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Research Article

Promote collaboration skills during the COVID-19 pandemic through Predict-Observe-Explain-based Project (POEP) learning

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ABSTRACT

It was previously found that students have low in learning collaboration, which is the learning process has not facilitated them to develop their skills. Therefore, this study aims to investigate the effects of project-based learning (PjBL), Predict-Observe-Explain (POE), and Predict-Observe-Explain based Project (POEP) on student collaboration skills in Biology education. The pretest-posttest non-equivalent control design was used and it involved 144 tenth grade students from Tarakan, Indonesia. This research was conducted from August to December 2020, while observation sheets was used to assess the student collaborations skills. The instrument used is the student collaboration skill observation sheet refers to Greenstein, 2012. The collaboration skills observation sheet has a score of 1-4 from each aspect. The aspects used are working productively, showing respect, compromise, and responsibility. Data collection in this study was carried out using WhatsApp, and Google Classroom as learning platform. The results of the analysis of covariance (ANCOVA) showed that PjBL, POE, and POEP affected their collaboration skills ($p < 0.005$). The LSD test result showed that PjBL, POEP, POE, and conventional learning models were significantly different in improving the skills. The POEP class had the highest posttest score, hence it can be used to improve student collaboration skills. This research contributes to providing a learning experience that empowers students' online collaboration skills.

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INTRODUCTION

Generally, education aims to prepare students for a better life and provide qualified work skills for them (Pllana, 2019). The 21st-Century educational reform is a concrete action to develop a skilled and reliable generation to face modern challenges (Chu et al., 2016). Also, the globalization era promotes students to

apply knowledge through problem-solving and appropriate collaboration (Koh et al., 2010; Maas et al., 2018; Sturner et al., 2017). 21st-Century learning needs to center on thinking and collaboration skills (Shukri et al., 2020). Collaboration skills are an interpersonal arrangement that is more than just cooperation (Davidsen et al., 2020; Neubert et al., 2015). These consist of working productively, showing respect, compromise, and responsibility (Greenstein, 2012). Furthermore, productive work means using time efficiently to focus on a specific goal by involving all the group members. Showing respect means the group members tend to listen and discuss the ideas shared. Compromise is the active involvement of the members in achieving a goal, while responsibility deals with doing the best job and following the assigned task. Collaboration skills are measured through students' observation sheets during the learning process. Collaboration skills help students to generate new ideas (Gaggioli et al., 2011; Zanden et al., 2020).

Collaboration skills are needed in facing global challenges (Boholano, 2017). These help someone solve general problems Davidsen et al. (2020) by performing various roles, positive interactions, and interdependence (Sahin et al., 2014). Collaboration also teaches students to interact with peers, develop cognition and knowledge acquisition (Hidayati, 2019; Rannikmäe, 2016), improve their thinking and problem-solving skills (Boholano, 2017), as well as performance (Cheruvelil et al., 2020; Evans, 2020). Furthermore, it mobilizes and provides positive energy to others (O'Leary et al., 2013), facilitate their work, and identifies the abilities of team members (Keast & Mandell, 2014). Another study added that collaboration skills could train students to work together in planning, group decision making, goal setting, accepting roles, timing, creating a positive environment, and increasing learning effectiveness (Kuhn, 2015)\. However, collaboration skills are being neglected in learning. Most teachers only emphasize the concept mastery aspect. The observations on high school students in Biology education in January 2020 indicated that their collaboration skills need improvement. The results showed 55.71% productive work and 54.29% mutual respect in the basic category and 55.91% compromise and 51.43% responsibility in the beginner category, respectively. This preliminary study follows the research results, which state that students' collaboration skills still need to be improved to meet the needs of interdisciplinary scientific development (Sturner et al., 2017).

Unfortunately, during the COVID-19 pandemic, learning in schools no longer empowers collaboration skills. The observation results are that during online learning, students only do the tasks that are in the student worksheets. Learning that takes place does not take a meaningful learning process for students. It causes students to feel bored and not know each other with classmates. Communication is only carried out in one direction, between teachers and students. Student collaboration skills during learning have not become the focus of learning. They were learning at home causes parents to need help to help students learn (Hira & Anderson, 2021). Learning can provide a meaningful experience for students (Haryono & Adam, 2021). Especially during the current COVID-19 pandemic. Ideally, students are given space to collaborate even though learning is done online.

