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Mini Research Analysis Of Junior High School Science Learning Problems In Facing The Era Of Industry Revolution 4.0 And The Era Of Society 5.0

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Abstract – In the era of the industrial revolution 4.0 and the Era of Society 5.0, it demands quality human resources so that they are able to compete in global competition. Through science learning, learning about objects and natural phenomena cannot be separated from critical and creative thinking skills. The purpose of this mini research is to find out the ability of junior high school students in science learning on critical thinking and creative thinking skills. The research method is a mini quantitative research on questionnaires distributed to 20 science teachers and 120 junior high school students. The results of the research show that only 40% answered that they already believe they have critical thinking skills. Meanwhile, less than 50% of teachers have developed aspects of critical and creative thinking.

Keywords – Science Learning, Critical and Creative Thinking, Project Based Learning (PjBL). STEM (Science, Technology, Engineering, and Mathematics

I. INTRODUCTION

The 21st century is the century of globalization that requires humans to have skills, one of which is thinking skills to be able to survive and compete in global competition. Science lessons in which there are products in the form of concepts, principles, laws, theories, there is also a discovery process that can hone thinking skills, including critical and creative thinking skills. Critical thinking skills are skills to analyze complex situations using objectivity and consistency as standards. Creative thinking skills are the ability to answer problems based on existing data/information with various alternative answers. The answers given show originality, flexibility, fluency, and elaboration. In the Age of Society 5.

Learning science, especially in secondary schools, should open up opportunities for students to ask questions, generate ideas, and build the skills needed to naturally foster student curiosity through direct learning processes. This will raise awareness that learning science is very necessary to learn so that they can develop the ability to ask questions and seek answers based on evidence and develop critical thinking, (Andriani, L., Suhandi, A., & Pamela, IS (2021).

However, the achievement of science education in Indonesia is still in the low category. This can be seen from the results of the Program for International Student Assessment (PISA) at that time (OECD, 2018). For Science, it appears that the average score of Indonesian students is 398 with an OECD average score of 489. The low quality of education in Indonesia can be seen from various educational findings and surveys from independent institutions. From the results of research conducted by UNDP (United Nations Development Program) by conducting research on the human development index (HDI) which was released in

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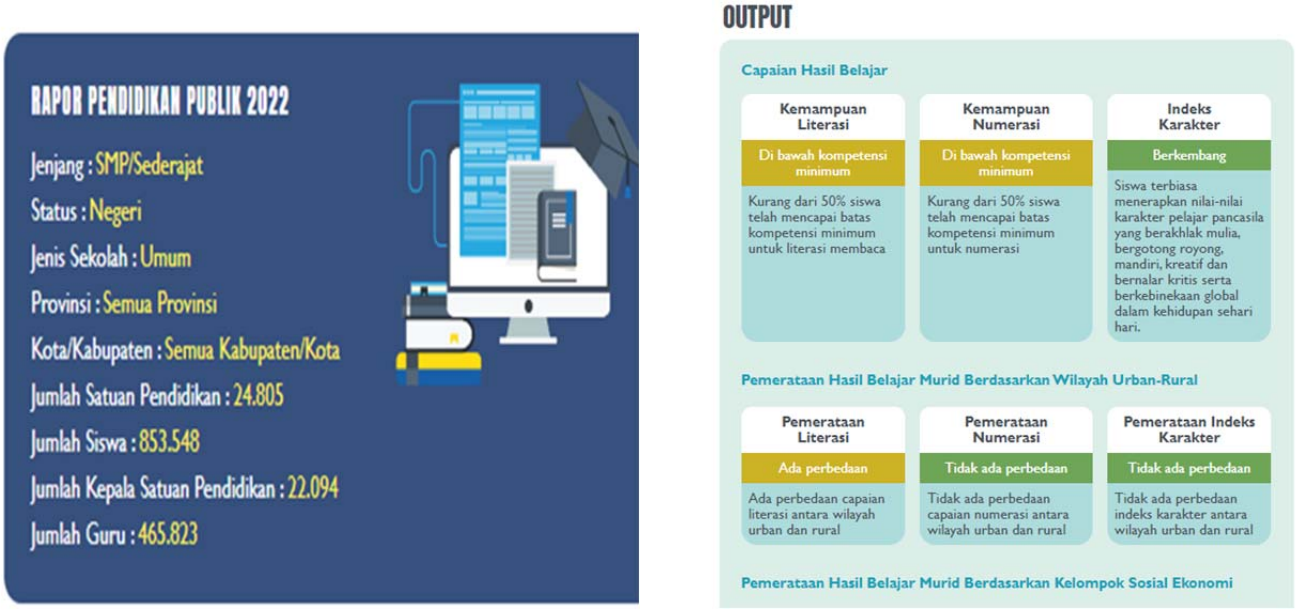
2010, on 169 countries placing Indonesia in position 108 (UNDP, 2012). The Third Mathematics and Sciences Study (TIMS), reports that the mathematics ability of junior high school students is ranked 34th out of 38 countries, while science skills are ranked 32nd out of 38 countries. By looking at the research results, reflecting the state of education in Indonesia is very concerning and it cannot be denied that Indonesia's human resources must be improved again. Mutakinati, L. (2018).

