



Implementation PJBL-based STEAM approach to polluting materials Environment to Improve Skills Collaboration Student

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Abstract: This research to investigate the implementation of the STEAM (science, technology, engineering, art and mathematics) approach based on Project Based Learning (PJBL) in environmental pollution content to enhance students' collaboration skills. The research utilizes the Pre-Experimental Design method. This type of research involves a single group of subjects receiving treatment without a control group. The research design employed is the One-Shot Case Study. Data collection techniques include documentation and non-test methods. The population comprises all 7th grade classes, with the sample specifically taken from the VII D class. Results obtained from categorization analysis for self-assessment and peer assessment are more dominant in the medium category; this shows that self-assessment and peer assessment are not optimal. Self-assessment (self-assessment) and peer assessment of skills Student collaboration is included in the medium category because of variations in learning perception and assessment of each individual. The result from the VII D indicates an increase in collaboration skills which obtains a score of 82,32 on average in meeting and 86,07 in meeting III and they are included in very good criteria. In conclusion, the STEAM approach based on Project Based Learning (PJBL) is effective in enhancing student's collaboration skills in the context of environmental pollution.

Keywords: PJBL; Pollution environment; STEAM approach; Skills collaboration

Introduction

Learning in the 21st century emphasizes ability of students to look for now from various sources, formulate problems, think analytically and collaboratively as well as collaborate in finishing problems (Kemdikbud, 2013). Skills collaboration is one of the abilities highly anticipated by students in the 21st century. Skills emphasize roles of students in something activities and appreciate connection. Work the same team to reach the same purpose. Skills expected collaboration in learning in the 21st century includes a number of indicators among others, students must contribute in a way active, working in a way productive, have a sense of responsibility, answer for together plan, show flexibility, and respect for others (Rahmawati et al., 2019). According to Ramdhan

(2023), The implementation of PJBL encourages students' active participation in project activities, triggers curiosity, and increases their learning motivation. Students not only gain a deeper understanding of science concepts, but also develop 21st century skills, such as critical thinking, creativity, collaboration, and problem solving. Group performance team to reach objective with use all over time in a way efficient in finishing assignments, as well not quite enough answer together and every member contribute with do your best and follow what is assigned. So, students understand and do not understand get benefit with happen reciprocal relationship (Sunbanu et al., 2019). The project-based learning model is a learning model that can be used to apply existing knowledge, train various thinking skills, attitudes and concrete skills (Fatah,

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2024). The Project Based Learning teaching model is often referred to as a teaching method that uses problems in its system with the aim of making it easier for students to understand and absorb the theory provided (Anggraini et al., 2020).

Activity learning done in a way group, with objective grow attitude cooperation between students in solve something problem. Through the application of the Project Based Learning model, students can also be invited to actively carry out project or product-based activities that can be done in groups or individually (Wahyudiono, 2023). Work in group is very profitable because student can interact with student other as well as can exchange opinion for obtain solution problem in discussion. Apart from that, students can also compare results it works with other members. Habituation attitude cooperation this is what brings change attitude to more direction good. This is in line with the findings Apriliani et al. (2018), learning that uses the Project Based Learning (PjBL) learning model can also make students work together with their group members, so that students can more easily solve problems to design and complete a project that has been assigned.

Based on interview with an eye teacher science lessons in class VII SMP N 3 Gorontalo are known that Skills collaboration or cooperation student still low. This matter proven in discussion group a number of student use time for telling stories, playing games, no exists work team, only one or two people doing the work and several group no do assignments given by the teacher. Supported by percentage mark students who reach the KKM skills collaboration only 40%. That matter happen because of the learning process still teacher centered. Therefore, that for help students so they can collaborate with good so need exists the right approach for used in the learning process. Approach that can used that is STEAM approach. For that need exists learning that can be done increase collaboration student.

Therefore that will done research on the material pollution environment and its impacts for ecosystem, accordingly with competence base 3.8 on the eye science lessons, for see the learning process student with method collaboration or work group. Learning on material pollution environment, existing problems inside it can linked with life student daily. In connection with that so need exists innovation that supports the learning process for help student in solve problem. Student can share ideas in finish assigned job. One of them through STEAM approach. Study skills collaborative in activity learning is very necessary possible approach stimulate student can cooperate that is with use learning STEAM- based (Sudarmin et al., 2021). According to Amir et al. (2021), the STEM approach is an approach that refers to four components

of knowledge, namely science, technology, engineering and integrated mathematics. Using the PjBL-based STEAM approach in learning can produce creative, fun learning and improve educational standards (Fitriyah et al., 2021).

