New Technologies for Project-Based Empathy Learning in Merdeka Belajar (Freedom to Learn): The Use of inaRISK Application and Biopore Technology

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New Technologies for Project-Based Empathy Learning in Merdeka Belajar (Freedom to Learn): The Use of inaRISK Application and Biopore Technology

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Abstract—The Freedom to Learn curriculum in higher education provides autonomous and flexible learning that is innovative, independent, and relevant to student needs. The use of new technologies such as inaRISK and biopore in project-based consideration learning is thought to be able to improve students' cognitive, affective, and psychomotor abilities. The purpose of this study was to determine the effect of using the inaRISK application and biopori technology in project based empathy learning. This research used a mixed method with a research and development (R n D) methods to determine the effectiveness of the learning model, a quasi-experiment to measure cognitive aspects, and applied descriptive statistics to measure affective and psychomotor aspects. To analyze R n D using ADDIE method then cognitive aspects, this research used homogeneity test, normality test, and t-test using SPSS 21 for Windows. The overall analysis (cognitive, affective, and psychomotor aspects) made use of a data sub code system through MAXQDA software, while network analysis was done by using Gephi 0.9.2 software. The results showed that there was a significant and positive influence of the inaRISK application and biopore technology on the students' cognitive, affective, and psychomotor aspects in the project-based consideration learning of Freedom to Learn.

Keywords—consideration project learning, freedom to learn, inaRISK, biopore

1 Introduction

Changing curriculum is typical to achieve educational objectives that adapt with the times. This corresponds to the definition of "curriculum" in Law Number 20 of 2003 concerning National Education, which states that the curriculum is a set of plans and arrangements regarding the objectives, content, learning materials, and methods used to guide the implementation of learning activities to achieve specific educational goals. [1]. In 2019, the Government of Indonesia, through the Ministry of Education, Culture, Research, and Technology, launched a new curriculum called Freedom to Learn. This curriculum was established to improve the previous curriculum, namely the 2013 curriculum.

The Freedom to Learn policy is a step to transform education to achieve Indonesia's Superior Human Resources (HR) who have a Pancasila student profile [2]. Pancasila is the ideology of the Indonesian nation, which is used as the basic principle of socialization, religious life, human rights, and cooperation. The Freedom to Learn policy also applies to higher education. The Freedom to Learn policy through Kampus Merdeka is expected to be the answer to current demands. Over time, students face changes in social, cultural, employment, and rapid technological advancements. Student competencies must be well prepared to suit the needs.

Not only is link and match required with industry and employment, but also with a rapidly changing future. Kampus Merdeka is a form of autonomous and flexible learning in higher education that is innovative, independent, and relevant to student needs [3]. Diverse forms of learning activities beyond higher education institutions can be carried out in this curriculum, that is, by implementing the Tri Dharma of Higher Education such as performing community service, conducting research, making independent projects, and participating in humanitarian programs. All these activities must be carried out with the guidance of lecturers.

Through well-designed-and-implemented Freedom to Learn, students' hard and soft skills will be formed strongly. Therefore, Kampus Merdeka is expected to be able to face the challenges of higher education in producing graduates who evolve with the times, science and technology advancements, the demands of business and industry, and the dynamics of society. The application of Freedom to Learn must be supported by appropriate learning methods and models. Strengthening character values must always be done to make students have the spirit of Pancasila and be able to face their social life. Scientific-based skills must also be improved so that students are capable of managing the physical environment. Through consideration learning and project-based learning in Freedom to Learn, students are expected to be able to achieve cognitive, affective, and psychomotor learning goals.

Consideration learning is an instructional model that prioritizes students' skills in the scientific context and how they interact in their lives [4]. The series of lessons contained in this empathy learning are expected to trigger and generate understanding and appreciation of various situations [4],[5]. Meanwhile, project-based learning is a learner-centered model that allows students to conduct an in-depth investigation of a topic and produce a product [7]. Students constructively deepen learning by applying a research-based approach to answer quality, actual, and relevant problems [8]. Project-based learning demonstrates students' skills in investigating problems and producing products as the right solution [9].