Based on the 2022 Public Education Report Card, the results of the National Assessment (AKM) of Minimum Competency Assessment for the Junior High School Equivalent level with State status, type of Public School, for all provinces in Indonesia, the number of Education units is 24,805 with a total of 853,548 students indicating that the achievement of student learning outcomes is still below minimum competency, ie less than 50% of students have reached the minimum competency limit for numeracy. Meanwhile, literacy skills are also still below the minimum competency, which is less than 50% of students have reached the minimum competency limit for reading literacy as shown in Figure 1 below.



Source :https://pusmendik.kemdikbud.go.id/profil_ Pendidikan/profil-region.php

Figure 1. Public Education Report Report 2022

Based on research results from journals related to learning motivation during the pandemic, a total of 344 respondents from 21 provinces in Indonesia totaled 92 male student respondents and 252 female student respondents. More than 50% of students experienced a decrease in their motivation to learn using distance learning methods, according to the students the atmosphere of the classroom and home was one of the reasons why their motivation had decreased. Furthermore, 61% of the reasons for the decrease in learning motivation are reasonable because it is not easy for students to find the right time to review or re-learn the subject matter that has been taught. The family environment that is sometimes not contributive becomes an obstacle to adjusting study time for students. Indeed, in this time of the COVID-19 pandemic,

Indonesia has recommended the development of science process skills since the 1984 curriculum (active student learning methods), 1994 curriculum (science process skills), 2006 curriculum (authentic assessment), and 2013 curriculum (scientific approach). However, the quality of science education in Indonesia for 15 year olds in the last decade has remained low (OECD, 2016). Learning tools (RPP, LKPD, subject matter texts, and assessments) that are consistent and in line with inductive/deductive reasoning are difficult to find in the field (Sudria, 2016).

At the end of the odd semester or the beginning of the even semester of 2022, education implementers, school managers and especially teachers are shocked by the implementation of a new curriculum, namely the prototype curriculum. Although according to Dr. Supangat in his book entitled 2022 Curriculum, Knowing the Prototype Curriculum for Schools and Teachers (2021), this prototype curriculum was prepared several years ago to be implemented in the Driving School Program. The rules regarding this prototype curriculum are contained in the Decree of the Minister of Education and Technology Number 162/M/2021 concerning Driving Schools.

The prototype curriculum is a competency-based curriculum to support learning recovery by implementing project-based learning (Project Based Learning) to support character development in accordance with the Pancasila Student Profile. So it can be said that the positive impact of implementing this prototype curriculum is learning that does not only rely on the target material, but project-based learning (Project Based Learning) with an emphasis on more essential material. Learning gets better with increasing student character. The potential of students can be further explored with various fun learning opportunities, with millions of hopes that learning loss can be prevented as a result of the ongoing Covid-19 pandemic.

