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Research Article

Implementation of project-based learning in Aquaculture Course at Tual State Polytechnique of Fisheries

Helena Afia Sahusilawane[1*], Jakomina Metungun[1], Abdul Zahri[1], Ellen Marta Lutur [1], Henny Fitrinawati[1]

Aquaculture Technology Study Program, Tual State Polytechnique of Fisheries, Street.Raya Langgur, 97166, Indonesia
** corresponding author: helenafia17@gmail.com*

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ABSTRACT

Project-based learning model emphasizes practical experience and real projects. By implementing this learning model, skills that are much needed in society and the world of work today can be developed well in higher education. The Aquaculture Technology study program at the Politeknik Perikanan Negeri Tual must prepare graduates who are competent at work. The aquaculture course offers location planning concepts, culture methods, feeding management, water quality management, disease control, harvesting, packing and transportation of harvested produce. These concepts can be learned by applying a project-based learning model using the Recirculating Aquaculture System (RAS) for fish culture. Thus, this study was aimed to analyze the effectiveness of project-based learning model implementation to improve the student learning outcomes in aquaculture course. In this study, seven students of 4th semester from the Aquaculture Technology Study Program was selected. The learning outcomes assessed include the cognitive domain using pre-test and post-test questions, while affective and psychomotor assessment used the 21st century skills, literacy skills, life skills, reports and presentations. All data were analyzed descriptively. The results indicate that the project-based learning model is effectively applied in aquaculture course, as shown by the average initial test score of 55.29 and an increase in the final test score of 80.86; 21st century skills of 81.79; literacy skills of 74.95; life skills of 75.49; reports and presentations amounted to 74.14. In lecture activities, students are productive and creative in developing knowledge, attitudes, and skills in an integrated manner.

Keywords: *Recirculating Aquaculture System (RAS) project, skills in the world of work, student learning outcomes*

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INTRODUCTION

Vocational is a working-oriented education, according to the real needs in the field (Billet, 2011). In its implementation, vocational education places great emphasis on the psychomotor domain, conformity to technological developments, and orientation to the working field (Sonhaji, 2013). To achieve this condition, the Higher Education as the spearhead of education needs to strive to improve the quality of learning by using a student-centered learning model.

Project-based learning model is one of the alternative learning models that provides opportunities for educators to manage classes by developing project assignments based on investigative questions and challenging problems (Wena, 2014). In addition, the project-based learning model aims to develop technical and non-technical competencies of the learning subjects, and facilitate learning through practice related to the subject matter (Kusumaningrum & Djukri, 2016). Fathurrohman (2015) explained that projects used in this model as means to

achieve competence in attitudes, knowledge, and skills to solve problems. The prior skills are researching, analyzing, creating, presenting learning products based on experience. As a response to the success of the project implementation, feedback is needed as presentations and exams. Thus, this model emphasizes the application of knowledge and student independence to answer real problems related to the materials being studied.

The Aquaculture Technology (TBP) Study Program is a study program in vocational education of Politeknik Perikanan Negeri Tual in fisheries and marine affairs in the Eastern Indonesia region (Politeknik Perikanan Negeri Tual, 2024). This study program has designed a curriculum based on the KKNI (National Qualification Framework). This study program expects the graduates to have intelligence, competence, creativity and innovation by utilizing technology in aquaculture. Graduates of the TBP study program are expected to become aquaculturists, village assistants or fisheries extension workers, especially in the Southeast Maluku region, so the marine biota culture course is designed.

One of the courses in the TBP study program is the aquaculture technique course. Briefly, this course describes the concept of location planning, cultivation methods, feed management, water quality management, disease control, harvesting, packing and transportation of harvested products. So far, the implementation of the learning process in this course is generally presented using lecture and discussion methods. This causes students being less active in the learning process, followed by learning outcomes being less than optimal and students have difficulties in understanding and mastering the techniques and methods of fishery biota culture. If this condition emerges, the graduate learning outcomes (CPL) and course learning outcome (CPMK) are hard to achieve. Recently, the application of student-centered learning models, like project-based learning models, has not been maximized. Therefore, it is necessary to conduct a further study to analyze the effectiveness of project-based learning models in aquaculture techniques courses in the TBP study program, Politeknik Perikanan Negeri Tual.

METHODS

This study was performed on May to August, 2024 in TBP Study Program, Politeknik Perikanan Negeri Tual. The population in this study comprises seven students who take the aquaculture technique. Data were collected from pre-test dan post-test to determine the cognitive and observation assessment, while skills assessments were collected from the 21st century skills, such as critical thinking, creativity, collaboration, communication; literacy skills, namely information, media, technology; life skills, namely flexibility, leadership, initiative, productivity, social skill; content report and presentation, visual presentation, keywords selection, questions with the participants, gimmicks, and report writing.

