ISSN No:-2456-2165

Learning Development of Cooperative Model Based PhET Media to Reduce Potential Misconceptions in Dynamic Electric Matter for Tenth Grade in State Senior High School

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Abstract:- The purpose of this research to produce a cooperative model of physics learning that is feasible (valid, practical, and effective) by using PhET media to reduce the potential for misconception of Dynamic Electricity material in student grade X at State Senior High school. Development of learning material use the 4D model and trial use one group pretest-posttest design. The Data collection used observation , test (pretest-posttest) and questionnaire methods. The data analysis using quantitative descriptive, qualitative descriptive and certainty of response index. (1) Validity of learning material in terms of (a) validation of instruments are valid categorized, (b) Readbility of book and hand out are easier categorized for student's; (2) The practicality of the learning material in terms of: (a) The implementation of the lesson plan is very good, (b) the activity of the students is active, (c) the obstacles during learning can be overcome; (3) The effectiveness of learning material in terms of: (a) Student responses are very good, (b) decrease of potential misconceptions for each student and question are high categorized, increase for the number of students who know concepts and increase for learning outcame by clasical and individual. The conclusion of this research that The learning of cooperative model based PhET media are feasible (valid, practical, and effective) to reduce the potential misconception of high school students.

Keywords:- *PhET Media, Misconception Reduction.*

I. INTRODUCTION

In some countries, Physics educators investigate student errors in Physics material. The potential misconception is one of the factors causing the low results of Physics education. If the teacher teaches without paying attention to the wrong concepts of students already in the student's head before the lesson, the teacher will not succeed in instilling the correct concepts (Berg, 1991: 1). Misconceptions are found in all fields of science, such as physics, chemistry, biology, and astronomy. The efforts of students and teachers in studying physics properly and correctly experience many obstacles due to the condition of physics itself. There are theoretical lessons and concepts in physics that cannot be seen with the naked eye because there are very small parts such as the charge of electrons, protons, deutrons, electric currents or that are too large like planets. It is impossible to present the above in the actual version. In addition students before the lesson already have preliminary knowledge so that it will experience difficulties in the process of assimilation and accommodation of new information. So in physics learning can be displayed by animations with various computer programs that are freely available on the market and can even be downloaded for free on the internet such as the PhET program.

PhET (Physics Educational Technology) is a site created by the University of Colorado with the main sponsor of The William and Flora Hewlett Foundation. This site provides simulations of learning Physics, Chemistry, Biology, Mathematics, and Earth Knowledge which are free to download and use in classroom learning or individual learning. The following are the advantages of PhET besides being available for free (http://www.phet.colorado.edu), namely: 1) PhET project is research based, published and continues to be developed for the perfection of the PhET program by the PhET project team; 2) Helping students understand visual concepts by living what is invisible to the eye through the use of graphics and intuitive controls; 3) PhET simulation, its use is quite easy enough by "clicking" and "drag / drag" and providing measurements that can be manipulated by means of "right click" will appear a menu that is "change value" and other options; 4) PhET is very interactive which invites students to learn by exploring directly and getting direct feedback so students can develop understanding of scientific concepts; 5) A safe place for student exploration because children have the opportunity to learn and try simulations without penalty / short-circuit risk (such as in a simple electrical circuit) when trying something wrong, so hopefully children can be encouraged to learn more; 6) PhET simulation can be operated on line or off line so that it is expected to be able to help and accompany students when learning concepts outside the classroom because it is designed with minimal text so students easily integrate and can help with homework from the teacher.

Although PhET has many advantages, one of which is as a virtual lab, but PhET does not have specific instructions for use, specially instructions for studying dynamic electrical material and other physical material. This is a challenge for researchers to develop physics learning devices using PhET media which are expected to reduce the potential misconceptions on dynamic electric topic. Therefore, the teacher's ability to develop specific physics learning devices is still needed to serve the needs of misconception learning using PhET media.

This condition makes researchers interested to do research on reducing for the potential misconceptions. Students' misconceptions prior to the action of learning are called potential misconceptions (Zainnudin, 2018). This effort is expected to reduce the problem of potential misconceptions in Dynamic Electric material in grade tenth at high school. So that at the higher education level students are more successful in overcoming problems of physical concepts and social life. This means creating quality resources and ultimately being able to increase the nation's competitiveness in order to improve the country's economy and reliable human resources (Daryanto, 2011: 150).