Currently, America is eager to initiate education that develops STEM (science, technology, engineering and math) learning models. This idea arose because from year to year the achievement of US children's test scores in mathematics and science continued to decline. In fact, most children in the US are starting to lose interest in exploring STEM. If this continues, America's future is at stake, given that science and technology play an active role in the development of science and contribute to the creation of world civilization (Hussin, H. (2019)).

America strongly believes in this big role in STEM-based learning. Besides America, STEM education is now widely adopted by several countries. In Taiwan, the learning curriculum began to be integrated with the STEM curriculum and made students the center of learning activities (Lou et al, 2010). Malaysia collaborates with America by involving students in the STEM field so that they can compete in the 21st century economy. Apart from these countries, there are several countries that have also implemented STEM education, including Finland, Australia, Vietnam, China, and the Philippines. STEM has been developed in several countries for ± 3 decades and is increasingly significant in recent years, (Khotimah, RP (2021).

II. Research Methods

This mini research study was carried out at SMPN 6 Sawahlunto in the even semester of the 2021/2022 academic year. The population of this study were students in grades VII, VIII and IX, totaling 120 people. Along with science teachers throughout Sawahlunto City, totaling 20 people. The instruments used were in the form of a teacher needs questionnaire and a student needs questionnaire, which previously had been validated by expert lecturers. This teacher needs questionnaire is to find out whether science teachers have implemented learning that is able to produce students who have the ability to think critically or not. While the student needs questionnaire is to find out the obstacles students in learning science. This questionnaire is filled out online which is distributed in the form of a google formular. The data analysis technique for each item can be seen immediately from the answers given by the respondents, both in the form of graphs and percentages. So that it can be directly analyzed for each question item. The results of this mini research are to find out whether the STEM-based Project Based Learning (PjBL) learning model has been implemented in junior high schools. So the samples were science teachers from the city of Sawahlunto and several science teachers from other regions in Indonesia, such as from Aceh, Banten, Jambi, Riau and Bengkulu. Representatives of science teachers from each region in Indonesia adequately describe the understanding of science teachers about science learning with the PjBL (Project Based Learning) model based on STEM (Science, Technology, Engineering and Mathematics). So that researchers can determine whether this research can be continued or not.

III. Results And Discussion

A. Teacher Needs Analysis Results

Based on the analysis of the questionnaire given to 20 teachers, it was found that:

1. What methods and strategies do you usually use in science learning activities?

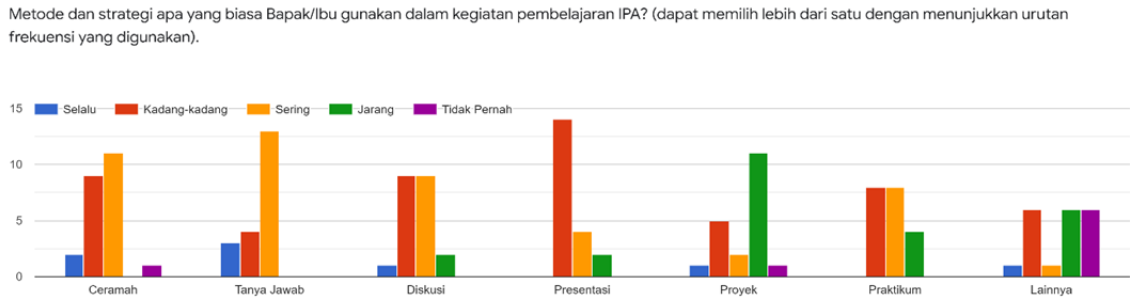


Figure 2. Results of Analysis of Learning Methods and Strategies

Based on Figure 2 above, of the 20 science teachers who filled out the questionnaire, the methods often used in science learning activities were more than 50% frequent lectures, questions and answers, discussions and practicum, and less than 50% for presentations, projects and others. For project activities more than 50% rarely do it.