The flow refers to the stages of project-based learning, namely (a) conducting a learning with basic questions, (b) designing a project plan, (c) preparing an activity schedule, (d) monitoring, (e) evaluating the project, (f) evaluating the project-based learning activities (Kemdikbudristek, 2023). The implementation flow is depicted in Figure 1.

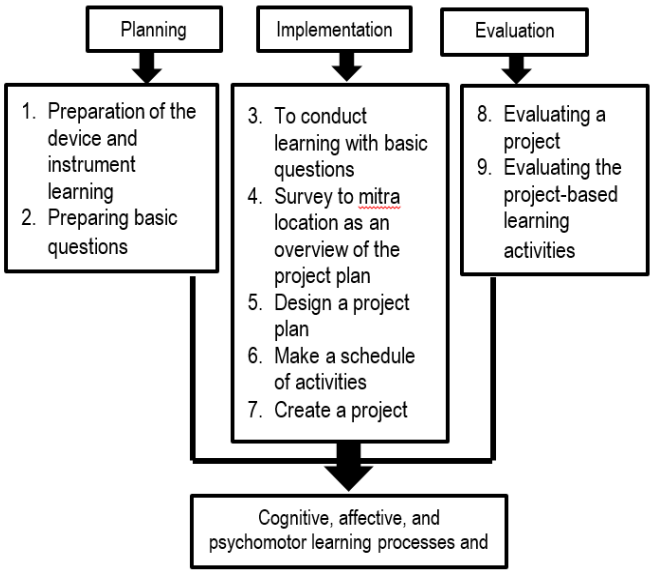

Figure 1. Workflow design

Data were analyzed descriptively by using a perception rubric with the criteria:

Table 1. Assessment criteria

Criteria	Score
Low	10-40
Fair	41-70
Good	71-100

The final score of cognitive assessment was obtained from 20% of pre-test and 80% of post-test, while the final score of affective and psychomotor assessments was obtained from the average of four assessment points. The final score of the course is:

$$Final\ score = \frac{(0{,}4xSAK)+(0{,}6x\ SAP)}{\text{maximum score}}\ x\ 100\%$$

Where,
SAK = final score of cognitive assessment;
SAP = final score of affective and psychomotor assessments

Effectiveness of learning method implementation was analyzed by the students' learning completion with the formula:

$$Learning\ completion = \frac{\text{Number of graduates}}{\text{Number of students}}\ x\ 100\%$$

Students that can complete the course is presented, if the average learning outcomes of courses in one class are ≥ 75%, followed by the average student attendance of > 70% and the average student activity is > 70% (Dewi, 2023).

RESULTS AND DISCUSSION

The aquaculture technique course uses project-based learning models with several steps taken. The first step is planning the course by creating the learning plan (RPS) and preparing basic questions. This is in line with Dinda & Sukma (2021) who stated that the first step in implementing project-based learning is asking basic questions. Project assignments arise from problems and questions. The questions are designed according to the abundant regional fisheries potential and the high level of community demand, like Barramundi. To meet the demand level, sustainable aquaculture efforts with high productivity are needed. Then, the question is, how to culture the Barramundi properly to obtain sustainable seed and broodstock. Before learning in class to elicit basic questions, an initial test (pre-test) is carried out to determine the students knowledge of the course.

The second step is the implementation of project tasks including lectures in class, surveys to partner locations at the *Tual Marine Culture Center* and *Daifin Tual, Inc.* The survey was conducted to obtain a picture of the proper fish culture, including location planning concept, culture methods, feeding management, water quality management, disease control, harvesting, packing and transportation of harvested results. This is in accordance with the Decree of the Minister of Maritime Affairs and Fisheries No. 2 of 2007 concerning good fish farming practices. Data were obtained from interviews with employees/technicians and direct observations at the location. Based on the results of these observations, students held discussions to find a proper culture method to answer basic questions. The project designed by lecturers and students in this course is Barramundi culture with the Recirculation Aquaculture System (RAS). The proper culture method is a logically designed project plan related to Barramundi culture with continuous water recycling process to maintain the water quality condition.

Next, the RAS project is constructed by students under the lecturer's monitoring to provide affective and psychomotor assessments of students. Students who demonstrate motivation, attitudes, and skills according to the assessment rubric are given awards to increase their enthusiasm for learning.