Previous studies showed that student collaboration is potentially empowered through a group (Havu-Nuutinen et al., 2019) and constructive learning (Pande & Bharathi, 2020; Pluta et al., 2013) as PjBL and POE models. PjBL is 21st-Century learning involving students' creativity (Maas et al., 2018), which enriches their independence and collaboration (Zain, 2018). It has also been reported to improve students' creativity (Shriki, 2013), problem-solving (Siew & Ambo, 2020), and collaboration skills (Li et al., 2020; Sturner et al., 2017). However, according to previous studies, most students become observers in project-based learning (Siew & Ambo, 2020). As a result, they lack the knowledge of the materials required to complete each assigned project. Furthermore, PjBL has a long learning time (Viro et al., 2020). In addition, the application of online project learning is not optimal in training students' collaboration skills (Guo et al., 2021). Students also find it difficult to collaborate in designing and completing projects during online learning (Lin, 2018).

Therefore, the PjBL learning model will be integrated into the Predict Observe Explain model into POEP. The POE model has the advantage of supporting student collaboration skills (Jasdilla et al., 2019). The POE learning model also makes it easier for students to make predictions that will assist students in designing a project (Ilma et al., 2022). POE is a learning strategy that provides opportunities for students to gain knowledge, observe phenomena, and communicate findings (Hilario, 2015). Students actively participate in POE learning (Jasdilla et al., 2019) and release acquired information, which builds on and combines prior knowledge with newly acquired ones (Adebayo & Olufunke, 2015). However, online POE learning does not train students' collaboration skills (Hilario, 2015; Sarıoğlan & Özkaya, 2021). Especially during a pandemic, which requires all learning to take place online. POEP learning will integrate all project learning steps into predict, observe, and explain stages. POEP learning consists of a predict-design project, observe-monitoring project, and explain-evaluate project. Integrating project-based learning models into POE is expected to

empower collaboration skills during online learning. Online project-based learning improves students' collaboration skills (Alibraheim & El-Sayed, 2021). However, online project-based learning does not emphasize mastery of concepts (Koh et al., 2010). Hence, it promotes practical expression of prior knowledge, sharing their interpretations, and enhancing students' collaboration skills (Lāma & Lāma, 2020).

The effect of project-based learning and predict-observe-explain on students' collaboration skills in science education has never been studied. POE learning is expected to overcome the limitations of PjBL and vice versa. Furthermore, PjBL provides a problem and a project but without predictions. Therefore, the predictive activities accommodated in the POE help increase the learning steps in PjBL. Prediction allows students to explore their curiosity about a problem (Zulkarnaen et al., 2017) and generate ideas based on experience (Adebayo & Olufunke, 2015). Comparing observations with predictions is a way to construct an object's understanding, accuracy, and rationality (Banawi et al., 2019; Sengul & Katranci, 2012). Based on the described empirical facts, it is necessary to combine POE and PjBL to become a Predict-Observe-Explain-based Project (POEP), potentially improving students' collaboration skills. This study aims to determine the effect of the combination of POE and PjBL models on students' collaborative skills.

METHOD

The research was conducted as a quasi-experimental study with a pretest-posttest non-equivalent control group design (Cohen et al., 2020) which can be seen in Table 1. The independent variables were the POEP, PjBL, POE, and conventional learning models implemented in four treatment classes. Conventional classes use a scientific approach. The participants were randomly selected and consisted of 144 senior high school students at tenth grade Senior High School 3 of Tarakan, North Borneo, Indonesia.

Table 1. Research Design

Pretest	Treatment group	Class	Number of students	Posttest
O_1	PjBL	X science 2	36	O_2
O_3	POE	X science 3	36	O_4
O_5	POEP	X science 4	36	O_6
O_7	Conventional	X science 1	36	O_8

One syllabus, lesson plans, student worksheets, collaborative observation sheets, and creativity essay tests were developed for data collection. According to Greenstein (2012), the collaborative sheets consisted of productive work, showing respect, compromise, and responsibility, which were observed based on scores 1-4 with categories 4 (excellent), 3 (good), 2 (sufficient), and 1 (poor). The instrument's validity and reliability were assessed using Pearson Product Moment (Creswell, 2014), degree of trust 95%. The reliability alone was tested with Cronbach's Alpha. The collaborative observation sheet was valid (0.736) and reliable (0.768).