In addition to the use of learning models, the use of technology is a requisite in learning. Technology is able to support learning, that is, to create proactive learning so that learning objectives are achieved optimally [10]. Various technologies can be used to simplify and solve problems that exist in the environment. One of the newest technologies in the field of environmental management against disaster threats is the inaRISK application.

The inaRISK application is a portal of risk review that uses ArcGIS Server as data services to describe the scope of disaster-prone areas, affected populations, potential physical and economic losses, and potential environmental damage. The application is integrated with the implementation of disaster risk reduction activities as a monitoring tool for the decrease in disaster risk index [11]. In general, inaRISK is crucial to determining our next actions in responding to and managing an at-risk environment.

According to the data on inaRISK, the locations around the campus of the State Islamic University of Sayyid Ali Rahamatullah (UIN Satu) Tulungagung, a campus that has implemented the Freedom to Learn curriculum, are at risk from flood disasters, landslides, droughts, and earthquakes. UIN Satu Tulungagung has a Social Science Education study program. Since the university is situated in a disaster-prone area, disaster education is intensified in the study program. Disaster mitigation activities involve learning as they aim to change the behavior, perception, and emotions of the community [12], [13].

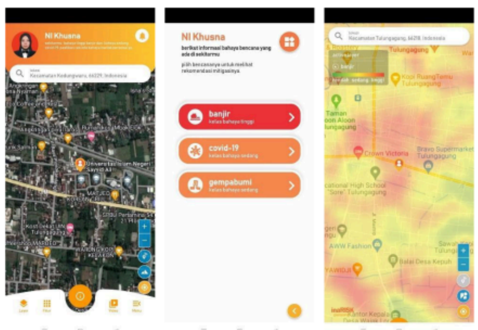


Fig. 1. The display of disaster threats on inaRISK

The inaRISK application provides accurate data on the disaster threats, and these threats need to be overcome by immediate and continuous action. One effort that can be made to overcome floods in the campus area is the application of biopore technology. To disseminate the importance of both technologies, students' skills in using them are trained through learning projects. The use of technology as an innovative educational paradigm is necessary to develop students' skills in managing the environment [8]. The use of scientific facilities in the form of environmentally friendly man-made products is needed to conserve the environment and to mitigate natural disasters.

In the rainy season, biopore technology is able to make the soil have more water absorption [14], thereby contributing to reducing waterlogging and soil erosion [15]. In addition, in agroecosystems, biopores play a key role in providing material flow for plant growth [15]. The existence of worms and roots that can modify soil structure can be manipulated by making biopores [16]. The benefits of biopores include reducing the risk of floods, increasing the amount of clean water reserves in the soil, and enhancing soil fertility. Based on these circumstances, the inaRISK application and biopore technology need to be implemented as a form of project-based empathy learning in the natural environment. The implementation of both technologies in an off-campus environment will create Freedom to Learn. The integration of inaRISK application and biopore technology in consideration learning and project-based learning is expected to improve students' cognitive, affective, and psychomotor abilities in managing the surrounding environment.

According to Delise (1997:27–35), project-based learning consists of 6 steps, namely connecting with the problem, setting up the structure, visiting the problem, revisiting the problem, producing a product or performance, and evaluating performance and the problem. Meanwhile, based on McPhail concept which has been modified by Bambang Soenarko and Endang Sri Mujiwati (2015), consideration learning involve 4 steps, namely exposing students to an "in the people's shoes" situation (if I was in someone else's situation), giving responses about thoughts and feelings, analyzing and proposing alternative solutions to problems, and making decisions by emphasizing the consequences taken with full responsibility [17]. Referring to the elaboration above, this study aims to investigate the effect of project-based consideration learning assisted by the inaRISK application and biopore technology on cognitive, affective, and psychomotor aspects.

2 Method

This research applied a mixed method. The development of the consideration and project learning model with inaRISK and biopore technology, follows model from Robert Maribe Branch with the ADDIE method (Design, Development, Implementation, and Evaluation) [17]. Furthermore, the model will be tested on a large scale with a quasi-experiment using a pretest-posttest control group design was utilized to measure cognitive aspects. Descriptive statistics was also applied to measure affective and psychomotor aspects. This study had limitations in the aspects measured. In terms of cognitive aspects, the measurement focused on student knowledge. In affective aspects, student activity and motivation were the focus of measurement. In psychomotor aspects, the one to measure was student skills during learning.

