EXPLORATION OF PROJECT BASED LEARNING AMONG TEACHER TRAINEES AT THE RIVERBANK OF MALACCA RIVER, MALAYSIA

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ABSTRACT

The purpose of this study is to explore the environmental research activities conducting by teacher trainees through Project Based Learning at Malacca River. The participants of this qualitative case study was involved two teacher trainees majoring in Science from Institute of Teacher Education Technical Education Campus. The research data were obtained through observations, documents and unstructured interviews. The findings showed that environmental research activities was carried out through in-situ and ex-situ process for investigate the water qualities of Malacca River. This study generally indicates that the implementation of Project Based Learning can improving teachers in the skills of science processes and the manipulative skills of trainee teachers in conducting scientific investigations. In conclusion in the quality way, this study may serve as a guide to shape individual development towards the growth of environmentally-smart citizen.

Keywords:
Exploration, Project Based Learning, Environment, Water Pollution, Science Process Skills

ABSTRAK

Artikel ini bertujuan untuk mengetahui aktivitas pembelajaran penyelidikan alam sekitar oleh mahasiswa calon guru berdasarkan kaidah pembelajaran berbasis proyek *(project based learning)* di sungai Melaka. Penelitian ini berbentuk kualitatif dan melibatkan dua orang mahasiswa calon guru dari Guru Kampus Pendidikan Teknik yang mempunyai pengkhususan dalam bidang Sains. Data penelitian diperoleh daripengamatan akutivitas mahasiswa calon guru, dokumen dan wawancara tidak terstruktur. Berdasarkan hasil penelitian didapati data bahwa aktivitas penyelidikan kualitas air dapat dilakukan secara in-situ dan ex-situ dan hasil penelitian juga menunjukkan bahwa pelaksanaan pembelajaran berbasis proyek dapat meningkatkan kemahiran mahasiswa calon guru dalam keterampilan proses sains dan melakukan penyelidikan penelitian saintifik .Kesimpulannya, penelitian ini dapat membentuk perkembangan individu secara terus menerus menuju pada melahirkan warga negara yang peduli pada lingkungan sekitar.

Kata kunci:
Eksplorasi, Pembelajaran berbasis proyek, Polusi air, Keterampiran proses sains

INTRODUCTION

Malaysia is a fast-developing nation. At the same time, the population growth rate is also increasing year by year. Although the population growth rate is increasing, Malaysians' knowledge on the environment still remains low. This can be seen more clearly when it comes to environmental issues such as water pollution. Azizah and Zanaton (2015) argued that environmental issues are still considered as ongoing and current issues even though these

issues have been debated previously. This is also due to the attitude of the people who underestimated these issues. Syuhada, Wafi and Chan (2019) explained that environmental issues such as the pollution of rivers are no longer alien to Malaysia. This is because preliminary findings showed that many in the society perceive that taking care of the environment and addressing these issues are the responsibility of the government and not the society itself (Azizah and Zanaton, 2015). The factors that contribute to these pollutions clearly

indicate a country's failure to form a first-class society in terms of environmental care.

Therefore, one of the ways to change the public's perceptions on environmental issues, especially river pollution, is through the medium of education, in particular through Environmental Education (EE). According to Haliza (2017), Environmental Education refers to planned efforts to educate the public either formally or informally so that the well-being and sustainability of the community and the environment is preserved and sustained. This is supported by Hidayah, Haryati and Seow (2013) who stated that Environmental Education is a key element in the delivery of environmental knowledge to humans in the hope of shaping human behavior to be more environmental friendly. In other words, EE is a very important part of one's life, especially in shaping an individual who shall excel in every aspects of life, specifically in relation to the environment. Many studies suggested that good education can produce a wise civilization that are capable of organizing life and making decisions that benefit humanity (Samruhaizad and Azahan, 2017). Therefore, knowledge regarding the environment or also known as EE is important to be nurtured in the community, mainly for future generations. This is because knowledge is capable of shaping positive practices in line with full understanding and awareness, for instance through interaction between the community and the environment focusing on issues such as water pollution.

