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# Need Analysis to Develop Global Warming e-Module Integrated Problem Bases Learning Model to Improve Students' 21st Century Skills

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**ABSTRACT**

*The challenges of globalization require students to have skills or skills, especially skills of 21st century. The skills of 21st century that students must increase are the 4C skills, including: thinking in critical, creative, collaboration and communication. The research aim was to analyze the need for the making of an e-module on global warming integrated with the PBL model to increase students' skills of 21st century. In the research there were three something investigated, namely physics teachers, physics lesson plans, physics materials of teaching, and students of class XI IPA. The research subjects were 4 physics teachers and 33 people class XI SMA students Negeri 13 Padang. The techniques for data collection used in this research were interviews, documentation and 21st century skills tests. The collected of data by appropriate instruments were analyzed using techniques of descriptive statistical analysis. Based on data analysis, the results obtained included: 1) teachers experience difficulties in the use of ICT for teaching materials, 2) the learning objectives developed had not been able to help students achieve learning behavior, 3) analysis of the students characteristics found that motivation, interest, and independence of students are in the less category, 4) analysis of students' 21st century skills found that the initial skills of thinking in critical, creative, collaboration and communication of students are in the less category, 5) analysis of student learning outcomes it is found that midterm exam scores are still in the deficient category.*

**Keywords:** E-Module, The PBL Model, and Students'21st Century Skills



## I. INTRODUCTION

In the era of globalization various skills must be mastered by students, especially 21st century skills. The important demand of the twenty-first century will necessitate a wide set of skills, with an emphasis on core subject skills, skills in social and cross-cultural, language proficiency, and a grasp of economic power and politics as they affect society [1]. The skills of 21st century are skills needed by someone to successfully face increasingly complex challenges, especially in order to achieve success in life and in the workplace [2,1]. Skills in the twenty-first century require each individual to have qualified skills or skills, both hard skills and soft skills, in order to join the workforce and compete with other nations [3]. The 21st century learning must lead to the achievement of learning objectives. To achieve the 21st century learning goals requires extensive knowledge, critical thinking, communication, collaboration, the skill to innovate or be creative and literacy. To answer the challenges of the globalization, students are required to have skills or skills, especially skills of 21st century.

The integration of 21st century abilities into learning is critical. New standards are required to ensure that students have the competencies required for the twenty-first century, including mastery of skills in creative, flexible to solve problem, collaboration, and invention [4]. Important skills for the 21st century contain specific skills hat need to be developed in learning, namely 4C skills which mean: "critical thinking, problem solving, metacognition, communication, collaboration, innovation and creativity, information literacy, and others". Therefore, students need to have competence in the 21st century, especially the 4C skills including: "thinking in

critical, creative, collaboration and communication". In the learning of 21st century applies a learner-centered model in learning or often known as Student Center Learning.

Student-centered learning is intended to encourage students to participate effectively in the development of knowledge, attitudes, and behavior. This method provides opportunities and facilities for students to develop their own knowledge in order to obtain a thorough understanding, which can eventually improve student performance [5]. The learner-centered learning approach is a teaching and learning procedure that is centered on the needs of children [6]. This demonstrates how the process of learning must take into account children's learning requirements and desires. To realize this, materials of teaching are needed that can encourage students to participate fully in their learning. One variation materials of teaching that can be used is electronic modules or often called e-modules.

E-module plays an important role in the learning step. The use of e-modules makes it easier for teachers to convey material so that teachers do not lack learning resources that are used as references. E-modules are expected to increase students' understanding and can be remembered in the long term [7]. In addition, e-modules can be used by students to research independently because they are easy to access, can be operated anytime and anywhere, and are easy to learn [8]. This can be realized if the teacher can package e-modules with systematic, interesting and informative presentation of material. The availability of interesting materials of teaching is the main point for teachers and students in the process of learning. Therefore, teachers must provide materials of teaching that are complete and attract student's learning interest.