Teachers must pay attention to the phases of the development of their students and characters of physics lesson. The education phase in Junior school and high school determines a person's life (Asmani, 2009: 8). According to Piaget, these children are in the phase of formal operations that have the ability to think abstractly and as purely symbolic as possible and problems can be solved through the use of systematic experimentation. This means that the child has been able to review the problem from several points of view and think alternative solutions to problems, reason based on hypotheses and logic, understand the symbolic meaning and make estimates of steps for the future.

Learning theory is a translation of how the learning process and information obtained by students. As explained by Trianto (2007: 12), that learning theory is an explanation of the state of learning activities and the way information can be received into students' thinking. The success of learning is influenced by many factors, such as Gagne's statement (in Trianto, 2007: 12) that the learning process in learners requires good learning conditions, namely the internal and external conditions must support each other. But with the application of learning theory can bring the impact of change for the better as expected.

The theory put forward by Allan Paivio (in Sutrisno; 2010) about the dual coding theory states that humans receive and process information through one of two available channels, namely visual channels (nonverbal images) such as graphics, animation and other data in the form of images , while verbal channels such as writing and sound or voices. Both of these channels can function either independently, parallel or together. Nonverbal channels process information simultaneously while verbal channels process information received sequentially.

Through the process of assimilation and adaptation, each individual's cognitive system grows and develops so that it can increase to a higher stage. The way of adjustment (assimilation and adaptation) is carried out by each individual because the student and it wishes to achieve a balanced or stable (equilibrium). The condition of equilibrium is a stable between the cognitive structure of students and experience in the environment (Nur, 2004: 13). In reality, a child or a student will always try to achieve balanced condition by using both the assimilation and adaptation processes.

Based on Vygotsky's theory (in Slavin, 2011: 58-60) explains the development of children or students there are four principles, namely: Self-regulation, private conversation, zone of proximal development, scaffolding. Basically Vygotsky supports the use of cooperative learning because cooperative learning in children to be team work to help each other in learning (Slavin, 2011: 60). This happens because in general peers can understand each other in the closest development zone with other friends. Cooperative learning provides a means of inner conversation for other children, so hopefully they can understand the reasoning processes of each other. When, there is interaction among team members with the process of talking to oneself when facing a problem, indirectly children benefit by hearing "thinking out loud" (Slavin, 2011: 60). In the process of listening to the thoughts or opinions of other members there will be debate or negotiation of concepts about alternative solutions. And the teacher is only as a facilitator so that a good concept negotiation takes place. The above description proves the great benefits of interaction between peers can advance children's thinking.

Contructivism learning theory basically explains about the learning centered on students. The rationale for the theory of constructivism is that students must try to find and transform complex information by their self for compare and analyze new information with old rules and then revise the information if there is a discrepancy with the development of science. The theory of constructivism was born from the thought of Piaget and Vygotsky, where both explain the existence of cognitive changes in students if the old conceptions that have been understood by students will change after going through a process of imbalance or the process of assimilation and accommodation when understanding new information (Nur, 2008 : 3).

In the statement of Muijs and Reynold (2008: 99-103) that teaching constructivism in practice also has elements namely modellig, scaffolding, coaching, articulation, reflection, collaboration, exploration, teachers provide choices and answers multiple realities, flexibility and adaptive. So the basic principle of constructivism in learning is that knowledge must be discovered and built by the individual and the process is experience as the main key to meaningful learning. Meaningful learning will not be realized without personal experience done directly by individuals. Therefore the teacher must ensure that students

actively build and experience themselves during the learning process.

The old paradigm in education is still widely used by teachers because of time and material reasons. Such conditions are still prevalent in the learning process in most schools in Indonesia (Wena, 2008: 189). The effort to overcome this problem is done by increasing the activeness of students in following the teaching and learning process. This was stated by Kemp (in Wena, 2008: 189) that there needs to be a process of teaching and learning activities that can encourage students to actively participate. With the activeness of students who are guided in the active learning process, it is expected that learning outcomes and student memory can improve because of the meaningful learning process. According to Lie (in Wena, 2008: 189) that the results of research on learning by peer teaching through cooperative models turned out to be more effective than learning dominated by teachers. Cooperative learning will provide a means for students to work together with peers in completing class assignments. And through the cooperative model too, a student will have the opportunity to learn resources or to be a role model for other friends

Make a mistake of concept can happen to anyone and even a professor (Suparno, 2005: 2), and healing misconceptions is not easy. Therefore, teachers are expected to detect potential misconceptions before starting the lesson. The potential of misconception is one of the obstacles in learning, especially physics can be a chain of misconceptions if the initial concept is wrong.

