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The Learning Implementation of Project Based Learning (PjBL) to Analyze Students' 4C Skills Ability

Septi Umalia Firda, * Titin Sunarti
Physics Education Departement, Faculty Of Mathematics and Science Education, Universitas Negeri Surabaya, Jl. Ketintang, Surabaya, Indonesia. Postal code 60231
*Corresponding Author e-mail: titinsunarti@unesa.ac.id

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Abstract

This research aims to analyze the increase critical thinking and creative thinking skills furthermore to describe collaborative skills and communication skills with PjBL method. This research quantitative type. Pretest-Postest given for critical thinking skills and creative thinking skills, while observation sheet for communication skills and collaboration skills. The populations students of grade X MNS, research samples 34 students of grade X MNS 2 even semester academic year of 2021/2022, with convenience sampling technique. Research instruments are assessment sheets of critical thinking, creative thinking, communication, and collaboration skills. To determine the increase critical thinking and creative thinking skills are analyzed by One sample T test and N-gain, while for communication skills and collaboration skills are analyzed by quantitative descriptive. T-test results showed a significant difference between pre test and post test results. N-gain analysis results showed that an increase creative thinking skills of 0.72 "moderate" category, critical thinking skills of 0.77 "high" category. While the average score of students' collaboration skills and communication skills are 64.85 and 65.07 respectively with good category. Conclusion of this research is given, students experienced an increase in creative thinking and critical thinking skills, furthermore for the communication and collaboration skills are categorized as good.

Keywords: PjBL, Quantitative, 4C Skills

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INTRODUCTION

From year to year, the learning process gives changes, starting from the ancient learning that is limited by space and time. With the development in this day and age, learning process can occur easily without limitations (Efriyanti & Annas, 2020). In this 21st century requires the government to carry out changes in human resources, the effort that can be done is by improving the education quality centered on the development of students' critical thinking abilities and skills (Karso, 2014). In the education system in Indonesia, the government is trying to keep up with the 21st century by changing the curriculum according to the development of the era. This refinement is conducted by changing the 2006 curriculum (EULC) to 2013 Curriculum (C-13). This latest curriculum is made to shape students who have the ability as individuals who are faithful, innovative, productive, creative, effective and can socialize with society and nation state, and world civilization (Kementerian Pendidikan dan Budaya, 2018).

Education in this 4.0 industry revolution era needed the skill to prepare students who will be ready to face the latest era in the present, the skills in question are 4C skills namely Critical Thinking and Problem-Solving Skills, Creative and Innovative Thinking Skills, Collaboration Skills, and Communication Skills (Arnyana, 2019). The 2013 Curriculum learning is in accordance with the 21st century, Ministry of Education and Culture designed a

learning that will be implemented which includes High Order Thinking Skills (HOTS) and 4c Skills (Sumarno, 2019).

Critical thinking skills are a must-have for students to be able to solve problems in life. Critical thinking ability is defined as a thinking ability that has a reason when solving problems or has a reason in the decision-making (Paringin et al., 2016). Critical thinking is the same as high-order thinking because it knows that all information that has been read cannot be used as a science that can be believed to be true, thereby must be reprocessed (Abidin, 2012).

Creative thinking skill is a thinking that gives the latest ideas in a concept or artwork. This creative thinking is highly wanted in the working world because needed a human resource that can give the latest innovations needed by a company (Moma, 2015). Creative thinking skills can sharpen students to find the latest ideas or describe the thoughts contents of students (Wahyuni & Kurniawan, 2018).

Collaboration skill is a social correlation, that is expected in the learning process all members can actively solve problems together. Collaboration can also be defined as a group that can solve a problem carried out by working together to get the desired goal together (Saenab et al., 2019).

Communication skill is a student can express his/her desire, moreover, communication can also create a social relationship and can show his/her true self. Communication can be in the form of oral or written. Written communication can be carried out verbally, whereas oral communication can be carried out by expressing opinions (Hariko, 2017).