The effort of integrating EE is also implemented at the Institute of Teacher Education or Institut Pendidikan Guru (IPG) among teacher trainees who are taking Science as their option through two courses, SCES3103 Environmental Biology and open elective, LASS3103 Education for Sustainable Environment. Based on the Summary of Information or Ringkasan Maklumat Kursus (RMK), these courses are offered so that teacher trainees majoring in Science will gain comprehensive knowledge

and understanding regarding the environment to be applied in everyday life and in school. Indirectly, these courses allow them to achieve the objectives of EE if it is fully understood and implemented holistically by teacher trainees.

Implementing EE is one of the means in achieving the Sustainable Development Goals (SDGs) by 2030, which is an initiative decided upon by all policy heads. Figure 1 shows a series of discussions on international environmental issues that have been held in recent years. The series of discussions held, aimed at finding the best solutions to address the deteriorating quality of the environment.

Figure 1. A series of international discussions held regarding environmental issues.

One way to disseminate environmental knowledge to the society, especially the younger generation, is through meaningful learning. According to Ainun, Zamri and Muna (2017), Teaching and Learning (TL) is very helpful to students in increasing their interest and motivation to practice lifelong learning. From another point of view, however, teacher success is a key factor that should be stressed when implementing meaningful learning, particularly when it comes to EE. According to Yap (2015), in the context of realizing the ambitions of Malaysian Education Blueprint 2013-2025 (MEB), to boost school performance and student achievement, teachers need to have a vision to change different facets of education, high-level thought and innovation. To achieve the educational aspirations of the nation, the success of teachers has been one of the most recent transformations (Ainun, Zamri and Wan Muna, 2017). This is because, affected

construction will have implications and can influence future behaviors (Norazizah, 2019). As such, teachers have been an important asset in the paradigm shift to empower Environmental Education especially for students.

In this regard, Anwar (2014) stated that teacher trainees are the most influential component in the establishment of processes and outcomes of a quality education. This is because, quality education cannot be achieved without support, but will also fall short due to lack of pedagogical competence in delivering knowledge among teacher trainees, especially concerning knowledge on the environment, particularly water pollution. Therefore, in order to enhance their pedagogical competence, teacher trainees should master the content and skills linked to the options taken in IPG to ensure effective TL. It aims to obtain effective delivery of TL to further enhance environmental knowledge through proper and accurate skills.

According to Hasmaliza and Zamri (2016), the ability to think effectively is a very important factor in today's increasingly challenging world. Therefore, appropriate TL mechanisms need to be implemented to deliver engaging and student-centered learning content. Nitche and Mai (2013) pointed out that Project Based Learning (PBL) is best suited to be implemented as this method teaches individuals to demonstrate a deep understanding of knowledge and skills.

Abdullah and Daud (2018) also stated that teaching approaches, strategies, methods and techniques should be implemented in the form of Higher Order Thinking Skills (HOTS) and student-centered. Therefore, the formation of knowledge among teacher trainees is one of the means in delivering EE to primary school students, through a more recent and student-centered approach. It is in line with the mechanisms and concepts of PBL carried out in this study. This is supported by Roslina and Zanaton (2017) who stated

that PBL is an approach that enhances 21st century students' skills, whereby it is crucial to produce a balanced human capital spiritually and physically. It is clear that in order to produce a knowledgeable generation, teacher trainees must be prepared to take on the responsibility and play an important role in achieving the national's aim in shifting the perceptions of the new generations concerning the environment.

In accomplishing teacher success, training's provided to teacher trainees are now seen as a difficult task in overcoming the obstacles and challenges, for instance in delivering knowledge regarding the environment. According to Alizah and Zamri (2015), the teaching and learning process at higher education is often found to be more likely to use lectures as the main teaching technique. Teaching using lectures can sometimes be tedious and can lead to drowsiness besides resulting in passiveness among teacher trainees. This is because, when lecturers deliver lectures, students are often found to be just listeners by not involving themselves in the teaching and learning process and thus resulting in the absence of two-way communication between lecturers and students (Alizah and Zamri, 2015). This makes it difficult for teacher trainees to understand the lessons in detail, especially when it comes to the topics concerning the environment.

The objective of this study is to:
1. Explore the Teaching and Learning Process among teacher trainees using the Project Based Learning method through environmental research activities.