Preconception is the initial knowledge students have before getting certain material and the truth is uncertain. This is because before students take a physics lesson, students already have daily experiences with physical events so that students freely develop many conceptions that are not necessarily the same as those of physicists (Berg, 1991: 1). The concept is a very small piece of information (Ibrahim, 2012: 7). Meanwhile, according to Ausabel (in Berg, 1991: 8), the notion of concepts is the kinds of objects, events, situations, conditions or characteristics that are owned and represented in culture by a sign or symbol. Conception is the interpretation of concepts by someone (Berg, 1991: 8). Conception built by students is sometimes not necessarily in accordance with the conception of physicists or teachers. Students' conceptions are usually built based on their previous life experiences (Suparno, 2005: 3). So the conception is a person's opinion or thought about a thing.

Misconceptions have other names such as alternative concepts, alternative frameworks, alternative conceptions, or children theories. Misconception is a conception that is understood by students and the understanding is clearly different and often even contrary to the scientific concept of experts (Ibrahim, 2012: 13).

Misconceptions in physics almost all of the world are the same as Osborne statement (in Berg, 1991: 63) that there are four misconceptions of electric current namely: the flow in / out of one pole can make lights turn on, currents that move in opposite directions from two poles of a battery will collide then turn on the lights (clashing currents), the amount of current will be reduced because it is used by lights and other devices (consumption models), and currents that do not change / remain (the science model). According to Berg (1991: 62) who examines electrical misconceptions there are misconceptions in circuits that are not simple, namely: a) consumption models, b) local reasoning, c) Voltage sources are fixed current sources, d) in lamps arranged by series or parallel arranged If the cable is pulled apart, the potential difference of the incoming cable to the empty lamp and the exit cable is considered zero. Even a number of physics teachers in a upgrading system consider the voltmeter to be faulty rather than the conception of the pontesisial difference wrong and e) many students are confused with the terms series and parallel.

Misconception has resistant properties and is difficult to change. Misconceptions will affect the mindset of students at the next level and sometimes even carry over forever (Berg, 1991: 12). Therefore it is necessary to attempt to justify the misconceptions experienced by students. The initial step to correct misconceptions is to identify misconceptions that occur in students. There are several ways to identify potential students' misconceptions, including the multiple choice test with open reasons and the Certainty of Response Index (CRI).

The use of multiple choice questions with open reasoning is based on research conducted by Amin and Treagust (in Suparno, 2005: 123). The multiple choice questions used are open reasons where students must answer and write reasons for the answers. Students' answers on multiple choice are then matched with their reasons, is there a relationship between the answers with the reasons. Some possible answers to students working on are as follows:

a. The answer is correct and the reason is correct
b. The answer is correct but the reason is wrong
c. The answer is wrong but the reason is correct
d. The answer is wrong and the reason is also wrong
e. Students do not answer

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ISSN No:-2456-2165

Of the five possible answers above, when a child has a answer, the child is said to understand the concept while the answer e is said the child does not know the concept. Furthermore, for students who answer b, c, and d are answers that have great chance of containing potential misconceptions if learning has not been done and become misconceptions if learning has been done. Certainty of Response Index (CRI) is a way to find out the misconceptions that have been developed by Saleem Hasan. CRI is widely used in various surveys, especially those that require respondents to give opinions about the certainty that respondents have of their ability when choosing and constructing knowledge, laws or concepts, which have been built up both in themselves and to determine the answer to a question.

In this study, the degree of certainty used is a scale of six from 0 to 5 as stated by Hasan (in Tayubi, 2005: 8) shown in Table :

CRI Scale	Remarks Criteria
0	If you answer a question it's 100% predictable
1	If in answering questions about the percentage of guessing elements is between 75% -99%
2	If in answering questions about the percentage of guessing elements is between 50% - 74%
3	If in answering the question about the percentage of guessing elements is between 25% - 49%
4	If in answering the question about the percentage of guessing elements is between 1% - 24%
5	If in answering the question there is no element of guessing at all (0%)

Table 1:- Tabel of Operationalization of CRI Criteria (Hasan in Tayubi, 2005)

When the respondent has a CRI scale of 0-2, it means that the degree of certainty is of low value. This explains that the element of guesswork made by respondents when answering is very high without considering whether the answer is right or wrong. In addition to the above understanding that when the CRI score is low (0-2) it is also meaningful if the condition of the students does not know the concept when giving answers.