Learning based STEAM can also be done create system learning active Because fourth aspect the needed at the same time For finish problem, solution it also shows that student can unite draft abstract from all aspects (Khariyah, 2019). Application deep STEAM approach learning must can integrate all components, ie with using a learning model. A learning model that can integrate STEAM components are project based learning based project (PjBL) (Mu'minah et al., 2020). This matter in accordance with study Supriyatin et al. (2023), that learning based on STEAM-PJBL can increase Skills 21st century is one of them Skills collaboration. In approach this possible student in a way directly into the world of work where focused on discovery solution on existing problems. Collaboration skills are a learning process that is carried out together to balance differences, views, knowledge, play a role in discussions by providing advice, listening and supporting each other (Greenstein, 2011). STEAM-PjBL learning can provide student enthusiasm in participating in learning because it is student-centered, contextual, comprehensive and comprehensive (Suryaningsih et al., 2022). Students will be more enthusiastic about taking part in lessons because students are directly involved in the learning process.

Based on background behind above, researcher want to do something study with title " implementation PJBL- based STEAM approach to the material pollution environment For increase Skills collaboration student class VII of SMP N 3 Gorontalo."

Method

This study will held at SMPN 3 Gorontalo in the even semester year teachings 2023/2024. This study is study experiment with method pre-experimental design. Types of research this use one group given subject treatment or not own class control. Research design used is One-Shot Case Study. On design this, given treatment to student, then done observation about Skills collaboration from activity learning student. Instrument research used form questionnaire self-assessment, peer assessment and sheets observation Skills collaboration student. Data analysis techniques using statistics descriptive.

Results and Discussion

Research Results

Self-Assessment

Contribute By Active

Result of skills collaboration aspect 1 viz contribute in a way active can see as the following are included in the range $X \leq 12$ percentage of 11% incl in category low. Next, in the range $12 < X < 18$ we get percentage of 71% incl in category currently. Furthermore with range $X \geq 18$ obtain percentage of 18% incl in category tall.

Table 1. Skill Score Category Collaboration

Range	Frequency	Percentage	Category
$X \leq 12$	3	11%	Low
$12 < X < 18$	20	71%	Currently
$X \geq 18$	5	18%	Tall
Amount	28	100%	-

Work by Productive

Result of aspect Work in a way productive can see that range $X \leq 12$ obtain percentage of 36% incl in category low. Then range $12 < X < 16$ obtain percentage of 28% incl in category currently. Furthermore with range $X \geq 16$ obtain a percentage of 36% included in category tall.

Table 2. Skill Score Category Collaboration

Range	Frequency	Percentage	Category
$X \leq 12$	10	36%	Low
$12 < X < 16$	8	28%	Currently
$X \geq 16$	10	36%	Tall
Amount	28	100%	-

Responsible

Result of aspect responsible answer can see that range $X \leq 12$ obtain percentage of 21% incl in category low. Then range $12 < X < 16$ obtain percentage of 46% incl in category currently. Furthermore with range $X \geq 16$ obtain a percentage of 32% included in category tall.

Table 3. Category Skills Collaboration

Range	Frequency	Percentage	Category
$X \leq 12$	6	21%	Low
$12 < X < 16$	13	46%	Currently
$X \geq 16$	9	32%	Tall
Amount	28	100%	-

Show Flexibility

Result of aspect show flexibility can see that range $X \leq 13$ obtain percentage of 21% incl in category low. Then range $13 < X < 19$ obtain percentage of 68% incl in category currently. Furthermore with range $X \geq 19$ obtain the 11% percentage included in category tall.

Table 4. Skill Score Category Collaboration

Range	Frequency	Percentage	Category
$X \leq 13$	6	21%	Low
$13 < X < 19$	19	68%	Currently
$X \geq 19$	3	11%	Tall
Amount	28	100%	-

Respect for others

Result of aspect respecting others can see that range $X \leq 12$ obtain percentage of 11% incl in category low. Then range $12 < X < 16$ obtain percentage of 64% incl in category currently. Furthermore with range $X \geq 16$ obtain 25% percentage included in category tall.

Table 5. Skill Score Category Collaboration

Range	Frequency	Percentage	Category
$X \leq 12$	3	11%	Low
$12 < X < 16$	18	64%	Currently
$X \geq 16$	7	25%	Tall
Amount	28	100%	-

Peer Assessment

Contribute by Active

Result of aspect contribute in a way active can see that range $X \leq 14$ obtain percentage of 18% incl in category low. Then range $14 < X < 18$ obtain percentage of 68% incl in category currently. Furthermore with range $X \geq 18$ obtain the 14% percentage included in category tall.