2. What learning models are often used by you in science learning?

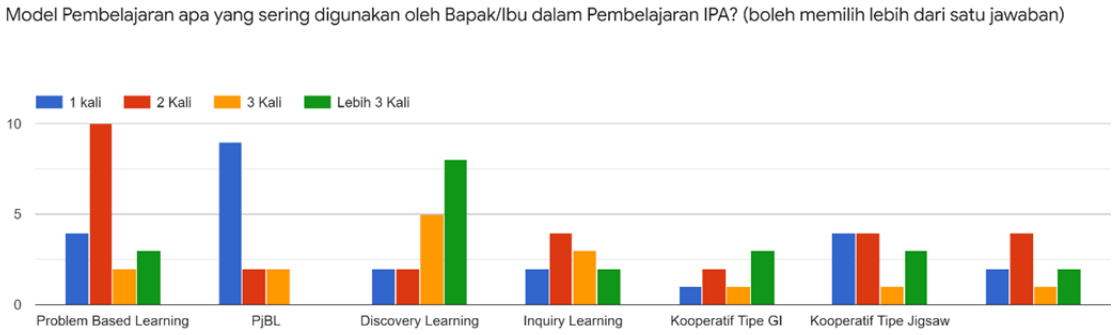


Figure 3 Results of Learning Model Analysis

Based on Figure 3 above, of the 20 science teachers who filled out the questionnaire, the learning model that is often used is Problem Based Learning, generally using this model up to 2 times, while the Project Based Learning (PjBL) model generally only uses it once. Discovery learning is generally more than 3 times and for inquiry learning, cooperative learning is generally less than 50% using.

3. What learning media do you use in learning activities?

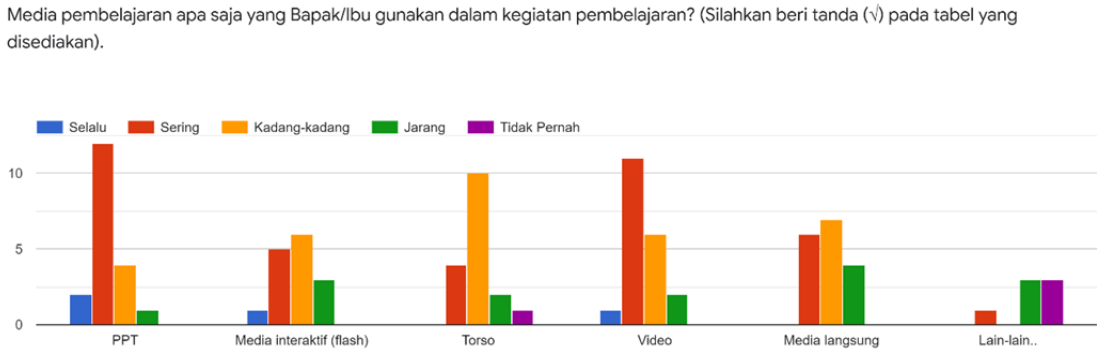


Figure 4 Results of Learning Media Analysis

Based on Figure 4, of the 20 science teachers who filled out the questionnaire, more than 50% often used power point (PPT) media, sometimes used Torso, often used video. And less than 50% of science teachers use interactive media (Flash) and direct media. This shows that more than 50% of teachers apply the lecture method by showing PowerPoint (PPT) so that students are required to listen. And very rarely involves students directly in learning. This is evident from the direct media is very rarely used.

4. What teaching materials do you use in learning activities?

Figure 5 Results of Analysis of Teaching Materials Used

Based on Figure 5, of the 20 science teachers who filled out the questionnaire, more than 50% answered that they always used textbooks, often used student activity sheets (LKS), rarely used e-modules, often used modules, sometimes used handouts, rarely used booklets, and rarely used e-modules. poster. It can be seen here that the teacher relies heavily on textbooks when teaching. This can be seen from the answers of teachers who always use textbooks in learning while other teaching materials are rarely used.

5. Can the printed books that you use in learning grow students' creative thinking skills?

Figure 6. Results of Analysis of the Use of Printed Books

Based on Figure 6, of the 20 science teachers who filled out the questionnaire, 50% answered yes, meaning they believed that the textbooks used in learning could foster students' critical thinking skills, 40% answered maybe, and 10% answered no. It can be concluded that 50% of science teachers are not sure that the printed books they use during learning are able to improve students' critical and creative thinking competence. The printed book referred to here is a 2013 curriculum science book which is used as a science learning guide at the junior high school level

6. Have you implemented a learning approach where students are able to determine an action to formulate solutions with creative thinking skills?