Table 1. Pretest-posttest control group design

Class	Pretest	Treatment	Posttest
Experiment	O1	X	O2
Control	O3	-	O4

This research addressed the students of the Social Science Education Study Program at UIN SATU Tulungagung, Indonesia, in the 2021–2022 academic year. The population included the students who took Fieldwork 1 course, comprising a total of 119 students. The selected sample was class 4A, which consisted of 23 students as the experimental class. This class was treated using project-based consideration learning, which was aided by inaRISK and biopore technology. Meanwhile, the control class involved 21 students from class 4B. The treatment for this class was conventional learning.

(a) (b)

Fig. 2. Learning process in experimental class (a) The making of biopores (b) Measuring soil infiltration

Fig. 3. Laboratory learning in experimental class

This research made use of an essay test to measure the students' cognitive competence. To measure affective aspects, namely student activity and motivation, this research used a questionnaire containing indicators about feelings of pleasure in learning, attention in following lessons, and active participation in learning activities. Meanwhile, psychomotor aspects were measured by using an observation checklist, which contained components of student skills in managing learning activities.

The data in this study were analyzed in several ways. An independent sample t-test was used to measure the students' cognitive aspects through the posttest. Prior to this, however, the prerequisite tests were carried out in the form of normality test and homogeneity test. The normality test used the Shapiro-Wilk with a significance value of $p > 0.05$, while the homogeneity test used the Leven test with a significance value of $p > 0.05$. These tests were carried out using SPSS 21 for Windows. The following are the hypotheses that were tested in this study:

H0: There is no difference in the ability to understand knowledge before and after the application of project-based consideration learning using the inaRISK application and biopore technology.

H1: There are differences in the ability to understand knowledge before and after the application of project-based consideration learning using the inaRISK application and biopore technology.

Regarding decision-making criteria, if the significance value is 0.05, H0 is accepted. If the significance value is 0.05, H0 is rejected. This research applied a descriptive quantitative technique as well as data coding using MAXQDA software to obtain a description of the students' motivation, activities, and skills. Then, the entire dataset was processed using a social relationship analysis technique with the help of MAXQDA and GEPHI 0.9.5 software.

3 Results and discussion

Implementation of learning in this research integrates and develops consideration models and projects assisted by inaRISK and biopori technology. To determine its effectiveness, the ADDIE model RnD method is used with the following steps:

Table 2. ADDIE model activity summary

Development Stage	Activity
Analysis	Pre-planning: thinking about the product (project consideration model assisted by inaRISK and biopori applications) to be developed. Identify products that are in accordance with student goals, learning objectives in the Field Work Course Identify the content of learning materials, Identify the learning environment and delivery strategies in learning
Design	Designing a fresh product idea on paper Designing novel product development instruments. Each instructional unit has a specific design. Detailed implementation instructions are supplied for the design
Develop	Develop product sets (materials or materials and tools) needed in development based on product design results. At this stage, the product (material or materials, tools) is started to fit the model structure. Creating instruments to measure product performance
Implementation	Implementing a new product for the first time in a learning or actual scenario. Reviewing the objectives of product development, encouraging student participation, and requesting input early in the assessment process
Evaluation	Critically evaluating the influence of learning in hindsight Evaluating the accomplishment of product development objectives Measuring the objective's accomplishments Collecting any information that will improve students' performance.

Based on the summary of the activities of the ADDIE model above, the learning process integrated consideration model and project-based learning, which were assisted by inaRISK and biopore technology through the following steps:

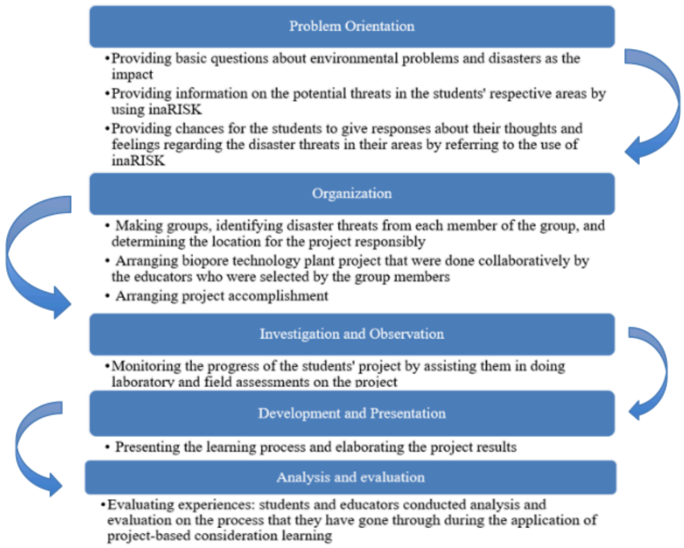


Fig. 4. The steps in implementing project-based consideration learning using the inaRISK Application and biopore technology

The effectiveness of the project consideration model using the inaRISK and biopori applications was measured by obtaining assessments from various materials and media experts. Then it was tested on a small scale and field trials. The test results are as follows:The stages of small-scale trials and field trials were carried out to take into account the practicality of a learning model and the media used. The results of the calculation of the comparison of small group trials and field trials are in the table below.

Table 3. Comparison of trial results

No	Rating Points	Trials		Category
		Small Group	***Field***	
1	The material that has been conveyed is clear	96%	97%	Well
2	Project consideration learning with inaRISK and biopori applications encourages curiosity	74%	99%	Well
3	This learning activity is interesting	72%	90%	Well
4	The steps in learning can give enthusiasm in learning	90%	94%	Well
5	Understanding of messages or information is easy to understand	82%	83%	Well

6	The material presented is easy to understand	94%	86%	Well
7	Project consideration learning with inaRISK and biopori applications supports easy learning of materials	90%	85%	Well
8	Explainer videos can make it easier to learn independently	96%	85%	Well
9	This learning can increase knowledge and insight	92%	80%	Well
10	The learning atmosphere is not boring	90%	85%	Well
Overall Average		85%		Well

The results of the student response questionnaire about project consideration learning with the application of inaRISK and biopori an average of 87.6% so that it meets the criteria for product effectiveness. Furthermore, Before investigating the effect of project-based consideration learning with the use of inaRISK application and biopore technology, normality and homogeneity tests were carried out. The normality test result of the gain score is shown in Table 5, while the result of the homogeneity test is presented in Table 4.

Table 4. The result of homogeneity test

Test of Homogeneity of Variances			
Levene Statistic	***df1***	***df2***	***Sig.***
7,198	1	41	,010

As Table 4 shows, the Sig. value is 0.010 (0.010 > 0.05). Therefore, the data of the two classes are homogeneous. To conduct the normality test, this research used the same data as the homogeneity test, that is, the pretest scores (middle test scores) of class 4A (experimental class) and class 4B (control class). The normality test was conducted using SPSS 21 for Windows.

Table 5. The result of normality test

One-Sample Kolmogorov-Smirnov Test			
		Experiment	***Control***
N		22	21
Normal Parameters[a,b]	Mean	83,05	80,52
	Std. Deviation	5,232	3,027
Most Extreme Differences	Absolute	,220	,235
	Positive	,220	,235
	Negative	-,167	-,202
Kolmogorov-Smirnov Z		1,031	1,079
Asymp. Sig. (2-tailed)		,239	,195

a. Test distribution is Normal.
b. Calculated from data.

Referring to Table 5 regarding the normality test results, the Asymp. Sig. (2-tailed) value of the experimental class is 0.239, while the control class is 0.195. The Sig. value of the experimental class is greater than 0.05 (0.239 > 0.05), and the Sig. value of the control class is greater than 0.05 (0.195 > 0.05). With this evidence, H0 is rejected and both datasets are declared normally distributed because the value of Asymp.Sig. (2-tailed) > 0.05. The next step was to test the hypothesis using a T-test to know the differences in the students' understanding during the learning process, specifically after implementing the project-based consideration model assisted by inaRISK and biopore technology.