Table 6. Skill Score Category Collaboration

Range	Frequency	Percentage	Category
$X \leq 14$	5	18%	Low
$14 < X < 18$	19	68%	Currently
$X \geq 18$	4	14%	Tall
Amount	28	100%	-

Work by Productive

Result of aspect Work in a way productive can see that range $X \leq 12$ obtain percentage of 22% incl in category low. Then range $12 < X < 16$ obtain percentage of 39% incl in category currently. Furthermore with range $X \geq 16$ obtain a percentage of 39% included in category tall.

Table 7. Skill Score Category Collaboration

Range	Frequency	Percentage	Category
$X \leq 12$	6	22%	Low
$12 < X < 16$	11	39%	Currently
$X \geq 16$	11	39%	Tall
Amount	28	100%	-

Responsible

Result of aspect responsible answer can see that range $X \leq 13$ obtain percentage of 36% incl in category low. Then range $13 < X < 17$ obtain percentage of 46%

incl in category currently. Furthermore with range $X \geq 17$ obtain the 18% percentage included in category tall.

Table 8. Skill Score Categories Collaboration

Range	Frequency	Percentage	Category
$X \leq 13$	10	36%	Low
$13 < X < 17$	13	46%	Currently
$X \geq 17$	5	18%	Tall
Amount	28	100%	-

Show Flexibility

Result of aspect show flexibility can see that range $X \leq 13$ obtain percentage of 14% incl in category low. Then range $13 < X < 17$ obtain percentage of 72% incl in category currently. Furthermore with range $X \geq 17$ obtain the 14% percentage included in category tall.

Table 9. Skill Score Category Collaboration

Range	Frequency	Percentage	Category
$X \leq 13$	4	14%	Low
$13 < X < 17$	20	72%	Currently
$X \geq 17$	4	14%	Tall
Amount	28	100%	-

Respect for others

Result of aspect respecting others can see that range $X \leq 11$ obtain percentage of 14% incl in category low.

Table 11. Observation Results Skills Collaboration

Observed indicators	Meeting I		Meeting II		Meeting III	
	Average value (%)	Criteria	Average value (%)	Criteria	Average value (%)	criteria
Contribute in a way active	73.21	Good	90.18	Very good	89.28	Very good
Work in a way active	61.60	Good	83.93	Very good	85.71	Very good
Responsible answer	63.39	Good	87.5	Very good	86.60	Very good
Show flexibility	53.75	Enough Good	77.68	Good	83.03	Very good
Respect for others	49.01	Enough Good	72.32	Good	85.71	Very good
Average	60.17	Enough Good	82.32	Very good	86.07	Very good
			84.19			Very good
Gain Test			0.60			currently

Discussion

This study carried out at SMP Negeri 3 Gorontalo City with use sample class VII D with student A total of 28 people used material in study This is pollution environment with use STEAM based approach Project Based Learning for increase Skills collaboration student. Importance activity in the process of learning, teaching for can reach objective learning. As for inside study this activity observed learning that is Skills collaboration student in the learning process.

Skills collaboration there are five indicators observed that is contribute in a way active , working in a way productive , responsible answer , show flexibility

Then range $11 < X < 17$ obtain percentage of 72% incl in category currently. Furthermore with range $X \geq 17$ obtain the 14% percentage included in category tall.

Table 10. Skill Score Category Collaboration

Range	Frequency	Percentage	Category
$X \leq 11$	4	14%	Low
$11 < X < 17$	20	72%	Currently
$X \geq 17$	4	14%	Tall
Amount	28	100%	-

Observation Results Skills Collaboration

Based on the table 11 is the average percentage collaboration students, happens increase in each indicator collaboration student. Collaboration average student amounting to 84.19%. At the first meeting with using the discovery learning model still low namely 60.17%. Then at the II meeting with use PPA-based STEAM approach is increasing namely 82.32%. Whereas meeting III experienced enhancement Again namely 86.07%. This matter show that there is improvement in each meeting, things have consequences participant educate already understand and understand will duties and roles within group.

and respect for others (Rahmawati et al., 2019). For see Skills collaboration seen from usage questionnaire that is self-assessment and peer assessment (assessment friend peer) where student given 25 questions containing 5 indicators about collaboration student about project which, carried out 5 items each question. In line with Alias et al. (2015) student research tend like evaluate they Alone or with evaluation peer compared to with teachers, assessment based student give information about self itself is possible No in accordance with what is an educator mark.