This study was conducted from August to June 2020 on the material scope of biology, biodiversity, living things classification, bacteria, viruses, and protists. The learning activities were conducted online via WhatsApp and Google Classroom during the COVID-19 pandemic. WhatsApp and Google Classroom were applied in the research as it is considered more practical and easier to access (Khaleyla et al., 2021).

Learning was implemented in each class as follows, where the PjBL steps were (1) determining the basic questions, (2) planning a project, (3) preparing a schedule, (4) monitoring students and project's progress, (5) assessing results, and (6) evaluating experiences. Conversely, the POE steps included (1) preparing predictions, (2) making observations, and (3) explaining the results. Meanwhile, the steps of POEP, meaning integration of PjBL with POE, were (1) Predict-Design project, (2) Observe-Monitor project, and (3) Explain-Evaluate project. The learning process using a scientific approach consists of observing, asking questions, gathering information, associating, and communicating.

The data were analyzed using ANCOVA and LSD with SPSS, which were both carried out to determine the effect of the POEP model on students' collaboration skills and creativity. The normality and homogeneity of the data were checked first, followed by assessing these properties using the One-Sample Kolmogorov-Smirnov and Levene's Tests, respectively, with a degree of trust of 95%. The LSD test was calculated to determine the significance level of the learning model.

RESULTS AND DISCUSSION

The prerequisite for the hypothesis testing was to perform the normality and homogeneity test. The hypothesis requires that all data be normally distributed and homogeneous, while the results are presented in

Table 2. While, the effects of PjBL, POE, POEP, and conventional learning on students' collaboration skills and creativity were determined through the ANCOVA results with pretest scores as covariates, as shown in Table 3.

Table 2. The normality and homogeneity test results of students' collaboration skills and creativity

Treatment Group	Normality		Homogeneity	
	N	Sig	**Score Levene's Test**	Sig
Collaboration skill pretest	144	0.060	1.210	0.050
Collaboration skill post-test	144	0.100	1.020	0.386

According to Table 2, the students' collaboration scores were normally distributed and homogeneous (level of significance> 0.05), therefore the ANCOVA hypothesis testing was conducted to determine the learning models' effect.

Table 3. ANCOVA results (Collaboration skills)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1772.857[a]	4	443.214	190.518	0.000
Intercept	508.654	1	508.654	218.647	0.000
XCollaboration	1.357	1	1.357	0.583	0.446
Class	1772.730	3	590.910	254.006	0.000
Error	323.365	139	2.326		
Total	19170.000	144			
Corrected Total	2096.222	143			

R Squared = 0.846 (Adjusted R Squared = 0.841)

Table 3 shows the differences in learning models with significance (sig < 0.05). Therefore, the hypothesis that the learning model affects students' collaboration skills is accepted. Then the LSD test was carried out, and the results can be seen in Table 4. While Table 4 shows significant differences in the learning models, and these can be seen from the highest posttest mean scores in the POEP (15.40), PjBL (13.08), POE (8.33), and conventional (6.72) classes. Based on the results, the POEP class had the highest mean score, and all the mean scores are presented in Figure 1.

Table 4. LSD test results (collaboration skills)

Class	Mean	LSD	Notation
Conventional	6.72	7.31	a
POE	8.33	8.92	b
PjBL	13.08	13.67	c
POEP	15.40	16.00	d