Table 6. The result of t-test (hypothesis testing)

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	*Upper*			
Pair 1	Control – Experiment	-5,953	6,779	1,034	-8,040	-3,867	-5,759	42	,000

As depicted in Table 6, the value of Sig. (2-tailed) in the T-test is 0.000 (0.000 < 0.05). Thus, H1 is accepted, and there is a significant effect of the treatment on the experimental class (class 4A). Referring to Table 6, it is known that the value of Sig (2-tailed) = 0.000, which means that the Sig. value is less than 0.05 (0.000 < 0 0.05). Therefore, H1 is accepted and H0 is rejected, indicating that treatment has an impact on the students. The obtained Sig. value reveals a difference in learning outcomes between the experimental class and the control class. The mean score of the experimental class was 91.3, while the control class was 83.2. To conclude, there is a positive effect of project-based consideration learning assisted by the inaRISK application and biopore technology on cognitive aspects, evidenced by the students' test scores.

In addition to having an impact on learning outcomes in the form of test scores, the use of project-based consideration learning assisted by inaRISK and biopore technology also had an effect on student activities, motivation, and skills. Table 7 shows the score categories to assess student activity, motivation, and skills in the control class and experimental class. The scores are set by categorizing posttest scores based on the applied curriculum at the research site.

Table 7. Score categories

No	Score	Predicate	Decision	No	Score	Predicate	Decision
1	96 - 100	A	PASSED	6	71 - 75	C+	PASSED
2	91 - 95	A-	PASSED	7	66 - 70	C	PASSED
3	86 - 90	B+	PASSED	8	61 - 65	C-	PASSED
4	81 - 85	B	PASSED	9	56 - 60	D	FAILED
5	76 - 80	B-	PASSED	10	0 - 55	E	FAILED

After testing the hypothesis, it is necessary to code the data to describe a clear relationship among the indicators. Table 8 presents the results of cognitive aspects, which involve student learning activities (ability to ask questions, answer, and propose ideas); learning motivation (student willingness to take notes, follow rules, and stay focused during learning); and student skills (ability to imitate, compile, follow procedures, finish work properly and appropriately, and take action naturally).

Table 8. The result of data coding

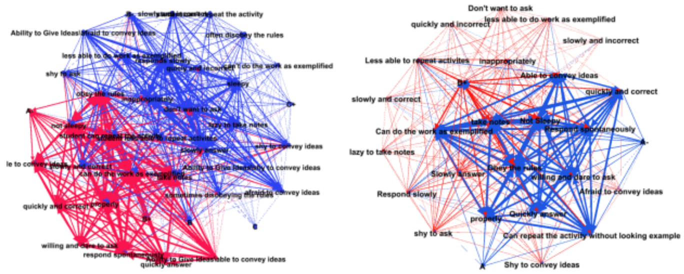
No	Code System	Experimental Class		Control Class	
		Segments	*Percentage*	*Segments*	*Percentage*
1	**Value**				
	A	4	17.39	0	0
	A-	5	21.74	4	19.5
	B+	14	69.87	4	19.5
	B	0	0	5	23.81
	B-	0	0	5	23.81
	C+	0	0	2	9.52
	C	0	0	1	4.76
	TOTAL	23	100.00	21	100.00
2	**Questioning Ability**				
	The students are willing and dare to ask	16	69.57	6	28.57
	The students are shy to ask	5	21.74	5	23.81
	The students do not want to ask	2	8.70	10	47.62
	TOTAL	23	100.00	21	100.00
3	**Answering Ability**				
	The students give answers quickly	17	73.91	8	38.10
	The students give answers slowly	6	26.09	13	61.90
	TOTAL	23	100.00	21	100.00
4	**Ability to Propose Ideas**				
	The students are able to convey ideas	18	78.26	8	38.10
	The students are shy to convey ideas	3	13.04	6	28.57
	The students are afraid to convey ideas	2	8.70	7	33.33
	TOTAL	23	100.00	21	100.00
5	**Taking notes ability**				
	The students take notes	21	91.30	13	61.90
	The students are lazy to take notes	2	8.70	8	38.10
	TOTAL	23	100.00	21	100.00
6.	**Rules**				
	The students obey the rules	23	100.00	13	61.90
	The students sometimes disobey the rules	0	0.00	5	23.81
	The students often disobey the rules	0	0.00	3	14.29
	TOTAL	23	100.00	21	100.00
7	**Concentration**				
	The students are not sleepy while learning	23	100.00	13	61.90
	The students are sleepy while learning	0	0.00	8	38.10
	TOTAL	23	100.00	21	100.00