MATERIALS AND METHODS
Research Design

For the purpose of this study, the research design employed is qualitative study by conducting a case study at Malacca River, Malacca aiming to explore the

processes involved in relation to the water pollution at Malacca River among teacher trainees through the PBL method. According to Yin (2009), case study is defined as a form of empirical inquiry conducted to study contemporary phenomena occurring in real life contexts, especially when phenomena are beyond the bounds of knowledge and context. In addition, case study is also an appropriate research design if the focus of the research is on the process (Merriam, 2001) as it can provide a picture or pattern in understanding better. According to Noraini (2010), qualitative research is often used by researchers to find meaning and to understand a phenomenon in depth and breadth. Accordingly, qualitative research design is viewed to be very compatible for exploration-based research (Yin, 2015).

Sampling

The location selected for this case study was a river called the Malacca River located in Malaysia. The Malacca River is located in the heart of Malacca City and serves as a tourist attraction for the environmental aspects. According to Ang (2016), the state government is redeveloping the Malacca River into something like the Venice of the East, as part of its tourism program.

Besides, the sampling also included the profile of participants involved in this study. There were only two participants involved in this study. The participants consisted of 23-year-old teacher trainees from June 2016 Intake studying at the Institute of Teacher Education Technical Education Campus (IPGKPT). There were only two participants involved in this study as Patton (1990) stated that no rules were set in sample size selection in a qualitative study, but sample size depends on what the researcher wants to explore, performed in a timely manner besides allowing the research to obtain in-depth information.

In addition, the sample selection used in this study was the purposive sampling

method. This is because, the choices made are intentional to specific individuals, events and environments based on significant information that will allow the researcher to explore further. In fact, participants are aware of the development and journey of a phenomenon of the location that is being studied (Creswell, 2012). The best sample according to Patton (1990) is to select a participant who has homogenous sampling or sampling characteristics. This is for the purpose of getting more in-depth and focused data. According to Noraini (2010), the selection of purposive samples through snow ball technique is very good and suitable for qualitative studies as the selected sample has information that the researcher wants to know because the sample is aware of the development and phenomenon occurring at the study site. This technique is shown in Figure 2.
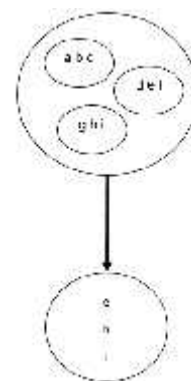

Figure 2. Snow ball technique involving purposive sampling.

Patton (2002) stated that "the logic and power of sampling lies in the selection of 'cases with rich information' to be studied in-depth" (p. 230). Cases with rich information involve individuals, events or circumstances, in which researchers can learn widely about the issues being studied. This view is in line with Merriam (2009) as she stated that the selection of potential participants enables the acquisition of information to the point where no new information is discovered or overlapped.

Instrument of Study

Overall, the process of preparing to collect the data is called instrumentation. The instruments of this study consisted of observation protocols, interview protocols and informal documents carried out at the Malacca River as the location of the study. At the location site, the observations were recorded by the researcher in the form of a learning story as well as a checklist. Learning story is a detailed and concrete description of the things that have been observed. In addition, participants' observation technique was also implemented in which the researcher joins a group of informants where they notice the presence of the researcher to make observations based on real, authentic situations (Angrosino and Mays de Perez, 2000). This is because, researchers are part of the participants and they are taking part in the group activities or situations studied (Denzin & Lincoln, 2000). The interviews conducted were in the form of semi-structured interviews. Othman (2009) stated that questions in semi-structured interviews are predetermined, but the answers to these questions are open, which can be developed at the discretion of the interviewer and participants. Unofficial documents on the other hand, consisted of the preparation of a report from the teacher trainees regarding the investigation conducted at the Malacca River. Documents, according to Merriam (1988) are supporting or additional data. The information obtained not only enables the researcher to support and add evidence, but also assists in verifying the information obtained from interviews and observations (Ghazali and Sufean, 2018).

Validity and reliability refers to the level of stability and consistency of the instrument set so that the items constructed are capable of being answered by the participants without any doubt (Noor Ashikin, 2019). Therefore, in order to obtain the reliability of the instrument, validation from experts concerning the validity of the constructs and language used in the study had been obtained as well as the used of data triangulation method for the purpose of data collection to ensure consistency of the data obtained.