Whelan et al. (2022) stated that the project-based learning model provides students with challenges about real-life problems, which requires thinking skills to design a project that can be applied in real life. There are three pillars that are the basis for the implementation of this model, including (a) Real-World Problem, starting from real problems that are relevant to the topic of the course, (b) Real People, opportunities to meet new people or practitioners who are directly related to the problem, and (c) Real Product, opportunities to produce useful products or portfolios. These three pillars have been developed in this study.

The monitoring results on project-based learning by students in each assessment part contain:

Cognitive

The learning results in cognitive part was assessed by pre- and post-test. The pre-test was performed to determine the initial capability of students, before learning activity. This condition is presented from the pre-test score of seven students at 55.29, then increased to 80.86 after the post-test (Figure 2).

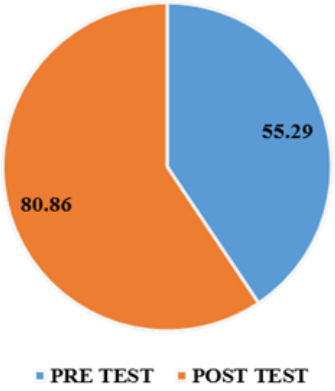

Figure 2. The pre test and post test scores of Aquaculture Technique Course

The scores of each student are shown in Table 2. The pre-test scores are 61 by only one person, 60 by one person, 57 also by one person, 55 by one person, 52 by two people, and 50 by one person. Thus, the students' pre-test scores are in the sufficient criteria. On the other hand, the highest post-test score is 85 obtained by three people, 80 by one person, 78 by two people, and 75 by one person. The final score of the cognitive assessment is in the range of 70 to 80.2. This condition indicates that the students' post-test scores are in the good criteria, because students who offer aquaculture techniques courses are 4th semester students who have passed the prerequisite courses and have ready knowledge about fisheries.

Table 2. Final score of cognitive assessment in Aquaculture Technique Course

Student	Pre test Score	Post test Score	Cognitive Final Score	Criteria
1	61	85	80,2	Good
2	55	80	75	Good
3	52	78	72,8	Good
4	52	78	72,8	Good
5	60	85	80	Good
6	50	75	70	Good
7	57	85	79,4	Good

The application of PjBL from empirical studies shows that improving the learning outcomes is possible in the cognitive domain. The PBL is advantageous to involve students more in learning (Nafiah and Suyanto, 2014; Khotimah and Salimi, 2017). With their involvement in learning, their understanding in the materials presented will increase (Soraya Mei and Purnomo, 2019).

Affective and Psychomotor

Affective and psychomotor assessments are presented in Tables 3, 4, 5, and 6.

Table 3. Learning skills (A) in affective and psychomotor assessments

Student	Critical thinking	Creativitity	Collaboration	Communication	Average
1	85	85	90	90	87.5
2	80	80	80	85	81.25
3	80	85	90	85	85
4	75	80	85	85	81.25
5	85	80	85	85	83.75
6	70	75	85	80	77.5
7	75	75	80	75	76.25
Average	78.6	80	85	83.6	81.79

In Table 3, the average value of learning skills or 21st century life skills for 1 class is 81.79 from four assessment rubrics, namely critical thinking, creativity, collaboration, and communication. The highest average value in the collaboration parameter is 85, followed by communication skills of 83.6 and the lowest in critical thinking of 78.6. This condition indicates that students who attends Aquaculture Technique course have high collaboration and communication skills, in line with Rambely et al. (2013); Xu & Liu, (2010) that project-based learning is collaborative learning to increase innovation in producing project assignments. This model develops communication skills and makes decisions to produce certain projects integrated with theory.

Table 4. Literacy skills (B) in affective and psychomotor assessments

Student	Information	Media	Technology	Average
1	75	85	75	78.33
2	74	80	73	75.67
3	73	78	75	75.33
4	72	75	75	74
5	75	80	74	76.33
6	70	73	71	71.33
7	71	75	75	73.67
Average	72.9	78	74	74.95

In Table 4, the average literacy skills score for 1 class is 74.95 from three assessment rubrics, namely information, media, technology. The highest average score is obtained from the media parameter at 78 and the lowest is found in information at 72.9. This shows that students who attend Aquaculture techniques course have higher learning media mastery than others.

Table 5. Life skills (C) in affective and psychomotor assessments

Student	Flexibility	Leadership	Initiative	Productivity	Social skill	Average
1	75	85	80	78	80	79.6
2	73	80	78	75	75	76.2
3	72	80	76	76	80	76.8
4	71	75	73	71	76	73.2
5	74	80	80	75	78	77.4
6	70	71	72	70	80	72.6
7	73	70	72	73	75	72.6
Average	72.6	77.3	75.9	74	77.7	75.49

According to Table 5, the average value of life skills or 21st century life skills for 1 class is 75.49 from five assessment rubrics, namely flexibility; leadership; initiative; productivity; social skills. The highest average score can be found in social skills at 77.7 and the lowest score is obtained from for the flexibility parameter at 72.6. This shows that social skills are inspired by the study program students, followed by the ability to cooperate in the learning skills aspect.