All education levels starting from elementary school, JHS, SHS, and college levels can use 4c skills in the learning process. 4c skills can be practiced in all subjects, one of them is physics subject. Physics is a science that studies problems in the natural symptoms that can be proven in fact or real (Hernawati, 2018). By reviewing the physics learning, students are expected to be able to have the material understanding to relate to everyday life. The students' understanding of the material related to everyday life is intended for the students to better master the concepts and theories in the studied materials (Astuti, 2015). Therefore, the learning model that will be conducted affects the students' learning results.

The presence of change in the learning condition can create a new problem, namely the decline in the students' skills. In the teaching and learning process, students are focused to be able to memorize the studied material better. This teaching and learning process that always memorizes will make the thinking skills of students impeded. This condition caused the development of the students' thinking skills to be not optimal. The impact of the decline in students' skills can affect the physics concepts in everyday life, because of only memorizing a theory in the material (Rauziani et al., 2016).

The learning model that is perceived to be suitable for the implementation of 4C skills in physics learning is Project Based Learning (PjBL) learning model. The PjBL learning model is a learning that makes a joint together, the joint project is carried out with students. It is intended for students to think critically, generate new ideas, create collaboration between students and allow students to express themselves (Munawaroh et al., 2012). This learning model established a student-centered learning, and teachers only direct students in order to be in accordance with 4C namely implementing critical thinking, collaboration and communication skills through the given problem-solving model (Permata et al., 2019). Students can understand the factual concepts better after the PjBL is given because students produced real projects (Utari, 2019). Just like what is conducted by (Surya et al., 2018) that students can express their creativity with PjBL thereby train students to generate new ideas. From the new ideas in PjBL students can make a decision when designing the project that will be done (R. T. Sari & Angreni, 2018).

The material that is perceived to be suitable with PjBL is Newton's Laws, because in Newton's Laws is one of the Natural Sciences that can dig the students' 4C skills (Khasani et al., 2019). In this Newton's Laws there are many concepts that can be used everyday, for

example on the elevator there are many forces namely normal force and weight force. Some forces in the Newton's Laws require students to explain what kind of force acts on an object, this trains students to solve the given problems (Sekarpratiwi et al., 2018).

With the advancement in the 21st century, namely the advances in technology and information, education in Indonesia required that learning can be in accordance with the existing development (Saenab et al., 2019). Therefore, this research aims to analyze the students' 4C skills by using Project Based Learning learning model.

METHOD

In this research used Quantitative research type. This research is conducted at Surabaya State Islamic Senior High School with research samples of 34 students in grade X MNS 2 academic year of 2021/2022. The sampling used is convenience sampling technique, which means that the samples are determined by the school where the research is conducted or based on the approval of the school. The data collection technique is conducted by giving the pretest and posttest questions as well as observation sheets.

Critical Thinking and Creative Thinking Skills

In the quantitative research type is conducted to determine the increase in the students' critical thinking and creative thinking skills with PjBL learning model. The one group pre test – post test design research design is conducted.

$\mathbf{Z_1}$	**X**	$\mathbf{Z_2}$

Figure 1. One Group Pre Test – Post Test design

Description :
Z_1 : Pretest Value
Y : Learning with PjBL
Z_2 : Posttest Value

The data collection method carried out contains 10 questions, 5 questions to determine the level of students' critical thinking skills and 5 questions to determine the level of students' creative thinking skills. The research instruments used are pre test – post test questions sheets to analyze the critical thinking and creative thinking skills. The data analysis techniques are conducted by normality test, homogeneity test, and N-gain test with the help of IBM SPSS Statistics 21.0 software. The normality test and homogeneity test become the requirements before the hypothesis test is conducted. If the students' pretest and post test results data are distributed normally and homogeneous then the parametric test can be conducted. If the data results obtained are not distributed normally and inhomogeneous then the non-parametric test is conducted.