Research Procedures

Participants of the study through PBL method during teaching and learning, involved three main phases: (1) First or Early Phase, (2) Second Phase and (3) Third or Last Phase. First Phase was the starting point of this study, which was to identify the current knowledge and experience of teacher trainees and to address issues in a particular topic. In this study, selected topics were related to the water pollution at Malacca River. There were also discussions held with other trainees in order to acquire other important inputs.

The Second Phase involved research activities conducted by the teacher trainees at the location site. At this level, the teacher trainees needed to obtain information related to the topic that was being explored, for example through sources such as books, videos, pictures or the internet. Finally, Phase Three was the culmination of the PBL method by presenting a comprehensive report based on the investigation.

Next were data transcription, encoding and analyzing that were done in detail. Qualitative data is written based on the basis of narrative (storytelling) and descriptive (description). In addition, the data collected were from a variety of sources and consisted of a very rich data set. Therefore, for the purpose of this study, data from observations, interviews and documents were collected and processed according to the need of information to answer the research question. Finally, researchers needed to conclude and report based on the research.

Data Analysis

Once the data has been collected, researchers began to organize the data in meaningful ways through analytical processes. Data obtained from observational sources, interviews and documents, were analyzed using narrative analysis and theme-based content analysis, following three key processes presented by Miles and Huberman (1994) through Interactive Models, which were (1) data degradation, (2) display the data and (3) conclude with a verification as shown in Figure 3. The process of analyzing this data was carried out as soon as the first data was obtained. For example, first observation, first interview and first document reading.
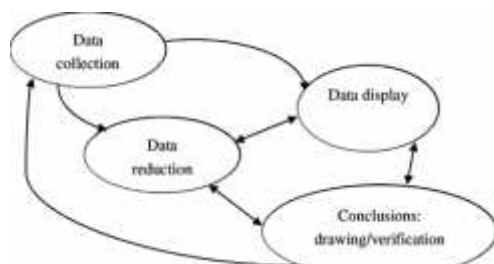

Figure 3. Interactive data analysis adapted from the Interactive Model by Miles and Huberman, 1994, p. 12.

While implementing this process, researcher have taken continuous action in following the cycle of collecting, filtering, displaying and verifying data.

RESULTS AND DISCUSSIONS

This section will answer the research question which is, 'What are the environmental research activities undertaken by teacher trainees through Project Based Learning method?' In order to obtain this data, sources from observations, interviews and unofficial documents in the form of brief reports on water pollution at Malacca River have been analyzed in detail, from Phase One to Phase Three.

Phase One: Issue Selection

This phase was conducted before the participants were on site which included discussions to identify the current knowledge and experience of the teacher trainees which were RA or Maria (not the real name) and RB or Ali (not the real name) and to express their interest on any topic. In this study, the topics selected were related to the environment. From the observation notes between RA from RA (1)O/CP-9/9 (note p. 1) and RB from RB (1)O/CP-9/9 (note p. 1), it was found that the participants wanted to focus on water qualities of Malacca River which is water pollution:

RA   :   *I think we should do research about water pollution.*

RB   :   *Is recycling not okay?*

RA   :   *I think the biggest issue right now is water pollution. We can see a lot of news from the newspaper, regarding water pollution.*

In addition, the opinion of the participants, namely RA from RA (1)I-9/9 (lines 65-71) on the PBL method was also asked through the interviews conducted. The participants of this study stated that PBL method has many benefits in the real world context. One of them is to attract and gain a meaningful learning. This is because the learning method is implemented directly at the research site at Malacca River besides enabling the participants to interact with the environment and the surrounding to obtain the desired information.