The average value of reports and presentations assessment is 74.38. Among all the parameters, the visual appearance has a higher value of 75.6 and the lowest is in the content or substance of the material studied at 73.1. This is somewhat different from the average of post-test score. In general, the Aquaculture Technology study program students are able to express their knowledge in writing, but verbal action still needs to be developed. The assessment of student reports and presentations can be seen in Table 6.

Table 6. Reports and presentation scores in affective and psychomotor assessments

Student	A	B	C	D	E	F	Average
1	75	80	77	80	76	80	78
2	74	75	73	78	75	76	75.17
3	75	78	76	76	75	78	76.33
4	72	74	73	71	74	72	72.67
5	75	80	74	80	75	80	77.33

6	70	70	70	71	71	70	70.33
7	71	72	70	70	71	71	70.83
Average	73.1	75.6	73.3	75.1	73.9	75.3	74.38

Note: A: content; B: visual style; C: diction selection; D: Q&A; E: eyes and movement; F: report-writing

Overall, the final scores of affective and psychomotor assessments obtained from the seven students range from 72.94 to 80.86 with good criteria, as presented in Table 7. This shows that Aquaculture Technology study program students who take this course have good abilities after being given project assignments.

Table 7. Final score of affective and psychomotor assessments

Student	Learning skills	Literacy skills	Life skills	Report and Presentation	Final score	Criteria
1	87.5	78.33	79.6	78	80.86	Good
2	81.25	75.67	76.2	75.17	77.07	Good
3	85	75,33	76.8	76.33	78.37	Good
4	81.25	74	73.2	72.67	75.28	Good
5	83.75	76.33	77.4	77.33	78.70	Good
6	77.5	71.33	72.6	70.33	72.94	Good
7	76.25	73.67	72.6	70.83	73.34	Good

The final score of the students obtained from three assessment parameters can be seen in Table 8. The calculation results indicate that the final score of 71.77 to 80.60 is in a good category.

Table 8. Final score of Aquaculture Technique Course

Student	Cognitive	Affective and Psychomotor	Final Score	Criteria
1	80.2	80.86	80.60	Good
2	75	77.07	76.24	Good
3	72.8	78.37	76.14	Good
4	72.8	75.28	74,29	Good
5	80	78.70	79.22	Good
6	70	72.94	71.77	Good
7	79.4	73.34	75.76	Good

Based on the final score in Table 8, the student's learning completion is 100%. This means that the project-based learning model is effectively applied in learning Aquaculture Technique course for students. The effectiveness of implementing the project-based learning model in the course is in line with Yudha (2019) and Serin (2019), who stated that the project-based learning model has a main idea that lies in the core concept of science. The Aquaculture Technique course has a core concept related to fish culture efforts using certain methods. Sulistiana (2022) stated that independent student involvement can encourage the knowledge construction in a real context to produce products as a learning achievement. In its application, a RAS system for Barramundi culture has been identified as a learning product. Similarly, Jumrodah et al. (2021) found that using the project-based learning model could help students develop ideas and solve problems related to laboratory-based phytoplankton culture.

In designing a project plan, students are required to think critically and creatively, and to provide solutions to the problems faced by farmers. In the assessment of critical thinking and creativity, students still need to be developed by directing students to find solutions through active collaboration and communication between students and lecturers.

Overall, the implementation of this model has a positive impact on students, namely (1) completing the project assignments with full responsibility, (2) having communication skills with the community, lecturers and work teams, (3) collaborating with teams and the community when conducting surveys, (4) Critical and creative thinking skills that are manifested in the Barramundi culture project plan with the Recirculation Aquaculture System (RAS), and (5) Finding various problems faced by the community after making presentations. These results are in line with

Whelan et al. (2022), who stated that the project-based learning model has a positive impact on independence and collaboration to produce a good quality product, besides the ability to solve problems, construct ideas, involve logic and intuition in manufacturing the product (Safithri, et al. (2021), (Fiana et al. 2019) and Nurfitriyanti (2016) (Sari & Angreni, 2018).