The N-gain result category analysis used a criterion as follows.

$$<g> = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}}$$

Where:
$<g>$: N-gain
S_{post} : Posttest Score
S_{pre} : Pretest Score
S_{max} : Maximum Score

Table 1. N-gain Category

Score	N-gain Category
g > 0.7	High
0.3 ≤ g ≤ 0.7	Moderate
g < 0.3	Low

(Hake, 1998)

Communication and Collaboration Skills

This research used quantitative descriptive research to describe the students' communication and collaboration skills with PjBL learning model. The results data in this research are in the form of observation results during the learning process. The data collection methods used are observation sheets and assessment results in the Students' Worksheets (SW). To describe the students' collaborative skills the observation sheet contains contribution, flexibility, responsibility, compromise, and communication (H. R. Pratiwi et al., 2020). Whereas to describe the students' communication skills the observation sheet contains 2 oral and written aspects. Oral includes conveying information, group discussions, submit opinions. And for the written contains the Students' Worksheets results (T. P. Pratiwi et al., 2020). The assessment of collaboration and communication skills used 1,2,3,4 likert scale. And to obtain the score of each student used the calculation as follows.

$$Score = \frac{score\ earned}{max\ score} \times 100$$

The analysis of the results of this data is interpreted in interval groups as in Table 2 below.

Table 2. Interval Category

Interval Score	Description
80-100	Very Good
61-30	Good
41-60	Fair
21-40	Poor
0-20	Very Poor

(Arikunto, 2013)

RESULTS AND DISCUSSION

This research is conducted to analyze the level of students' critical thinking and creative thinking skills as well as to describe the communication and collaboration skills with Project Based Learning learning model. To analyze this 4C skills used the quantitative research method.

Critical Thinking and Creative Thinking Skills

The pre-test and post-test research results for the creative and critical thinking skills are presented in Table 3.

Table 3. Pre Test and Post Test Results

Competency	SCORE	PRETEST	POSTTEST
Creative Thinking Skills	Min	25	55
	Max	37	87
	Average	31	71.52
Critical Thinking Skills	Min	20	52
	Max	27	88
	Average	23.35	73

In Table 3 it can be seen that there is a change in the students' creative and critical thinking skills after the PjBL model has been carried out. Judging from the final assessment results, the post test score is higher than the pre test score. This showed that there is a change in the students' creative and critical thinking skills after the PjBL model has been given.

In the One Sample T Test Test phase, there are 2 conditions namely has to be distributed normally and homogenous. Therefore, the normality test is conducted followed by homogeneity test.

Table 5. Normality Test Results

Competency	Description	Sig.
Creative Thinking Skills	Pretest	0.258
	Posttest	0.082
Critical Thinking Skills	Pretest	0.357
	Posttest	0.060

Normality test if less than 50 data or the sample used is small, the Sig results can use Shapiro Wilk Test (Jonathan & Effendi, 2020). Therefore, the normality test in table 5 used Shapiro Wilk Test because used data less than 50 data. The pretest and post test normality test results of the students' creative and critical thinking skills with PjBL learning model are distributed normally, because the Sig results obtained > 0.05.

Table 5. Homogeneity Test Results

Competency	Sig.
Creative Thinking Skills	0.205
Critical Thinking Skills	0.873

The Homogeneity Test results if the sig in the Based on Mean > 0.05, then the data can be considered the same or homogeneous. In table 6 the sig score obtained is > 0.05, therefore, the results of the pre test and post test data in the students' creative and critical thinking skills with PjBL learning model is the same or homogeneous, because the sig has met the > 0.05 condition.

Based on the normality and homogeneity test obtained the students' pretest and posttest results are distributed normally and homogenous, therefore, the hypothesis test is conducted in the form of parametric test. This parametric test used one sample t test, because the sample used one independent variable.

Table 6. One Sample T Test Results

Competency	Sig
Creative Thinking Skills	0.001
Critical Thinking Skills	0.000

In this research used a H0 hypothesis namely there is no effect in the creative and critical thinking skills of students after the PjBL learning model has been carried out. Whereas in the H1 hypothesis namely there is an effect in the creative and critical thinking skills of students after the PjBL learning model has been carried out. The One Sample T Test test results obtained sig (2- tailed) < 0.05. Therefore, the hypothesis of H0 is rejected and H1

is accepted. Then, it can be concluded from the results of One Sample T Test test showed that there is an effect in the creative and critical thinking skills of students after the PjBL learning model has been carried out.

