hands-on activities help students more effectively in developing positive attitudes towards physic. It's just that it takes a relatively long time to bring up student analysts from the *science magic* phenomenon as expressed by Serin and Mohammad Zadeh (2008) that it is very important improve attitudes towards science by giving enough time to encourage students during learning activities.

Students who have a negative attitude towards science, for example, are not interested or may cause them to fail in science (Abu Hasan Kasim in Aziz and Lin, 2011). Therefore it is very important to cultivate their interest at the beginning of learning, such as in the second steps through the addition of *science magic.*

CONCLUSION

Based on the analysis and processing of research data, it can be concluded that:

1. The application of ILD-assisted learning model *science of magic* to further improve the understanding of the material for heat is compared with ILD without assisted learning model *science magic.*
2. The application of ILD-assisted learning model *science of magic* for changing of better impact on attitudes toward physics student profile MA is compared with ILD without assisted learning model *science magic*.

SUGGESTION

The researcher suggests to the next researcher to examine other learning models that are more suitable with the help of *science magic* in physics material other Heat and to focus more on researching students' attitudes towards physics.

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