8	**Perception**				
	The students are able to do the work as exemplified by the lecturer	20	86.96	12	57.14
	The students are less able to do the work as exemplified by the lecturer	3	13.04	7	33.33
	The students are unable to the work as exemplified by lecturer	0	0.00	2	9.52
	TOTAL	23	100.00	21	100.00
9.	**Manipulating**				
	The students are able to repeat activities	17	73.91	11	52.38
	The students are less able to repeat activities	6	26.09	7	33.33
	The students are unable to repeat activities	0	0.00	3	14.29
	TOTAL	23	100.00	21	100.00
10	**Precision**				
	Learning activities are carried out properly	18	78.26	10	47.52
	Learning activities are carried out improperly	5	21.74	11	52.38
	TOTAL	23	100.00	21	100.00
11	**Articulation**				
	The students show their learning results quickly and correctly	17	73.91	7	33.33
	The students show their learning results slowly and correctly	3	13.04	5	28.31
	The students show their learning results quickly and incorrectly	2	8.70	5	28.31
	The students show their learning results slowly and incorrectly	1	4.35	4	19.05
	TOTAL	23	100.00	21	100.00
12	**Naturalization**				
	The students give spontaneous responses	18	78.26	9	42.86
	The students give slow responses	5	21.74	12	57.14
	TOTAL	23	100.00	21	100.00

Sources: primary data analysis using MAXQDA software

The results of the data coding above show the percentage of answers for each assessment indicator. Numerically, it can be seen the difference between the two classes. Further analysis was carried out using social relationship analysis in order to display a clear picture of the relationship.

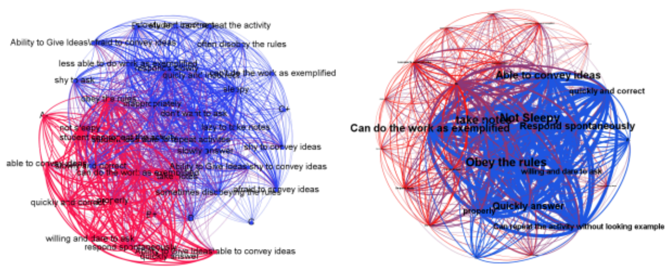
Figure 5 describes the condition of each class. Each line shows the relationship among indicators that contribute to the resultant effect. The thickness of the line indicates the strength of the effect. The direction of the arrow shows a cause and effect relationship. In general, in the control class, it is clear that the blue lines create more networks. In the blue net, there is a relationship between poor grades and low activities, motivation, and skills, all of which are interrelated. Meanwhile, the experimental class showed a strong relationship between good grades and good activities, motivation, and skills. Furthermore, to obtain a clearer overview and draw conclusions, a social relationship analysis was performed.



(a) (b)

Fig. 5. Overview of (a) Control class (b) Experimental class

The following figures show the preview of the control class and experimental class. Figure 6 shows a more specific preview than the various assessment indicators in this study. The size of the letter shows the dominant aspect. In the control class, it can be seen that the use of conventional learning affected the students' behaviour. For instance, many students were sleepy during the lesson. They were also shy about asking questions. In addition, they were too lazy to take notes. On the contrary, there was a strong effect of project-based consideration learning on the experimental class. Participants in the experimental class were able to convey ideas, answer questions quickly and correctly, concentrate on learning, take notes, imitate works modelled by the lecturer, follow the applicable rules, be confident in asking questions, answer questions quickly, complete projects successfully, and repeat activities without looking at the lecturer's examples.



(a) (b)

Fig. 6. Preview of (a) Control class (b) Experimental class

Initially, the lecturer provided a clear understanding and explanation of what criteria are used to assess the students' projects. The consideration model helps the students solve problems wisely and responsibly during the project-based learning process. At the first meeting, after the lecturer gave an introduction, the students formed groups and operated the inaRISK application based on their respective locations of residence. Furthermore, the students had to choose a suitable location for a biopore planting project. For this reason, directions and research guidelines need to be given to the students before starting the project and linking them to local conditions [19].