Moreover, to determine the level of increase in students' creative and critical thinking skills after the PjBL model is given, then the N-Gain test is carried out.

Table 7. N- Gain Test Results

Competency	**<*g*>**	**Category**
Creative Thinking Skills	0.72	Moderate
Critical Thinking Skills	0.77	High

The N-gain test results in the students' creative thinking skills after the PjBL learning model is given has an increase with moderate category level. Whereas the students' critical thinking skills after the PjBL learning model is given has an increase with high category.

The research results in the increase of students' creative and critical thinking skills with PjBL learning model are supported by the research conducted by (Trimawati et al., 2020). This research stated that the students' creative and critical thinking analysis has a different increase in each student, this difference can be seen in the problem-solving given by the teacher. It can be seen from the decision making, formulating conclusions, designing hypotheses, and arranging projects. The students' creative and critical thinking skills will experience an increase after the PjBL learning model is given especially in the physics material, this is because in the project making students can see factually in everyday life and the concepts that occur in the studied material. The same thing is also supported by the research of (Ananda et al., 2021). This researcher gave a statement that students are able to express themselves with a project that can be created with other students, by creating a project related to everyday life according to the studied material, it will be easier for students to understand the material as well as its application in everyday life.

The students' creative thinking skills after the PjBL learning model is given has an increase, because the project making carried out in groups provides students with scientific knowledge. Therefore, students can show ideas that students think for themselves, this can train students in the creative thinking skills ability to understand physics' concepts (W. P. Sari, 2018).

The students' critical thinking skills is very much needed by students to solve problems and to determine the learning results improvements (Rauziani et al., 2016). The critical thinking skills with the PjBL learning model can open and improve the students' mindset, this is because students are required to take a step on an action in the project making carried out together (Permata et al., 2019).

Collaboration and Communication Skills Ability

This research is conducted to describe the collaboration and communication thinking skills in the PjBL learning model. Students are carried out or arranged projects in groups, conducted discussions in groups, finished Students' Worksheets in groups, and presented the results that they have been working on in groups in front of the class alternately each group. this process is conducted to determine the students' collaboration and communication skills ability. In the process of the project making together and discussions between groups can review the students' collaboration skills. Whereas when the Students' Worksheets are carried out in groups and presented in front of the class alternately, this process can review the students' communication skills ability.

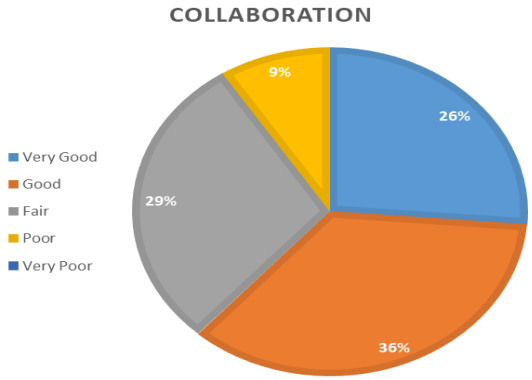

Figure 2. Collaboration Skills of Each Student

Based on Figure 2 regarding the collaboration skills the highest percentage is in the good category with the total of 34 students namely 36%. Therefore, it can be concluded that from 34 students mostly has a good category. Whereas only 9% students from the total of 34 students that has a poor category. The collaboration skills are reviewed from 5 indicators namely responsibility, flexibility, value communication, compromise and contribution, presented in Table 8.

Table 8. Collaboration Skills Ability

Collaboration Skills Indicators	Average	Category
Responsibility	50	Fair
Flexibility	69.85	Good
Value Communication	66.18	Good
Compromise	61.76	Good
Contribution	76.47	Good
Average	64.85	Good

In Table 8, it can be seen that the collaboration skills of all students in the contribution indicator has the highest score with average sig score of 76,47 with good category for the "contribution" indicator. This means that most of the students can take part in the project making process so that the contribution is well established. In this PjBL learning model is intended for all students to be actively contributed, responsible, flexible, and compromise. The role of the teacher is only as a facilitator to manage the learning process course. This statement is supported by the research by (Permata et al., 2019). There is a relationship between one student and another by providing this PjBL learning process students can be responsible on the assignments that have been discussed together to maintain time efficiency and produce the best project from the other group. The students' communication skills in the PjBL learning is presented in Figure 3.