The ideal conditions expected were not in accordance with the real conditions in the field. Based on the results of the initial studies that have been conducted, it was found that there are problems in learning physics, especially in the 21st century skills of students. Students' initial critical and creative thinking skills can be seen from the results of knowledge tests in the form of essay questions. Students' critical thinking skills obtained a value of 55.17 and students' creative thinking skills obtained a value of 54.25. Meanwhile, communication skills were observed from written ideas in the form of reports on group practicum results. Students' communication skills obtained a value of 69.25. The results of the 21st century skills assessment show that students' 21st century skills are still low. Therefore, this problem should be a concern for teachers to improve students' 21st century skills.

One of the solutions to overcome these problems is developing global warming e-module integrated PBL model to increase students' 21st century skills. The use of technology and information in education provides opportunities for students to access subject matter interactively. Interactive learning can be presented in the form of e-modules so that it can be accessed easily on smartphone devices. To improve students' 21st century skills, teachers must integrate model in learning that are appropriate to the material characteristics to be taught. The model of learning that is in accordance with global warming material is problem based learning (PBL).

From this solution, there are three theoretical studies that need to be carried out. The first theoretical research is about e-modules. E-module is a advances in the field of technology that change modules from printed form to modules in electronic form, but still apply the printed modules characteristics in manufacturing. E-modules are clear and systematic self-materials of learning in electronic format in order to achieve certain learning objectives [12]. E-modules also adapt various components contained in printed modules in general [13]. E-modules are expected to increase students' understanding and can be remembered in the long term [14]. Thus, the e-module is a renewal of the printed module which can provide memorable learning to students.

The electronic module has several characteristics. The e-modules characteristics, including: 1) self-instructional, students can educate themselves without relying on others; 2) self-contained; all learning content from a single competency unit studied is contained in a single module; 3) be self-contained and independent of other media; 4) adaptable, in response to advances in science and technology; 5) User-friendly; the module should also satisfy the requirements of being friendly/familiar with the wearer. 6) Consistency in font design, spacing, and layout; 7) sent via computer-based electronic means; 8) making use of different functions of electronic media to create multimedia; 9) Make use of the numerous features provided by software applications; 10) must be meticulously designed (paying attention to learning principles) [15,1]. Therefore, the use of e-modules really supports students in learning both in direct learning and independent learning.

The use of e-modules in learning has several advantages. The advantages of the e-module include: a) increasing student motivation; b) Following the evaluation, the teacher and students know which modules the students have succeeded in and which parts of the module they have not succeeded in; c) research materials are distributed more evenly in one semester; d) education is more efficient because materials of learning are arranged according to academic level; e) static presentations in the print module can be changed to be more

interactive and dynamic; f) elements of verbalism that are too high in the print module can be reduced [15,2]. Therefore, e-modules are effective for use in learning and can increase students' learning interest.

The second theoretical research relates to the model of Problem Based Learning or often referred to as the PBL model. Problem based learning is a model in learning that uses the context of problems to improve students' thinking skills. The PBL model is a model in learning that can train and improve the ability to solve issues based on real-world problems encountered by students [16]. In the PBL model the teacher directs students to research real-life problems to train and improve critical thinking skills and gain important knowledge from solving these problems [17]. PBL is a renewal in learning, because students will be more optimal in thinking through team work, will make students able to hone their thinking skills on an ongoing basis [18]. The integration of problem-based model in learning in learning can help students to solve problems in physics that are close to real life.

The PBL model has several advantages. The advantages of the PBL model include: 1) increasing student motivation; 2) improve student's problem solving abilities; (3) improve student's library research skills; (4) improve student's thinking skills; and (5) improve students' resource management skills [19]. Student's thinking skills can be trained by applying the PBL model so that they can improve student's 21st century skills so that learning objectives can be achieved properly. By applying the PBL model in learning, it can hone students' thinking skills and can increase students' learning interest.