Researchers: *In your opinion, what are the benefits of PBL method?*

Maria   :   *In my opinion, PBL has a lot benefits. One of them ... is it can be done at the research site. We can see the Malacca River, interview the employees. In short, I would really love it and it can attract anyones' interest. Especially when it is being carried out outside of IPG. Of couse we can gain meaningful experiences.*

RA (1)I-9/9 (lines 65-71)

Phase Two: Exploration Activities

This phase involved in-situ activity. This was evident during the implementation of the PBL method, where the water samples had been taken at several checkpoints at Malacca River, (1) Kampung Morten, (2) Pangkalan Rama, (3) Kampung Hulu dan (4) Bandar Hilir based on the scope of work distribution that was done during the First Phase between the participants. It can be seen that RB was beginning to express a keen interest by commenting on the physical condition of the water sample taken, "It looks clear, but there is some smell". This behavior of RB was recorded by the researcher in RB (1)O/CP-13/9 (note p. 4). This finding is also supported by the observation note from RA, which also showed a similar response to the physical condition of the river's water, which is, "I thought the water is clean, because I did not see any waste on the surface of the river". The responses were recorded by the researcher in RA (1)O/CP-13/9 (note p. 4).

To investigate the environmental issues involved regarding water pollution, the investigation was carried out by collecting the data with reference to the water samples from Malacca River by the participants. Figure 4 shows that the participants collected samples of water from Malacca River taken at all four checkpoints at certain times. Collection of this sample was performed using a mobile device to measure the pH value as shown in Figure 5. Next, they were bottled and labeled as in Figure 6 to allow the samples to be identified during data analysis.

Figure 4. The participants were collecting samples of water from the Malacca River.

Figure 5. A mobile device used to measure pH values.

Figure 6. Some of the samples of water that have labeled on the bottle.

While conducting this study, the lowest PH value obtained from Malacca River at 4 p.m. was 6.32, proving that the water in the area at moment the water was taken had low acidity as compared to other checkpoints and at other times.

RA   :   *There are many fish at checkpoint 1 this morning... because of the pH value which is 6.81, which is still within the range. Fish can definitely*

survive within this value.

RB   :   *The pH value at checkpoint 4, at 4 p.m. this afternoon checked using the portable pH meter shows the value which is 6.32. It is decreasing. The water is slightly acidic. I wonder why?*

Through discussions conducted with each other in RA (1)O/CP-13/9 (note p. 5) and RB (1)O/CP-13/9 (note on p. 6) resulted in different findings, as it was clear that the participants made every effort to find the cause of the low pH value. The above data is also supported through an unofficial document, DTR 01(29/9/19), which was the information gathered regarding the value of pH at different locations and times.

Observational data from observation notes also indicate that the participants collected more detailed information when they discovered oil as in Figure 7 at the fourth checkpoint, at Bandar Hilir.

"That is why the pH value changes. There's some oil here. But it can't really be seen. You have to take a good look. After all, this is the last station for the cruise to stop. There's a lot of hotels in this area! Food stalls too! "

RA (1)O/CP-13/9 (note p. 6)

Figure 7. There is some oil spilled on the surface of the water.

Phase Three: Representation of Information

For the Third Phase, the participants measured ex-situ data that was not performed in the original location. In this regard, data analysis was performed in a laboratory equipped with the apparatus necessary to measure some values for a specific parameter.

Exploration Activities for Dissolved Oxygen

One of the research activities conducted at Malacca River was measuring Dissolved Oxygen (DO). Dissolved Oxygen is important in measuring water quality which indicates the content of dissolved oxygen in the water flow. In addition, the dissolved oxygen is also one of the most important elements for the aquatic life to carry out the process of respiration and also acts as a control for the quality of water. The rate of Dissolved Oxygen content varies throughout the river. This can be proven by analyzing an unofficial document via DTR 01(29/9/19). The reading value at checkpoint 1, in the morning was the lowest at 0.50 mg/L, while the highest reading value was at checkpoint 2 at 4 p.m. at 6.64 mg/L.

The rate of Dissolved Oxygen content varies along the river. Observational data below also indicate that the participants found that the values for Dissolved Oxygen were lower in the morning than in the evening.

"It looks like the value at 7 o'clock is the lowest, especially at checkpoint 1."

RB (1) O/CP-21/9 (note p. 2)

In addition, the value of Dissolved Oxygen may also be influenced by the low flow of the river water as shown in Figure 8, which was located at the riverbank. Riverbank are more vulnerable to toxic waste that was caused by service sectors such as the hospitality industry and the food industry that contribute to the reduction of Dissolved Oxygen content. The four locations studied by the researcher was located at the riverbank of the river.

Figure 8. Low current at the riverbank of Malacca River.