CONCLUSION

The Project-based learning model is effectively applied in Aquaculture Technique course for students of Aquaculture Technology Study Program, Politeknik Perikanan Negeri Tual. This condition is indicated by the learning completion reaching 100% and is qualified as a good criteria, based on the final score of cognitive, affective and psychomotor assessments. In learning activities, students are productive and creative in developing knowledge, attitudes, and skills in an integrated manner.

REFERENCES

Billet, S. (2011). *Vocational Education: Purposes, Traditions, and Prospects*. New York: Springer.

Dinda, N. U., Sukma, E. (2021). Analisis langkah-langkah model project based learning (PJBL) pada pembelajaran tematik terpadu di sekolah dasar menurut pandangan para ahli (studi literatur). *Journal of Basic Education Studies* 4(2), 44-62.

Fathurohman, M. (2015). *Model-Model Pembelajaran Inovatif*. Yogyakarta: Ar-Ruzz Media.

Fiana, R. O., Relmasira, S. C., Hardini, A. T. A. (2019). Perbedaan penerapan model project based learning dan problem based learning terhadap hasil belajar Matematika kelas 4 SD. *Jurnal Basicedu* 3(1), 157–162.

Jumrodah., Liliasari., Adisendjaja, Y. H., Sanjaya, Y. (2021). Keterampilan berpikir kreatif mahasiswa calon guru biologi pada konsep biota laut menuju pembangunan berkelanjutan melalui pembelajaran berbasis proyek. *Edu Sains* 9(1), 98-106.

Keputusan Menteri Kelautan dan Perikanan No. 2 Tahun 2007. Cara budidaya ikan yang baik. Jakarta.

Khotimah, K., Salimi, M. (2017) Penerapan model problem based learning untuk meningkatkan hasil belajar. *KALAM CENDEKIA*, 5(1).

Kusumaningrum, S., Djukri, D. (2016). Pengembangan perangkat pembelajaran model project based learning (PjBL) untuk meningkatkan keterampilan proses sains dan kreativitas. *Jurnal Inovasi Pendidikan IPA*, 02(02), 241-251.

Nafiah, Y. N., Suyanto, W. (2014) Penerapan model problem-based learning untuk meningkatkan keterampilan berpikir kritis dan hasil belajar siswa

Nurfitriyanti, M. (2016). Model pembelajaran project based learning terhadap kemampuan pemecahan masalah matematika. *Jurnal Formatif*, 6(2), 149–160.

Rambely, A. S., Ahmad, R. R., Majid N., M-Suradi, N. R., Din, U. K. S., A-Rahman, I., Mohamed, F., Rahim, F., Abu-Hanifah, S. (2013). Project-based activity: root of research and creative thinking. International *Education Studies*, 6(6).

Safithri, R., Syaiful, S., Huda, N. (2021). Pengaruh penerapan problem based learning (PBL) dan project based learning (PjBL) terhadap kemampuan pemecahan masalah berdasarkan self efficacy siswa. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 5(1), 335–346.

Sari, R. T., Angreni, S. (2018). Penerapan model pembelajaran project based learning (PjBL) upaya peningkatan kreativitas mahasiswa. *Jurnal Varia Pendidikan*, 30(1), 79–83.

Serin, H. (2019). Project based learning in mathematics context. *International Journal of Social Sciences & Educational Studies*, 5(3), 232–236.

Sonhadji, A. (2012). *Manusia, Teknologi dan Pendidikan Menuju Peradaban Baru*. Malang: UM Press.

Soraya, M. L., Purnomo, A. (2019). Membangun empati siswa melalui bermain peran pada materi konflik sosial kelas VIII C SMP Lab UM. *Jurnal Teori dan Praksis Pembelajaran IPS*, 4(1), 7–14.

Sulistiana, I. (2022). Peningkatan hasil belajar siswa melalui model pembelajaran problem based learning (pbl) pada mata pelajaran IPA kelas IV SDN Blimbing Kabupaten Kediri. *PTK: Jurnal Tindakan Kelas*, 2(2), 127-133.

Wena, M. (2014). Strategi Pembelajaran yang Inovatif Kontemporer: Suatu Tinjauan Konseptual Operasional. Jakarta: Bumi Aksara.

Whelan, A., Leat, D., Thomas, U., Bahirah, N. (2022). Project based learning (PBL) for students in alternative provision and student referral units (AP / PRUs) within the landscape of violence reduction (Issue October).

Xu, Y., Liu, W. (2010). A project-based learning approach: a case study in China. *Asia Pacific Educ. Rev,* 11, 363–37.

Yudha, C. B. (2019). Penerapan project based learning dalam mata kuliah penelitian tindakan kelas. *Dwija Cendikia: Jurnal Riset Pedagogik*, 3(1), 30.