While the high CRI value when the answers given by students / respondents on a scale of 3-5 means that the answers given by students have high trust and students use rules and concepts so there is no guessing element. On a scale of 3-5, right and wrong answers greatly affect the analysis of misconceptions. If the answer given by the student is correct, it means that the answer has a high level of confidence because students can provide an explanation of the truth of their concepts in the written reason column. If the answer given by the student is wrong, it means that the student has experienced a misconception when determining the answer, then this condition is an indicator of misconception in students. The possibility of misconception and not knowing the concept are summarized in Table 2:

Criteria Answer	Low CRI (<2.5)	High CRI (> 2.5)
Correct Answer	The answer is correct but low CRI. That mean is lucky guess and interpreted unknown concept	The answer is correct and high CRI, That mean is understand about the concept.
False Answer	False answer and low CRI. That mean you don't know concept	False anwer and high CRI, that means misconception

Table 2:- Classification of Student Answers based on CR1 (Hasan in Tayubi, 2005: 8)

Based on the theory outlined above about the CRI problem and analysis, students' answers can be classified into 3 categories, namely:
a) Understand the concept that is when students can answer correctly and have a high CRI
b) Don't know the concept that is when students answer incorrectly and have low CRI
c) Potential of misconceptions / misconceptions that is when students answer incorrectly and high CRI scores
In this research using a cooperative learning model.

Cooperative learning is ruled by the theory of constructivism which states that students must find themselves and transform complex information, check new information with old rules and revise if there are rules that are no longer appropriate (Trianto, 2007: 13). Students are required to really understand and apply knowledge, and must work to solve problems, find solutions for themselves and try hard to find new ideas. Cooperative learning is a learning model that focuses on group work that is expected to be able to change the norms in the culture of young people and make high achievements in academic learning tasks (Arends, 2008: 5).

Some previous studies on the use of PhET media in physics learning can prove significant results, as conducted by Samsuri (2010) stating that learning physics using simple PhET and KIT media on dynamic electric material runs effectively, Kustijono et al (2010) states that physics learning Using a virtual lab (PhET) on direct current electricity material provides sufficient thought process skills and good inquiry performance on students as well as high student activity, excellent learning outcomes and teachers can perform well, and Lilis Firmiyani's research (2011) states that the learning outcomes of small group processes are better than large groups when using PhET media.

Based on the background described above, the researcher was motivated to conduct research on the development of learning devices using PhET media with cooperative learning models to reduce potential misconceptions on the dynamic electrical material of grade tenth at high school, then the problem in this research is: "How is the feasibility of learning devices using PhET media with cooperative learning models to reduce the

potential misconceptions on dynamic electric teaching materials?"

II. METHOD

The subjects in this study are the PhET media-oriented learning tools with a cooperative model to reduce the potential misconceptions for electric dynamic topik. The device was applied to students in class X-Science 3 (A) and X-Science 5 (B). The number of students in each class is 32 students, held in second semester of the 2016/2017 school year at Public Senior High School 2 of Mojokerto city.

The research procedure consisted of two stages: the first stage was developing learning devices that used cooperative learning models and PhET media to reduce the potential for misconceptions of dynamic electric subject matter in the tenth grade, while the second stage applied the results in the first stage in learning for tenth grade students. The implementation phase in the class used the One Group Pretest-Postest that adopted from Arikunto (2006: 85), which is described as follows :

O_1 X O_2

Information:
X : Teaching learning process used development learning devices (treatment)

O_1 : observation / initial test before treatment on class (tenth grade student) to determine student who are the potential misconceptions
O_2 : observation / final test after treatment on class (tenth grade student) to find out students who are misconceptions

A. The research instrument used consists of :

1. Conceptual Validity Sheet Learning Tools

The form used to assess the feasibility of productive Physics learning devices that have been developed. The validation sheet is given to expert lecturers in their major subject. The validation sheets are consists of lesson plan, student's worksheet based of PhET and test question form.

2. Readability Sheet of Learning Devices.

This instrument is used to assess the readability or the level of student understanding of the device development result. This instruments are student textbooks and worksheets. This sheet is form of readability which must be filled out by students.

3. Observation Sheet for Lesson Plan Implementation

This sheet was given to two observer teachers for observe the researcher when appliying learning device in the class. Scores obtained by the teacher in carrying out the teaching and learning process include preparation, introduction, core activities, closing, and time management.