Figure 7. Results of Analysis of Creative Thinking Skills

Based on Figure 7 above, it can be seen that only 30% of teachers believe that they have implemented a learning approach where students are able to determine an action to formulate solutions with creative thinking skills. Meanwhile, 45% of them answered undecided, and 25% answered no. So it can be concluded that science teachers currently have not implemented learning that can improve critical or creative thinking skills.

7. The level of the cognitive domain of learning objectives derived from the basic competencies and indicators that you use in preparing learning plans. (Please tick (√) in the table provided)

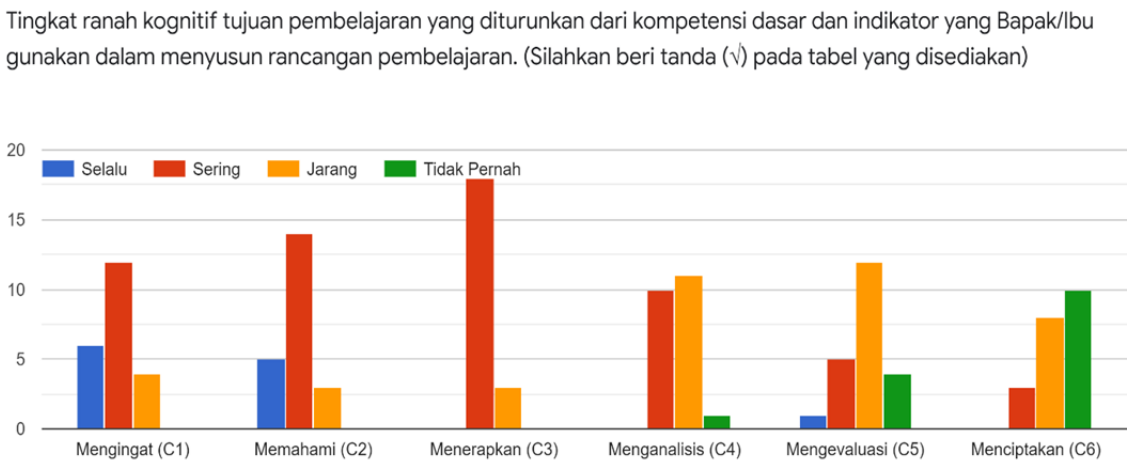


Figure 8 Results of the Analysis of the Conative Level of Learning Objectives

Based on Figure 8 above, 50% of science teachers answered that they often applied the level of the cognitive domain of learning objectives derived from basic competencies and indicators used in preparing learning designs, namely remembering (C1), understanding (C2) and applying (C3), and less than 50% use the cognitive domains of Analyzing (C4), Evaluating (C5) and Creating (C6). This means that more than 50% of science teachers do not determine critical and creative thinking skills in learning objectives.

8. Do you know about STEM (Science, Technology, Engineering and Mathematics)? If yes, what do you know?

The answers from the 20 teachers are presented in table 1 below:

Table 1. Results of Teacher Knowledge Analysis About STEM

Teacher	***Answer***
1	☞ *Not yet*
2	☞ *Group lessons*
3	☞ *do not know*
4	☞ *Combined method of pure science, technology and mathematics*
5	☞ *Engaging math skills in science*
6	☞ *Curriculum that focuses on the subjects of Science, Technology, and Mathematics. The approach is the integration of elements of science, technology application and calculations.*
7	☞ *linking learning materials with science, technology, engineering and mathematics* ☞ *Don't Know*
8	☞ *Learning that involves arithmetic*
9 ***10***	☞ *Yes, combining several competencies from various subjects that can collaborate so as to produce projects that can be carried out by students*
11	☞ *Yes ... learning a material where in that learning as teachers we apply science, technology, engineering / engineering and mathematics in a project* ☞ *Ever heard*
12	☞ *Learning methods that involve students to work*

13	☞ *A learning approach involving science, technology, engineering and mathematics*
14	☞ *Not*
15	☞ *A data-based learning approach, analyze, and integrate it in technology*
16	☞ *Integrated learning that includes all STEM elements in the material presented*
17	☞ *Learning approaches*
18	☞ *I've heard of it but don't know it completely*
19	☞ *Learning model*
20	

Based on the table above, it can be concluded that more than 50% of science teachers in the city of Sawahlunto are not fully familiar with STEM and apply it in learning.