The use of model in learning must be in accordance with the material characteristics to be taught to students. The use of an effective model in learning will make it easier for teachers to teach. Activities of learning should also be fun for students. All model in learning have their own advantages so that teachers must be careful in choosing a model in learning that is suitable for the material to be taught. In this research the material to be taught is global warming material which is very closely related to the lives of students and has complex problems. Therefore, the model in learning that is suitable for use in global warming material is the problem based model in learning.

The third theoretical research relates to skills of 21st century. The skills of 21st century are skills needed by a person to successfully face increasingly complex challenges, especially in order to be successful in life and career in the world of work [2,2]. Skills in the 21st century require each individual to have qualified skills or skills, both hard skills and soft skills, in order to be able to enter the world of work and be ready to compete with competitors from other countries [20]. To answer the challenges of globalization, students are required to have skills or skills, especially skills of 21st century. The skills of 21st century have several facets. skills of 21st century are divided into three basic categories, namely: (1) life and career skills; (2) learning and innovation skills; and (3) information and technology media skills [21]. In the learning and innovation skills category, the 4C skills of the 21st century were found, namely: a) creativity; b) critical thinking; c) communication; and d) collaboration. Skills 21 that need to be improved in learning for students are critical thinking skills, creative thinking, collaborating and communicating.

In this paper the researchers chose Global Warming topic in Phase E of SMA as the material to be tested. In this topic there are problems that are presented to students who have context with the real world. The description of the real problems makes students play an active role in analyzing problems and then providing solutions to these problems. Therefore, researchers consider this material important to be used as research material.

Based on the description of the problems that have been described, it can be stated that preliminary research to develop global warming e-module integrated PBL model needs to be carried out. The purpose of this research is to explore the need to develop global warming integrated PBL model to improve student's skills of 21st century. Based on the research objectives, it can be formulated that this research question is how the needs of teachers and students to develop global warming e-module integated PBL model to improve student's skills of 21st century.

## II. METHOD

This research uses a quantitative descriptive method that is oriented towards the development of a product. Descriptive research is a research method that describes and interprets objects according to what they are [22]. In this preliminary research, a needs analysis was carried out. Needs analysis aims to identify and define basic problems in learning in schools so that this can address the gap between the current state and the current situation. Needs analysis consists of several analyzes including: analysis of physics learning problems, learning objectives analysis, learning settings analysis, analysis of student characteristics, analysis of skill of 21st century and analysis of students' physics learning outcomes.

In this research there were three objects investigated, namely physics teachers, physics lesson plans, physics materials of teaching, and students of class XI IPA. Physics teachers are used to get information about learning physics in schools. There were 4 physics teachers at SMA Negeri 13 Padang who were interviewed to obtain this information. RPP and materials of teaching are the second object to obtain information on the integration of physics materials of learning and their application. Padang 13 Public High School students were used to obtain 21st skill of 21st century information. The students number involved in collecting this data was 33 people.

The techniques for data collection used in this research were interviews, documentation and 21st century skill tests. Data on the implementation of physics lessons by physics instructors was gathered through interviews. An interview guide sheet was used as the tool. Documentation is used to collect information about the integration and implementation of physics materials of learning. Lesson plans, physics books, and class XI high school physics worksheets are among the papers used. A document assessment sheet is the tool used. The skill of 21st century test is used to get an overview of students' early skill of 21st century. The instrument used is an essay question sheet and performance appraisal.

Certain analytical techniques are used to analyze data collected by appropriate instruments. The descriptive statistical analysis technique was used in this study. Descriptive statistics are those that use sample data or a population to describe or provide an overview of the topic under study. In this descriptive statistics without conducting analysis and drawing generalizable conclusions. There are several descriptive statistics data displays that can be used, such as: ordinary tables, frequency distributions, graphs, and explanations of data groups through the mode, median, mean value, group variation and standard deviation [23].