4. Observation Sheet Obstacles during Learning

Observation sheet on constraints during learning is used to find out the obstacles during the implementation of learning. This sheet is filled in by observers and researchers, both before and during learning, so that researchers can provide alternative solutions to overcome obstacles that arise.

5. Pretest / Posttest Question Sheets

This sheet is used to obtain data on the reduction of misconceptions that are followed by an increase in understanding of concepts and completeness of dynamic electricity learning experienced by students in learning using PhET media with a cooperative model. These pretest and posttest questions use a reasonable multiple choice test and include the level of student confidence in the answer. This test method is called certainty of response index.

6. Observation Sheet Student Activities

Student activity observation sheets are used to observe the activities of students in following the learning process that uses learning tools using PhET media and cooperative models. This sheet was given to two observer teachers.

7. Student Response Questionnaire Sheet

Student response questionnaire sheets filled out by students and used to determine students' responses to learning activities that have been carried out. The questionnaire was filled out after the end of the whole learning process.

B. Method of Colleting Data

This type of research is a development research that has already existed to overcome a problem, especially in learning physics. Therefore the data collection method must be adjusted to the data type. The data collection methods used by researcher is as follows:

1. **Validation by expert (Lecturers)** are used to obtain the feasibility of learning device that have been developed by researchers. Data obtained from validation are learning plans, book about dynamic electricity, student worksheets and test questions to detect potential misconceptions.

2. **Observations** by two observer teachers to observe the implementation of research include the implementation of a lesson plan, identifying obstacles in research and student activities

3. The **test** was conducted twice. The first is called pretest given to student before the application of learning device developed by researcher that is to detect potential misconceptions. The second test is called posttest given to student after researcher is appliying of learning device in the classroom whose function is to determine students who experience misconceptions.

4. The **questionnaire** is used to obtain data of readability and student respones. Questionanaire readability is given to students before book and worksheets are applied in teaching learning process, while student

response questionnaire are given to students after the learning process finish.

5. **Interviews** are used to complete the data on the test answer sheet if there are students whose answers are incomplete or do not write the reason for the answer and the value of the CRI confidence level

C. Analyzing of Data

The purpose of data analysis in this research is to answer research questions or determine variable value which further formulate conclusions. The following research data will be analyzed:

1. Validation Analysis of Learning Devices

Validated instruments are Lesson plan, student textbook, worksheet and Pretest / posttest questions. Data analysis for the validation of the lesson plan was carried out with a qualitative descriptive analysis by averaging the scores of each component.

Category	Score	Interval Value
A	> 4.20	Very valid
B	3.41 - 4.20	Valid
C	2.61 - 3.40	Fair Enough valid
D	1.81 - 2.60	Less Invalid
E	<1.80	Very less or Very less valid

Table 3:- Description of validation score lesson plans and Student Worksheets (Utomo, 2013: 65)

Category	Score	Interval Value
Very good / very decent	3.51-4.00	Can be used without revision
Good / decent	2.60-3.50	Can be used with minor revisions
Poor / inadequate	1.70-2.59	Can be used with major revisions
Not good/Not worth	0.00-1.69	Not yet usable

Table 4:- Description of validation score for Student Textbook (Suharsimi, 2006: 256)

2. Device Readability Analysis

The readability value is the level of student understanding the results of devices development which in research are student textbooks. To get the readability value of the device, then analyzed descriptively based on the level of readability of the device as in Table 5.

$$Score = \frac{Amount\ \ of\ \ True\ \ Answer}{Amount\ \ of\ \ miss\sin g\ \ word} X100\%$$

Category	Score	Interval Value
Free level	> 60%	Material too easy = high
Learning level	40% - 60%	Appropriate material for learning = medium
Pressure level	<40%	Material too difficult = low

Table 4:5 Readability value of textbooks Taylor (in Utomo, 2013: 68)

3. Analysis of the Implementation of Lesson Plan

The assessment of the implementation of the teaching syntax phases by using integrated science learning device was carried out by two trained observers, so that they could operate the observation sheets correctly. The criteria for each phase in the syntax in question are implemented and not implemented. The implementation of lesson plans was observed by two observer teachers and their mean scores were analyzed to determine the results of the assessment. This analysis is carried out by calculating the average score given by the observer with the criteria shown in Table 5.