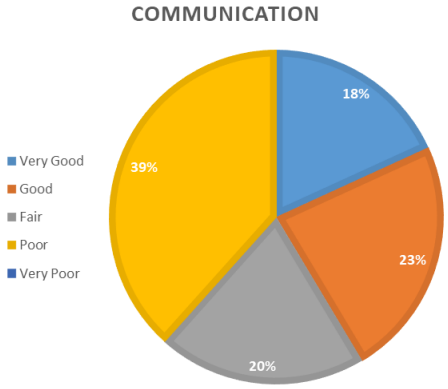

Figure 3. Communication Skills of Each Student

Based on Figure 3 regarding the communication skills of each student with the total of 34 students 39% is in the poor category. Therefore, it can be stated that most of the students are in the poor category in the students' communication skills when the PjBL model is given. Whereas only 18% students from the total of 34 students that has a Very Good category. The communication skills are reviewed from 2 oral and written aspects.

Table 9. Communication Skills Ability

Communication Skills	Assessment Aspects	Average	Category
Oral	Submitting Information	56,62	Fair
	Group Discussion	54,41	Fair
	Asking Questions	47,06	Fair
	Answering Questions	52,68	Fair
	Average	52,93	Fair
Written	LKPD Results	77,21	Good
Average		65,07	Good

In Table 9, the communication skills of all students from two aspects obtained different category, the Oral only has "fair" category whereas the written has a "good" category. The written result is higher compared to the oral result, this is because the students are still in the transformation process phase from JHS to SHS level which made them still have not known each other and made the students less confident to conduct a presentation in front of the class. The communication in the PjBL learning model can be reviewed at the end of the lesson namely the presentation process in front of the class and Students' Worksheets results. Communication is very much needed in this research where students are presenting in front of the class and arguing with other groups (Mulyadi, 2016). Communication is a form of response between students that can make students learn to give a response to a problem, such as feedback carried out between students. According to the opinion of (Lestari, 2021) the students' skillfulness in communicating can be reviewed when students explained the ideas made, displayed information, gave feedback and respond well enough. However, according to (Riyadi & Pujiastuti, 2020) Communication cannot be based only on the successful communication in conveying ideas or information directly but also can convey ideas in the form of oral or written.

The observation results of student activities in the Newton's Laws material in the Simple Elevator project. This observation results described the project results of one of the groups accompanied by a report containing the theory in the Simple Elevator, the tools used, ways to create the project and how to test and analyze the results. This aims to describe the students' communication and collaboration skills.

Figure 4. Students' Project Results Simple Elevator.

The communication skills are conducted in two ways namely verbal and written by using observation sheets. The verbal assessment is conducted when the students conducted group discussion, present, asking questions and answering questions, whereas for the written

assessment is conducted by assessing the Students' Worksheets of each group. The collaboration skills are conducted when students started to design a project. From the observation results the students' activities when they designed the simple elevator project, it is seen that all students are actively involved in group activities. This is proven by the suitability of the collaboration and communication indicators with the activities conducted by students.

CONCLUSION

Based on the results and discussions of this research, it can be concluded that there is an increase in the creative thinking and critical thinking skills in students. The N-gain test results the creative thinking skills of 0.72 included in the "moderate" category. Whereas for the N-gain test results the critical thinking skills of 0.77 included in the "high" category. The category in the interval data of students' collaboration and communication skills obtained both results with the same category namely "good" category. The collaboration skills obtained an interval average of 64.85 whereas the communication skills obtained an interval average of 65.07.

RECOMMENDATION

Research can be conducted with the other recent-based implementations, such as PjBL learning model by using E-Learning and PjBL Blended learning model because nowadays learning is not limited by space and time. This research used small data samples to obtain relevant data, it would be better to use a larger number of data samples.

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