B. Results of Student Needs Questionnaire Analysis

This student needs analysis questionnaire was filled out by 120 students from SMPN 6 Sawahlunto. Consisting of 43.3% of class VII students, 14.2% of class VIII students and 42.5% of class X students. 58.3% of these students said that learning science was difficult, and 41.7 said it was not difficult. The following are some of the results of the analysis of the answers to the student needs questionnaire:

1. Which way of learning do you enjoy and make it easy to understand science lessons?

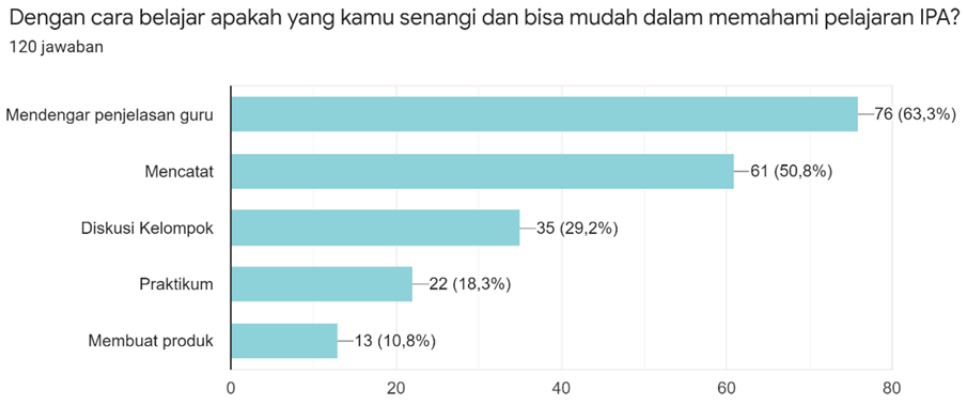


Figure 9. The results of the analysis of how to learn science that are easy for students to understand

Based on Figure 9 above, of the 120 students who filled out the questionnaire, it was found that 63.3% said that by listening to the teacher's explanations they were happy and easy to understand science lessons, 50.8% by taking notes, 29.2% group discussions, 18.3 % Practicum and only 10.8% made products (projects). This is because the learning method they have received so far is generally the lecture method from the teacher. So that it is by hearing the explanation from the teacher that it is easier for them to understand science learning. That's because it is adjusted to the evaluation they undergo, which is generally in the nature of remembering, understanding, and applying. So that critical and creative thinking skills rarely appear in learning. This is in accordance with the student's next answer.

2. Do you have the following competencies?

Asked about the 21st century competencies that students already have. This answer is based on the opinion of students