Quantitative questionnaire data analysis begins with the highest score received from each indicator. The total number provided by all students sampled for each indicator is then calculated. The following step is to compute the percentage value of each indicator. The formula for calculating indicators is as follows:

$$\text{Value percentage} = \frac{total\ score}{maximum\ score} \times 100\% \qquad (1)$$

Then the values percentage obtained from processed by data is analyzed using the categories in Table 1:

**Table 1**. Trends in Data Alignment Between Learning Objectives and Basic Competencies

| Kategori | Persentase (%) |
|---|---|
| Excellent | 80 – 100 |
| Good | 70 – 79 |
| Enough | 60 – 69 |
| Deficient | <60 |

Source: Kemendikbud [15,3]

## III. RESULTS AND DISCUSSION

The first result of the research is the problem of using electronic modules. The data collection instrument used was a questionnaire given to the teacher. Questionnaires on the use of ICT for teaching materials were given to two physics teachers at SMA Negeri 13 Padang. The components of the problem of using ICT for electronic module teaching materials include 1) obstacles in making e-modules (CE), 2) obstacles in mastering e-modules (EM) 3) obstacles in mastering software (SM) 4) obstacles in making e-modules with software ( CS), 5) constraints on using e-modules for learning (UL). The results of the analysis of problems using e-modules can be seen in Figure 1.

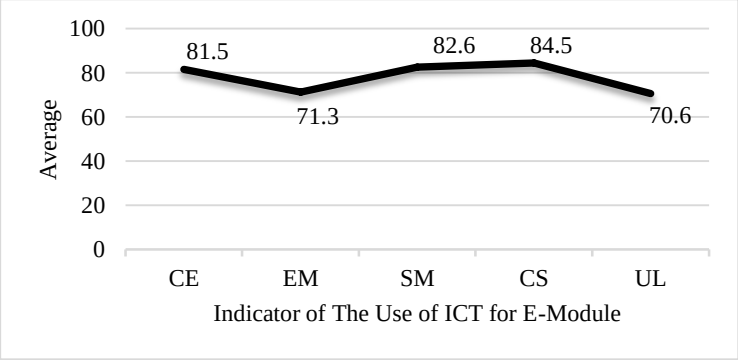


**Fig 1.** The Use Of ICT for Teaching Materials

Based on the data in Figure 1, it can be seen that teachers experience problems in using e-modules. According to the data, it can be explained that teachers find it very difficult for indicators of obstacles in making e-modules with software with a score of 84.5 which is in the high category. The indicators of constraints for making e-modules and constraints for mastering e-modules are in the high category with values of 81.5 and 82.6 respectively. Whereas the indicators of constraints on mastering e-modules and constraints on using e-modules for learning are in the sufficient category with a value of 71.3 and 70.6. From the data obtained, it can be concluded that teachers find it difficult to use ICT for physics teaching materials.

The second result of the research is the analysis of learning objectives. The analysis result can be explained in detail through a review of the lesson plan documents used by physics teachers at SMA Negeri 13 Padang on the material of Global Warming which refers to the data analysis result. First, the learning objectives are in accordance with the basic competencies and core competencies that have been formulated. The average teacher lists the achievement of the students being taught for one basic competency, this reflects the learning objectives designed by the teacher considering the students being taught. Second, operational verbs were found in the basic competencies of knowledge and skills that were on average below the minimum level of skill of class XI students. This shows that the learning objectives designed by the teacher do not consider appropriate learning behavior for the skill level of class XI students on basic knowledge and skills. Third, it was found that the average teacher included learning conditions that could help students achieve learning behavior, this is a reflection if the learning objectives designed by the teacher considered the realization of learning conditions according to operational verbs to achieve learning behavior. Fourth, the average teacher includes the level of success expected according to the learning conditions, this explains that the learning objectives designed by the teacher have considered the level of success in accordance with the learning conditions applied.