Exploration Activities Biochemical Oxygen Demand

In order to analyze the next parameter, the participants focused on Biochemical Oxygen Demand (BOD). Biochemical Oxygen Demand is an indicator of the degree of contamination caused by industrial, domestic and agricultural waste. High Biochemical Oxygen Demand value indicates that the water tested is contaminated. This means that there are more inorganic substance that can be decomposed by microorganisms and more oxygen were used in the process. Findings from observation notes in RA (1)O/CP-28/9 (note p. 1) and RB (1)O/CP-28/9 (note p. 1) indicate that through the data analysis done by the participants, showed that there were several checkpoints that exceeded the specified Biochemical Oxygen Demand concentration range . From the survey data, it was found that checkpoint 2, at 7 a.m. had the highest, while checkpoint 2 at 4 p.m. had the lowest.

Ammoniacal Nitrogen Exploration Activities, NH_3N

In analyzing the next parameter, the participants focused on Ammoniacal Nitrogen, NH_3N. The observation note dated 21/9/19 showed that during the investigation in the laboratory, the focus was on measuring the value of NH_3N (refer to Figure 9 to Figure 13).

Figure 9. Materials and apparatus used to test water samples.

Figure 10. One of the participants analyzing the water samples

Figure 11. Examples of water samples (left) compared to distilled water (right).

Figure 12. Some examples of water samples from the Malacca river that have been analyzed.

Figure 13. One of the procedures for measuring the value of Ammoniacal Nitrogen.

The parameters of Ammoniacal Nitrogen were used as indicators of the presence of domestic sewage from areas around the Malacca River. This is because, high value of Ammoniacal Nitrogen in the water indicated the occurrence of contamination through the presence of ammonia, which was a highly toxic pollutant. Figure 14 shows the results of the analysis from the laboratory through an unofficial document, DTR 01(29/9/19).

TITLE: Nitrogen Ammonia, NH_3N

DATE	TIME	CHECKPOINT	READING VALUE (mg/L)
13 September 2019	7 A.M.	1	0.73
		2	0.74
		3	2.39
		4	1.75
	2 P.M.	1	1.27
		2	0.25
		3	0.94
		4	1.14
	4 P.M.	1	0.08
		2	0.09
		3	1.07
		4	0.28

Figure 14. Results of data collection for NH_3N parameters.

Findings from this unofficial document indicate that through the analysis done by the participants, there were locations where the value of NH_3N was above normal. The highest NH_3N value was recorded at checkpoint 3, 2.39 mg/L, while the lowest NH_3N value was 0.08 mg/L at checkpoint 1. Therefore, high value of NH_3N indicated that the water tested was contaminated. Because of this, the river is an indicator of the degree of pollution caused by waste from nearby hotels, restaurants/food stalls and drainage systems.

Figure 15 shows the findings and discussion of the research question, 'What are the environmental research activities undertaken by teacher trainees through Project Based Learning method?'

Figure 15. The findings and discussion of the study.

CONCLUSION

In conclusion, the findings suggest that there are three phases applied when conducting studies using this PBL method. The methods include Phase One: Issue Selection, Phase Two: Exploration Activities and Phase Three: Representation of Information. The three phases involved focus on investigative activities along the Malacca River using the PBL method.

In Phase One, when it comes to environmental issues, it can be construed that maximum understanding can be achieved through investigative activities conducted by the IPGKPT teacher trainees involved in the study. The issues chosen in relation to water pollution at Malacca River were autonomous considering their respective interests and ability to implement the PBL method and PBL is a key strategy for shaping students and independent thinkers.

Exploration activities in Phase Two: Exploration Activities which involved investigations on pH, Dissolved Oxygen, Biochemical Oxygen Demand and Ammoniacal Nitrogen, were conducted at the location site. From the findings of the study gained from the observation of the scenarios in which the participants themselves took part in after visiting the study site, the results were very encouraging. This is because, when this research activity was conducted, the participants gained direct and tangible experience when applying the PBL method on the location site.

Once the findings of the study were presented in Phase Three: Representation of Information through unofficial documents and supported by observations gathered at Malacca River, it was found that the issue of water pollution was indeed related to the attitude of the community as well as their lack of empathy to the environment. In other words, Malaysians' knowledge concerning the environment is still at a very low level.

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