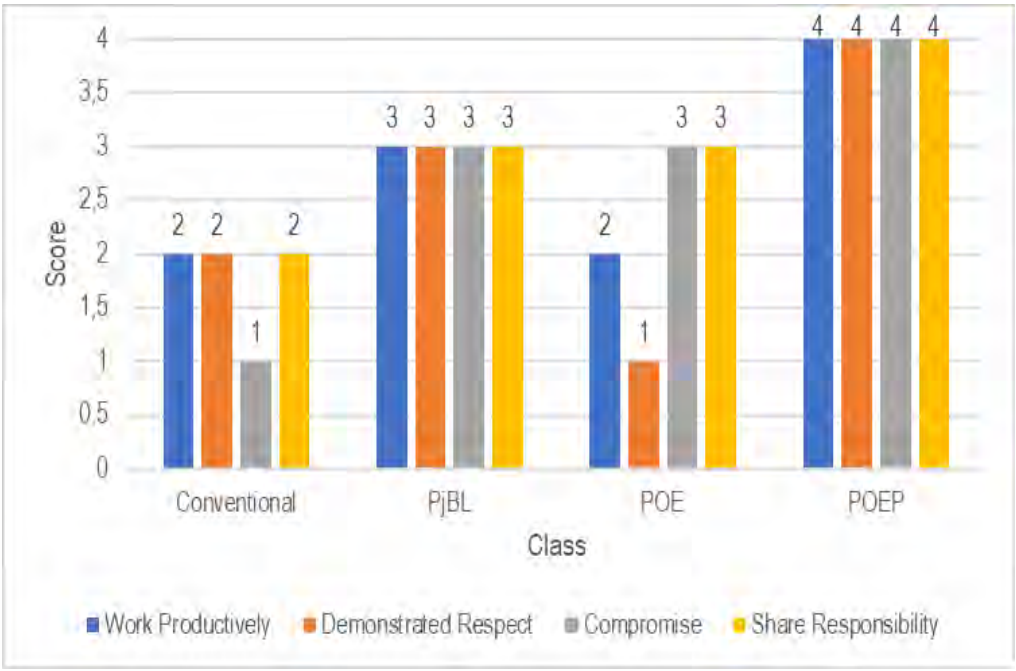

Figure 1. The mean score of conventional, PjBL, POE, and POEP learning models

Figure 1 shows the students' collaboration skills score with a maximum of 4. The work productively aspect had mean scores of 2, 3, 2, and 4, where the highest with the excellent category was in the POEP class, and the lowest was in the conventional and POE with the good category. The demonstrated respect had 2, 3, 1, and 4, while the highest was in the POEP class with an excellent category. The compromise had 1, 2, 3, and 4, where the highest was in the POEP class with an excellent category. Finally, the shared responsibility had 2, 4, 3, and 4, where the highest was in the PjBL and POEP classes with excellent categories, and the lowest was in the conventional with good categories.

The results showed that the learning models affected students' collaborations. However, POEP provided the highest contribution to the skills compared to PjBL and POE. Furthermore, POEP involved students in productive work, mutual respect, compromise, and responsibility in completing group assignments. The observation results showed it during POEP learning. In basic competence 3.4 Analyzing the structure, replication, and role of viruses in life. Students determine the project title on the COVID-19 virus material and during active interaction with teachers and group members to identify problems relevant to their project activities. The product in this material is a poster to prevent COVID-19. Students empower their collaboration skills to design, collect facts and compose posters for COVID-19 prevention. All students are active in discussion activities. It indicates that students already have adequate knowledge to provide ideas and exchange ideas (Hilario, 2015; Sturner et al., 2017).

Collaboration skills in productive work aspects appeared during project design activities (Davidsen et al., 2020; Siew & Ambo, 2018) which were carried out when students had succeeded in determining the title and formulating predictions (Chenault, 2017; Tosun & Taskesenligil, 2013). Productive work is recorded when students design simple experimental activities on germination. It was observed that each group had one leader that helped the teacher to divide tasks into different groups. Furthermore, project design activities were carried out by compiling work procedures, preparing tools and materials, and making activity schedules (Davidsen et al., 2020; Kennedy & Odell, 2014). Cheruvelil et al. (2020) stated that productive work is achieved by dividing tasks into groups. Hence it trains students to be responsible. Greenstein (2012) stated that responsibility is about timeliness in collecting assignments and more about achieving the best work.

In the mutual respect aspect, collaboration skills were observed when students discussed with fellow members and presentations from other groups by listening to their ideas. Greenstein (2012) states that mutual respect is potentially carried out through group learning activities. Furthermore, O'Leary et al. (2013) reported that mutual respect provides positive energy to others. The same thing is recorded when students report their group's progress, where they convey the obstacles faced, and then others provide possible solutions.

Significant differences were found among POEP, PjBL, and POE in improving students' collaboration skills. POEP made a significant contribution to developing the skills through project design prediction, observation-monitoring, and explanation-evaluation. It is following the previous study, which stated that students' collaboration is improved through making predictions (Guo et al., 2021). Including compiling project work (Zain, 2017), observing and discussing (Li et al., 2020), analyzing as well as explaining (Lāma & Lāma, 2020). In online learning, to improve students' collaboration skills, POEP learning is highly recommended. Students' collaboration skills are challenging to develop in learning that only emphasizes memory, understanding, and analysis (Hasan & Pardjono, 2019).

CONCLUSION

The results showed that POEP was useful for promoting student collaboration skills. The POEP model can empower students to work productively, compromise, respect each other, and be responsible for completing the assigned tasks. Therefore, this POEP model is recommended for online learning.

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