The results of the analysis can be explained in detail through a review of the lesson plans used by physics teachers at SMA Negeri 13 Padang on Global Warming which refers to the results of data analysis. Indicators of learning objectives consist of 1) Audience (A), 2) Knowledge Behavior (KB), 3) Behavioral Skills (SB), 4) Attitude Behavior (AB), 5) Condition (C), 6) Degree (D). Presentation of data on the alignment of learning objectives with the basic competencies of each item statement is shown in the histogram of Figure 2.

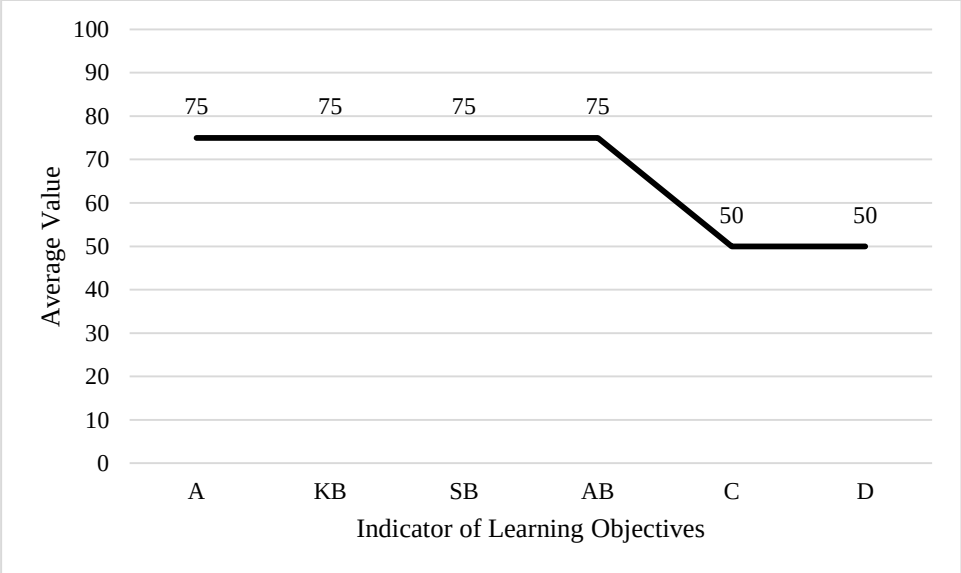


**Fig 2.** Alignment of learning objectives with the basic competencies of each item statement

Based on the data in Figure 2, it can be seen that the learning objectives can be achieved if the six components are fulfilled. The six components include audience, behavior (knowledge, skills, and attitudes), condition, and degree components. The results of the analysis show that the average assessment of the learning component in the lesson plan is 66.67 and is in the sufficient category. Learning objectives in lesson plans do not yet contain condition and degree components. Therefore, in order to achieve the learning objectives in accordance with the independent curriculum, it must include these six components and be carried out in accordance with the objectives that have been designed.

The third result of this study is regarding the analysis of student characteristics. There are 3 indicators of student characteristics that are measured, namely: 1) Background (BG), 2) Interest (IR), and 3) Motivation (MT), and 4) Learning Style (LS). Data on student characteristics were obtained from the results of a questionnaire analysis by class XI IPA 2 students. The results of the analysis of student characteristics can be seen in Figure 3.