Score	Category interval
1.00 - 1.99	Not good
2.00 - 2.99	Enough
3.00 - 3.49	Good
3,50 - 4,00	Very Good

Table 5:- Criteria for implementation of learning (Suharsimi, 2009)

The percentage to determine the implementation of the Lesson Plan uses the Percentage of Agreement (R) formula as follows:

$$R = \left(1 - \frac{A-B}{A+B}\right)$$

Note:
R = Percentage of Lesson Plan implementation
A = higher score by observer
B = lower score by observer

4. Analysis of Constraints while Learning

The finding of obstacles during the implementation of learning is done by observers, researchers, both before and during learning, as well as providing alternative solutions to overcome the obstacles that arise. Data obtained from the findings of obstacles during the implementation of learning were analyzed descriptively.

5. Analysis of Student Activities

Student activity data in learning are analyzed using quantitative descriptive analysis, which is used to observe student activities which include: paying attention to teacher explanations, raising initial knowledge about physics concepts, expressing opinions, reading textbook or student worksheet material, discussing while working on student worksheet and PhET, helping friends as a group, the responsibility of presenting work / learning activities, summarizing the material and irrelevant behavior / activities. Data about the average student activity observed during implemetation lesson plan were analyzed by the following formula:

$$P = \left(\frac{Average\ \ score\ \ by\ observers}{Amount\ of\ \ times\ \ frequensi\ \ observe}\right) x100\%$$

Instrument reliability is determined by the assessment of two observers with the level of reliability calculated using the Percentage of Agreement (R) formula

$$R = \left(1 - \frac{A-B}{A+B}\right)$$

Note:
R = Percentage of Lesson plan implementation
A = higher score by observer
B = lower score by observer

6. Pretest-posttest Analysis

a. Sensitivitas of item test

Before analyzing the potential for misconceptions, the researcher must analyze the sensitivity of the items from the results of the pretest-posttest. The validity of items is obtained by calculating the sensitivity of each item to determine the extent to which each item is able to measure the effect of learning. To measure the sensitivity of the items used the following formula:

$$Sensitivitas = \left[\frac{R_a - R_b}{T}\right]$$ (Groulund in Harefa, 2009: 76)

Information:
Ra = Number of students who answered correctly on the final test
Rb = Number of students who answered correctly on the initial test
T = Number of students taking the test
The criteria used to determine that the item is sensitive to the effects of learning, if it has a sensitivity value (S) ≥ 0.30 (Harefa, 2009: 76)

b. Analysis of Reduction of Potential Misconceptions

In this misconception analysis uses two stages, namely:

(Suprapto dalam Said 2012: 71)

1). Profile of misconception in class X students of SMAN 2 Mojokerto

This diagnostic test is to find out the understanding of concepts of students who do not know the concept, know the concept and misconceptions. This test uses reasonable multiple-choice questions and students must state the level of confidence in the answers given. The level of confidence has six scales, namely:
0 = fully suspect
1 = almost guessed
2 = not sure
3 = sure
4 = almost certain
5 = sure

Categories of answers from students can be seen in Table 6:

CRI Answer	Criteria Low (< 2.5)	High CRI (> 2.5)
Correct answers	Correct answers but on average low CRI. It is means guessing (lucky guess) then considered not knowing the concept	Correct answers and high average CRI means mastering the concept well
Wrong answers	Incorrect answers and low CRI mean do not know the concept	Wrong answers but high CRI means a misunderstanding of the concept called potential misconceptions/ misconceptions

Table 6:- Provisions for CRI Assessment
(Hasan in Tayubi, 2005: 7)

Based on the explanation above about the CRI problem and analysis, students' answers can be classified into 3 categories, namely:
1. Know the concept if students answer correctly and have high CRI
2. Don't know the concept if the student answers wrong or the student answers right but has a low CRI
3. Misconceptions if students answer incorrectly and have high CRI

2). Increased understanding of student concepts

From the pretest-posttest value, it can be analyzed the percentage of decreasing misconceptions and increasing students' understanding of concepts. Individually, a student is said to understand the concept of a good or complete category if he gets a score with a proportion of ≥ 75% and students are said to understand the concept of a category less if he gets a score with a proportion of <75%. understand the concept.

$$P_{individual} = \left(\frac{Total\ score\ of\ true\ \ answer\ by\ student}{Maximal\ \ Score\ of\ true\ answer}\right) \times 100\%$$

$$P_{Clasical} = \left(\frac{Number\ of\ student\ pass}{Number\ of\ all\ students}\right) \times 100\%$$

Techniques to determine the increase in the results of misconception by remediation using PhET media in this study using normalized gain techniques. The use of this technique is due to know the average value of G (normalized gain) of each group so that it can determine the effectiveness of remediation improvement results from each group with the following formula:

$$(g) = \frac{(S_{post}) - (S_{pre})}{Skor_{maks} - (S_{pre})}$$

Information:
$g_{(gain)}$ = increase in learning outcomes / academic skills
S_{pre} = average pretest or initial skill
S_{post} = average posttest or final skill (Hake, 1998)

The N-gain category of students as shown in Table 7.