During each week of the month, the students monitored their projects; measured the level of soil infiltration using a double ring infiltrometer; and measured soil conditions in the laboratory (soil pH, soil texture, soil moisture, soil limiting factors, biota in the soil). Then, they explained the project results in front of other lecturers and the students. In the fourth week, the students were able to present papers containing their project reports. In the final stage of learning, the students were required to apply communication skills to present their project reports.

The data search for learning was strongly supported by accurate information from the inaRISK application. The treatment was adjusted to the actual environmental conditions. As a result, project-based empathy learning is critical to reaping additional benefits. This is due to the fact that in designing and making products, they need knowledge and skills that the students can possess indirectly [20].

The first finding in this study revealed that the use of inaRISK application and biopore technology in project-based consideration learning had a significant effect on the cognitive aspects, evidenced by the students' test scores. This can be seen from the gain score mean of the experimental class, which was higher and significantly different from the control group. The mean score of the experimental class was 91.3 and the control class was 83.2. The provision of lecture materials using the integration of learning models (consideration and project) and technology (the inaRISK application and biopore technology) in Freedom to Learn was able to improve the students' knowledge of environmental management and disaster threats in their area.

The second finding exemplified that the use of technology and learning models was able to enhance the affective aspects such as student activities and motivation. It appears from the questionnaire results that the students in the experimental class earned a higher percentage than the control class in terms of the courage to ask questions, the ability to answer questions quickly, the courage to express ideas, the willingness to take notes, the concentration on learning, and the willingness to follow all the rules during the learning process.

The third finding showed a positive relationship between the use of inaRISK application and biopore technology in project-based consideration learning with the psychomotor aspects, identified from the students' skills. The results of the observations, which were analyzed through MAXQDA software, showed a higher percentage in the experimental class than in the control class. In Bloom's taxonomy, to assess psychomotor aspects, there are five indicators such as perception, manipulation, precision, articulation, and naturalization [21]. The students in the experimental class were able to imitate the lecturer's work; repeat their work without revisiting the examples; carry out their projects procedurally; present the results of their projects quickly and accurately; and respond spontaneously during the learning process.

In general, the current study supports previous research on the use of project-based learning and consideration learning with technology. The results of those studies have shown that laboratory project-based learning with technology was able to integrate knowledge and improve core skills [22]. The results of the 318 questionnaires also revealed that interest in learning through project-based learning had a positive effect, as indicated by the number of respondents' satisfaction with the knowledge provided [23]. Another study also showed that project-based learning created a positive learning community and learning experiences that were able to combine excellent written and oral learning outcomes [24]. In addition, project-based learning promoted good communication among group members to develop leadership, problem solving, and time-management skills [25], [26].

This study also supports the results of previous research on the application of consideration learning, which improved students' understanding of the environment and moral education and motivated students in learning [27]. Another study found that a positive attitude change indicated the effect of consideration learning on students' cognitive and psychomotor abilities [28]. The other researcher also stated that combining consideration learning with other models can improve students' skills in managing problems [29]. Therefore, the present study found novel information; that is, the integration of consideration learning and project-based learning with the inaRISK application and biopore technology not only affected cognitive aspects but also cognitive and psychomotor aspects.

4 Conclusion

Based on the results and discussion regarding the use of new technologies, namely the inaRISK and biopore technology, in project-based consideration learning in Freedom to Learn, it can be concluded that 1) the project-based consideration learning with inaRISK and biopore technology had a significant effect on the students' cognitive abilities. This can be seen from the gain score mean of the experimental class, which was higher and significantly different from the control group; 2) project-based consideration learning with inaRISK and biopore technology had a positive effect on the students' affective aspects during learning, evidenced by a higher percentage of interest and learning activities in the experimental class than that of the control class; 3) project-based consideration learning with inaRISK and biopore technology had a positive effect on the students' psychomotor aspects, indicated by good abilities in perception, manipulation, precision, articulation, and naturalization. For these indicators, the students in the experimental class had a higher percentage than the control class.

The results of this study provide recommendations for teachers or lecturers to integrate technology-based learning models; for instance, the application of project-based consideration learning with the inaRISK application and biopore technology. An instructional model must be supported by other aspects to create an effective and efficient learning. Further research can be developed by applying other technologies based on the raised issues. In addition, research and development of instructional models and technologies are critical to supporting this study.

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