Based on calculation obtained information that evaluation use peer assessment, students already

capable fulfil every indicator collaboration. Skills collaboration on aspect 1, namely contribute in a way active, in the range $12 < X < 18$ obtains percentage of 71% incl in category medium, p this show that student already capable contribute secara aktif. Aspect second that is Work in a way productive with range $X \geq 16$ obtain a percentage of 36% included in category high, p this also shows that student Already capable Work in a way productive. Then on aspects third that is responsible answer in the range $12 < X < 16$ get percentage of 46% incl in category currently. This matter show student already capable responsible answer. Aspect fourth that is show flexibility range $13 < X < 19$ obtain percentage of 68% incl in category currently. This matter means student capable for show its flexibility in the group. Fifth aspect that is respect others, range $12 < X < 16$ gain percentage of 64% incl in category currently. This matter show that student already capable for respect for others.

Peer assessment for first aspect _ that is contribute in a way active generated that range $14 < X < 18$ obtain percentage of 68% incl in category currently. The percentage results obtained show in PPA skills based STEAM project contribute in a way active is something abilities possessed by students together Friend historian in communicate as well as share ideas together effective to projects being worked on. Furthermore aspect second that is Work in a way productive with range $12 < X < 16$ obtain percentage of 39% incl in category currently. Furthermore with range $X \geq 16$ obtain a percentage of 39% included in category tall. Aspect third that is responsible answer generated range $13 < X < 17$ obtain percentage of 46% incl in category currently. Aspect fourth that is flexibility Then range $13 < X < 17$ obtain percentage of 72% incl in category currently. Then aspect final that's it respect for others is generated range $11 < X < 17$ obtain percentage of 72% incl in category currently.

Results obtained from categorization analysis for self-assessment and peer assessment is more dominant in the medium category, this shows that self-assessment and peer assessment is not optimal. Self-assessment and peer assessment of skills Student collaboration is included in the medium category because of variations in learning perception and assessment of each individual. Subjectivity and differences factors Interpretations can influence judgments, so results tend to vary and may be inconsistent. In addition, students' ability to accurately evaluating themselves and their peers could also be a factor influence that assessment.

Skills collaboration There are five indicators observed that is contribute in a way active, working in a way productive, responsible answer, show flexibility and respect for others (Rahmawati et al., 2019). Percentage results meeting First Skills the collaboration

still low namely 60.17%. Reason why Still low Because student only given LKPD in the form of question to fill in and that's it a number of whoever wants to do, that when observer taking place each group only 1 or 2 people doing it. Because of that's collaboration within group still low. Then at the meeting second with use PPA- based STEAM approach is increasing in a way significant namely 82.32%. Because it's there student start discuss about problem about pollution environment and start discuss for project that will made. This matter show that student start cooperate with good. Whereas meeting second experience enhancement Again around 86.07%. This matter show that there is increase in each meeting after implementation approach STEAM based PJBL. Due student Already understand and understand will duties and roles within group. In line with research conducted by Mu'minah et al. (2020) shows that PPA- based STEAM approach can increase Skills collaboration student Because learning This done in a way group. According to Lestari (2021) STEAM learning integrates art (srt) to grow and foster students creating a work. According to Sari et al. (2020) with STEAM, students feel more encouraged and more successful in their studies. Learning with a project based STEAM approach learning develops communicative abilities and collaborative in line with 21st century skills. This illustrates that in the 21st century, every individual is required to have collaborative abilities. In line with the findings of Tamin et al. (2022) that the demands of the world of work in the 21st century era place more emphasis on demonstrating individual abilities to work together to achieve a goal.

Conclusion

Based on research results obtained it can be concluded implementation of the STEAM approach based in project based learning (PJBL) in the material environmental pollution Results obtained from categorization analysis for self-assessment and peer assessment is more dominant in the medium category, this shows that self-assessment and peer assessment is not optimal. Self-assessment (self-assessment) and peer assessment of skills Student collaboration is included in the medium category because of variations in learning perception and assessment of each individual. Subjectivity and differences factors Interpretations can influence judgments, so results tend to vary and may be inconsistent. In addition, students' ability to accurately evaluating themselves and their peers could also be a factor influence that assessment. indicates in increase in collaboration skills which obtains score 82,32 on average in meeting and 86,07 in meeting III and they are included in very good criteria. In conclusion, the STEAM

approach based on Project Based Learning (PjBL) is effective in enhancing student's collaboration skills in the context of environmental pollution.

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