Score interval	Category
> 0.7	Height
0.7 - 0.3	Medium
<0.3	Low

Table 7:- Criteria for student N-gain (Utomo, 2013: 70)

7. Analysis of Student Responses

Analysis of student responses was analyzed using descriptive statistics, which were used to measure students' opinions of the learning tools taught by the teacher during the pilot. The response questionnaire includes the lesson plan, student textbooks, worksheets, the learning atmosphere and the way the teacher teaches, as well as the learning approach used. Data about student responses observed during lesson practice were analyzed by the equation:

$$P = \left(\frac{score\ by\ student}{Ideal\ score} \right) x100\%$$

with the criteria as shown in Table 8.

Score interval	Category
0% - 20%	Very weak
21% - 40%	Weak
41% - 60%	Enough
61% - 80%	Strong
81% - 100%	Very strong

Table 8:- Criteria for student response
(Riduwan, 2003)

Student response data is used to answer the question how students respond to learning using -based cooperative models.

III. RESULT AN DISCUSSION

A. Conseptual Validity of Learning Devices

Learning devices that have been developed by researchers, namely:

1. Validity of Lesson Plan

The lesson plan is a systematically compiled guideline by researchers as a guide for teachers in conducting learning activities in accordance with the model used in teaching and learning activities in class. the results of Lesson Plane validation obtained an average score for both validators is 3.41 - 4.20 with good criteria (valid) and a reliability level of 96% so that it can be used with minor revisions.

2. Validity of Student Textbook

Student textbooks are handbooks of materials that have been designed according to the needs of researchers, namely the learning of cooperative physics models using PhET media to reduce the potential misconceptions on dynamic electric material. The validation of student textbooks uses scores with criteria ranging from 0 to 4. The results of the validation of student textbooks compiled and developed by researchers as a whole get an average score of 3.51 – 4.00 with very good criteria with a reliability level of 94%.

3. Validity of Student Worksheets

Student activity sheets compiled by researchers adjusted to the research needs of physics learning using PhET media to reduce potential of misconceptions on Dynamic Electric material is expected that with this worksheet students can work together with teams and independently so that students can freely try and discover directly the concepts of dynamic electricity without any fear is wrong and immediately gets a response from the PhET application.

Based on the results of the validation, it is known that overall the student worksheets compiled and developed by the researchers obtained an average score of >4.20 with very good criteria and a reliability level of 97% with a very reliable category.

4. Validity of Pretest-Postest Question Sheets

Test questions developed by researchers in the form of multiple choice questions with reason and level of confidence in the answers given by students. This test question is expected to track misconceptions among students. Pretest-posttest questions are arranged and developed based on indicators and learning objectives to be achieved.

So the pretest-posttest developed by the researcher after being evaluated by the validator is declared valid, understandable and without revision it is appropriate to be used for research.

5. Readability of Student Textbook

Readability of student textbooks and student worksheets is determined by providing a readability test sheet in the form of words that are omitted and students are asked to fill in the words that are omitted on the reading on the test sheet.

Based on the readability test results of student textbooks and student worksheets, the average percentage of readability of student textbooks and student worksheets was 84% ang gets a high category. This means, the contents of these book and worksheets are very easy for students to understand.

B. Practicality of Learning Devicess

The practicality of the device that has been developed in this study can be seen from the implementation and the obstacles that arise in the implementation of learning.

1. Implementation of Lesson Plan

The implementation of learning is illustrated by the average score of observations which includes preliminary activities, core activities, closing and class atmosphere in class A and class B. Based on table 5, the average score of the feasibility of learning in class A and class B is 3.50 -

4.00 with very good implemented category and has an average reliability of 96.27%.

2. Obstacles in the Learning Process

The constraints in learning to reduce the misconceptions of Dynamic Electric material using cooperative learning models and PhET-based media are that there are some students who do not write down the level of confidence in the answers so that researchers must conduct interviews with students to obtain data so that it requires additional time in this research.

C. Effectiveness of Learning Devices

The effectiveness of learning devices in a teaching can be seen from the activities of students, student responses and the reduction of potential misconceptions after learning.