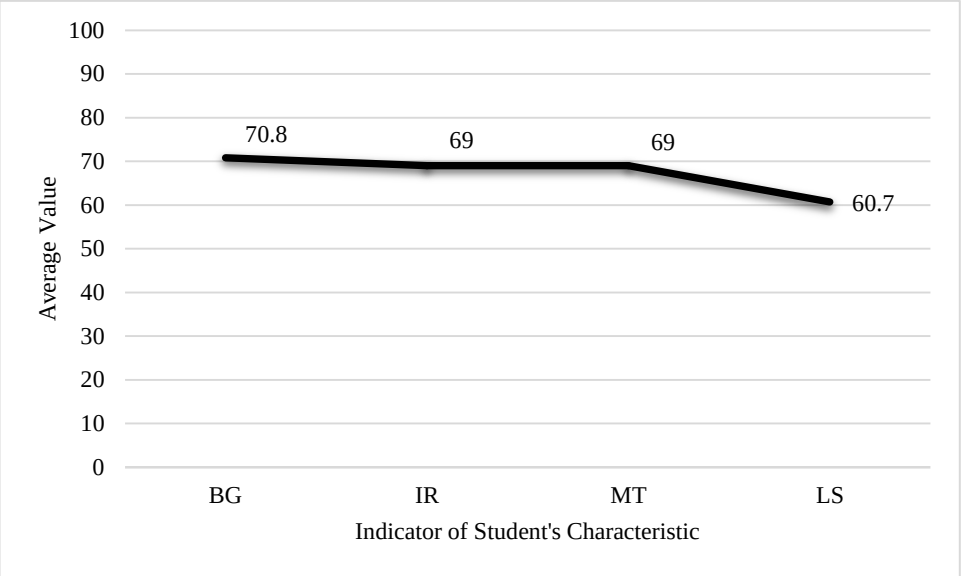


**Fig 3.** Student's Characteristics

From the data in Figure 3 it can be seen how the characteristics of class XI IPA students at SMAN 13 Padang in learning physics. According to the data it can be explained that the background indicators are in the good category while the indicators of interest, motivation and learning styles are in the sufficient category. This can be interpreted that the internal factors of students have not supported the physics learning process in order to obtain optimal results.

The fourth result of this study is regarding the analysis of 21st century skills. 21st century skills are measured from essay questions and performance appraisal. The indicators of 21st century skills that are measured are critical thinking skills (C1), creative thinking (C2), communication (C3) and collaboration (C4). The results of the analysis of students' 21st century skills can be seen in Figure 4.

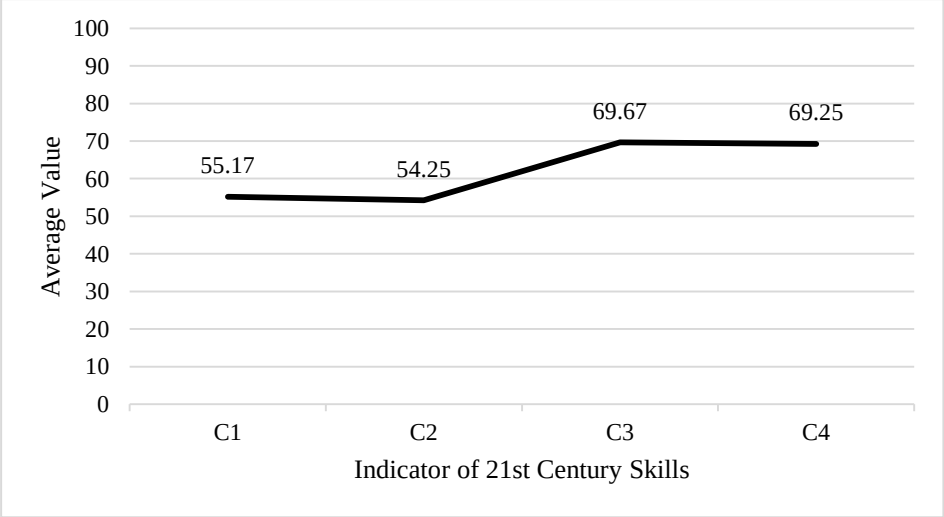


**Fig 4.** Students's 21st century skills

Based on the data in Figure 4, it can be seen an analysis of students' 21st century skills. Students' initial critical and creative thinking skills can be seen from the results of knowledge tests in the form of essay questions. Students' critical and creative thinking skills are in the less category with scores of 55.17 and 54.25 respectively. Meanwhile, students' collaboration and communication skills can be seen from the assessment of student performance through experimental or practicum activities. Student collaboration skills were observed when doing practicum in groups so that the value of student collaboration skills was 69.67 which was in the sufficient category. Communication skills are observed when students report the results of their group practicum in the form of a practicum report. Students' communication skills obtained a value of 69.25 which is in the sufficient category. The results of the 21st century skills assessment show that students' 21st century skills are still low.