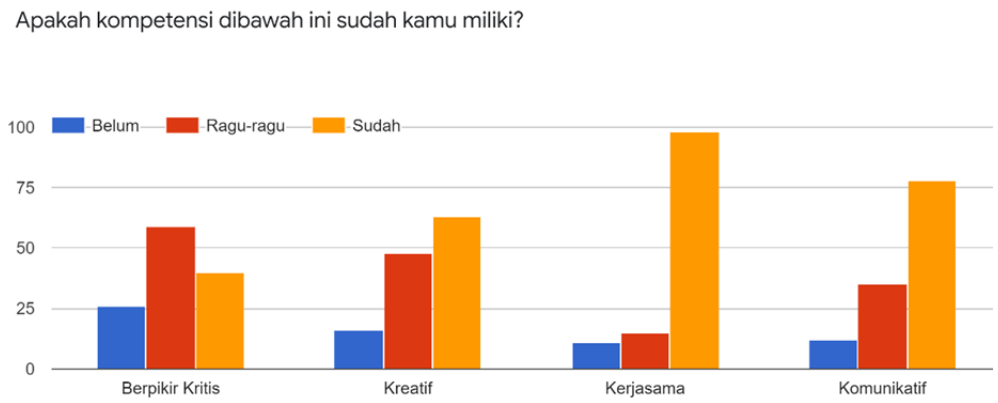


Figure 10. Results of 21st Century Student Ability Analysis

Based on Figure 10 above, it can be seen that more than 50% of students answered that they did not have critical thinking competence or were hesitant to have it, less than 50% who already had critical thinking competence. As for creative, more than 50% of students answered that they already have creative, cooperative, and communicative competence. However, this is only the opinion of the students. Not measured with a valid instrument. So the level of confidence is also below 50%. This data is collected solely to know from the opinion of students only.

3. In your opinion, what was the most difficult subject in science when you were in Grade VII?

This question is to see what material is difficult for students in this integrated science learning, whether in biology, physics or chemistry.

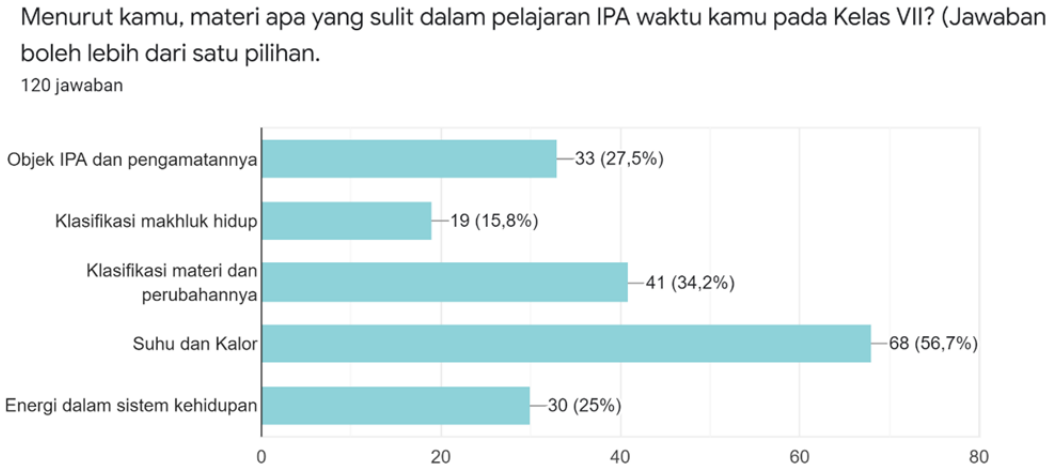


Figure 11. Results of Analysis of Science Materials Considered Difficult by Students in Class VII

Based on Figure 11 above, it can be seen that the science material for class VII which is considered the most difficult is the material for temperature and heat, which is 56.7% who answered. This material is physics material in integrated science. While 34.2% answered the material Classification of matter and its changes (Chemistry), 27.5% answered Science Objects and Observations (Physics), Energy in living systems (Physics and Chemistry) and Classification of Living Things (Biology) of 15.8%. This indicates that students have difficulty in calculating material rather than memorizing.

4. Which one do you like? Study alone or study in groups?

Figure 12. Results of the Analysis of the Science Learning Methods Preferred by Students

Based on Figure 12 above, it can be seen that of the 120 students who filled out the questionnaire, 72.5% of them answered that group learning was their preferred way of learning. 27.5% of them choose to study on their own. This indicates that students prefer learning in groups compared to studying alone.