1. Student Activities

Activities undertaken by students conducted during the learning process were observed by two teachers. Both observers made observations using student activity observation sheets.

Joint discussion activities between friends who dominate almost all learning meetings. The observation results of this activity have a high reliability both in class A and class B because it has a value of 96% and 95.58%.

2. Reduction of potential misconceptions

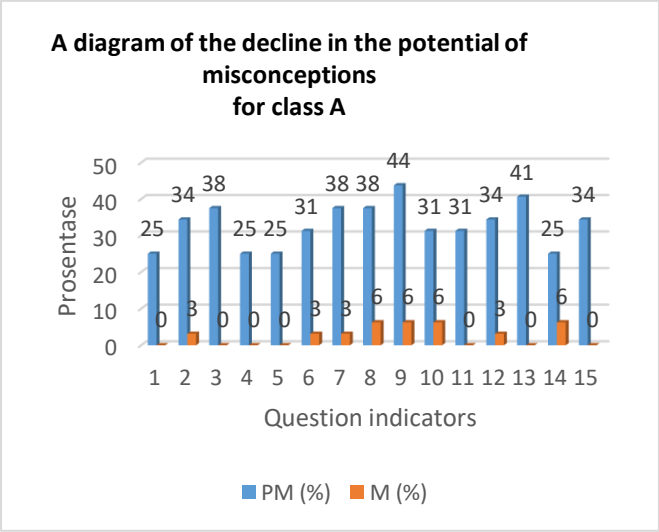

Fig 1:- Decreased potential for misconception in class A

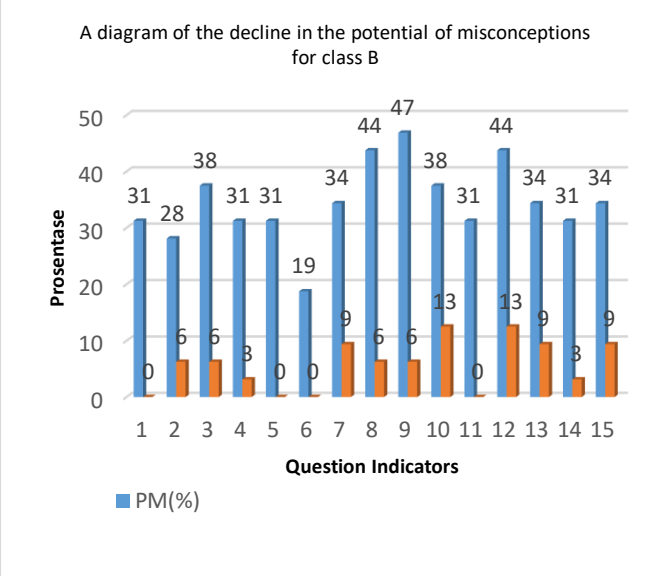

Fig 2:- Decreased potential for misconception in class B

If viewed from the problems, the average decrease in misconceptions is 93.49%, whereas when viewed from students, the average decrease in misconceptions per student is 90.32%. Decrease in misconception in this study is very good because it is almost close to the percentage of 100%.

3. Student Responses

Based on the analysis of student response data it is known that students' interest and attention to the PhET media taught using cooperative models can make students interested in learning physics, students are happy and interested. Students who are motivated in learning will show a significant decrease in misconceptions. It can be seen that the average response of students to this learning process is 92.00%.

IV. CONCLUSION

The tools developed include the Syllabus along with the lesson plan, the student worksheets are equipped with the Initial Knowledge Sheet, student textbooks and Pretest / posttest questions. Based on the findings above, it can be concluded that the development of physics learning tools for Dynamic Electric material using the PhET media taught by cooperative learning models has fulfilled the elements of validity, practicality and effectiveness so that it is feasible to be used to reduce the potential of misconceptions for high school students'

V. SUGGESTIONS

1. Preparation and discipline of students need to be considered, in order to fill out the questionnaire and questionnaire according to the provisions so that data processing in research can be done according to the stages that have been planned.
2. The use of PhET media can increase a teacher's creativity to innovate learning in the classroom and foster student creativity solving problems faced in real life. So teachers really need to spur creativity through seminars, workshops, scientific papers and educational innovation development competitions that are often held by formal educational institutions.
3. Decrease in the potential of students' misconceptions and activities is quite significant after receiving cooperative teaching using Phet media and their influence on learning problems in schools in general is very positive so further research is still needed.

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