The fifth result of this study is regarding the analysis of student learning outcomes. Student learning outcomes are seen from the results of the midterm exams for students in class XI IPA 1, XI IPA 2 and XI IPA 3 SMAN 13 Padang which are presented in Table 1.

**Tabel 2.** Analisis Hasil Belajar Peserta Didik

| Indicator | XI MIPA 1 | XI MIPA 2 | XI MIPA 3 |
|---|---|---|---|
| Number of students | 34 | 34 | 35 |
| Mean | 68,82 | 70,21 | 57,82 |
| Modus | 72 | 72 | 64 |
| Median | 72 | 72 | 64 |
| Minimum | 12 | 44 | 12 |
| Maximum | 80 | 82 | 96 |
| Range | 68 | 38 | 84 |

From the data in Table 1 it can be seen how the learning outcomes of students in learning physics. The results of the analysis of the midterm exam scores in class XI IPA 1 were 68.82 which was in the sufficient category, XI IPA 2 with an average score of 70.21 which was in the good category and XI IPA 3 obtained an average score of 57.82 which was in the category not enough. Data from the midterm exams obtained the lowest and highest scores for students, namely 12 and 96. Based on the data obtained, it can be concluded that students face difficulties in learning physics.

E-modules provide a safe and easy way to use in communicating and collaborating between students and teachers, various content in the form of text, images, video and audio [24]. By using e-modules in physics learning it is hoped that it can further improve students' skill of 21st century so that they have an impact on increasing learning outcomes in order to achieve learning goals. The successful use of e-modules as materials of teaching is proven by research conducted by Imansari & Sunaryantiningsih showing the e-modules result that have been developed obtain a score of 84.72% with very good parameters [25]. Analysis of student responses also showed that all aspects assessed in the questionnaire were categorized as very good so that it could be said that the e-module was appropriate for use as a learning resource.

This is also supported by the development carried out result by Zulyani showing that E-modules and RPP based on Problem Based Learning with the help of android are declared effective where when given test questions an average of 76.2% of students have scores above the minimum completeness criteria [26]. Physics e-module provides a good independent learning experience for students, and is able to attract students' learning attention through layouts, photos, and learning videos that support the presentation of material in accordance with predetermined learning objectives [27]. Thus, it can be concluded that the development of an integrated global warming e-module with the PBL model is urgently needed by teachers and students in order to improve students' skill of 21st century.

## IV. CONCLUSION

From the analysis of the data that has been done, it can be stated that there are five results from the preliminary research at SMA Negeri 13 Padang. First, an analysis of the problem on the use of ICT for teaching materials that teachers experience difficulties in the use of ICT for teaching materials. Second, the analysis of learning objectives considers learning conditions that can help students achieve learning behavior (condition) which is included in the poor category, learning behavior in basic competencies (behavior) is included in the poor category, success standards are included in the sufficient category and degree is included in the less category. Third, an analysis of the students characteristics found that the motivation, interest, and independence of the students were in the less category. This can be interpreted that the internal factors of students have not supported the physics process of learning in order to obtain optimal results. Fourth, an analysis of students' skill of 21st century found that the initial skills of critical thinking, creative thinking, collaboration and communication of students are in the less category. The skill of 21st century assessment result show that students' skill of 21st century are still low. Last, the analysis of student learning outcomes found that the midterm exams result were in the deficient category. Based on the initial research result at SMA Negeri 13 Padang, it can be concluded that teachers and students need the development of a global warming e-module integrated PBL model to improve students' skill of 21st century.

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