5. Have you ever received a project assignment from a science teacher by combining Science, Technology, Engineering (Designing) and Mathematics (STEM)

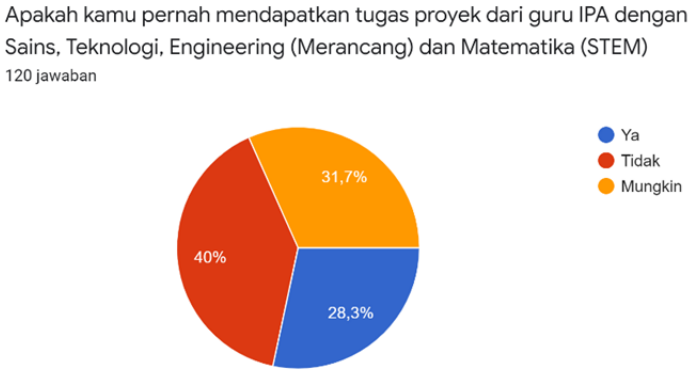


Figure 13. Analysis Results of the Implementation of the STEM-based PjBL Mode

Based on Figure 13 above, it can be seen that only 28.3% of students answered that they had received project assignments from a science teacher by combining Science, Technology, Engineering (Designing) and Mathematics (STEM), while 31.7% answered that they might or were unsure, and 40% answered no. This means that the STEM-based PjBL learning model in general has not been implemented in schools.

IV. CONCLUSION

Based on the results of the mini research above, it can be concluded that students' abilities in 21st century competencies, namely critical and creative thinking competencies, are still low. This is also evidenced by the implementation of learning that has not been student-centered. Still tends to conventional learning.

The problem of low critical thinking skills of students can occur because (1). In some classes, students tend to listen to the explanations given by the teacher as a result, students cannot develop their critical thinking skills, (2) students do not follow the lesson well. Another fact that students' low critical thinking skills can be seen from several things that occur during learning activities. (3) The learning materials that need to be memorized are indeed seen that students master the material that has been given by the teacher and students can also explain the material fluently, but it is different when they are given group assignments to study the material. students tend to re-explain not with their thoughts but with sentences that are almost exactly the same as those in the source of the book they are using. (4) At the end of the lesson students are also not able to conclude from each subject matter that has been studied. (5) At the end of the lesson the teacher tries to ask what conclusions can be drawn on each material, students cannot mention it and

students can only repeat a few sentences containing the material just taught, but it is not a conclusion only in the form of repetition.

Such learning shows that there are problems in learning that cause students' low critical thinking. Lasmawan (2004) identified several educational problems, namely: (1). Education emphasizes the development of cognitive aspects with the orientation of mastery of knowledge as much as possible and ignores the development of affective aspects and conative aspects, (2). Education does not provide the development of process skills, critical thinking skills, and creatively, (3) Education does not provide real experience through an integrated curriculum and learning approach. Learning that takes place in schools tends to show (1). The teacher talks more, (2). Learning management tends to be classical and learning activities are less varied, and (3) Teachers and books as learning resources. In the learning process, students are also less encouraged to develop thinking skills. The learning process in the classroom is only directed at the ability of students to memorize information (Sanjaya, 2009).

Based on research results from journals related to learning motivation during the pandemic, a total of 344 respondents from 21 provinces in Indonesia totaled 92 male student respondents and 252 female student respondents. More than 50% of students experienced a decrease in their motivation to learn using distance learning methods, according to the students the atmosphere of the classroom and home was one of the reasons why their motivation had decreased. Furthermore, 61% of the reasons for the decrease in learning motivation are reasonable because it is not easy for students to find the right time to review or re-learn the subject matter that has been taught. The family environment that is sometimes not contributive becomes an obstacle to adjusting study time for students. Indeed, in this time of the COVID-19 pandemic,

One of the learning models that are being developed in the world of education today and will be explored in this research is the development of a STEM-based Project based learning model to improve 4C (Critical Thinking, Creative, Communicative, Collaborative) competencies for junior high school students in science learning and are ready to face the new era. society 5.0

STEM can be applied in science learning with various learning models. Learning strategies to integrate STEM have learning models that have been tested and identified, namely Problem Based Learning (PBL), Project Based Learning (PjBL), and Inquiry Based Learning (Toto, 2019:2).

Among the several learning models that can be integrated with STEM, one of them is a project-based learning model (Project Based-Learning / PjBL). The PjBL model is used in this study because it has characteristics that are in accordance with STEM learning, namely PjBL begins with a problem that exists in everyday life that requires students to solve it by producing products/works.

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