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The Benefits of Adopting a Problem-Based Learning Approach on Students' Learning Developments in Secondary Geography Lessons

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Abstract

Problem-based learning (PBL) provides an appealing framework for teaching and learning not only within the subject of geography but also across other disciplines. It promotes a healthy environment for active learning with its diverse sets of activities, helping students carry out investigative inquiry in the learning processes. This study examines the potential benefits of adopting a PBL approach in teaching and learning in secondary geography classrooms. It takes into account the inputs needed from both teacher and students in determining the success of the approach implementation. The study shows how, through careful planning and preparation, PBL activities can effectively enhance students' engagements and improve their grasp of geographical content knowledge. However, the teacher's shortcomings in performing the role of facilitator did highlight a limitation for the research, which hindered the success of the implementation. Future research should continue to actively examine experiences from teachers in PBL applications, discussing the circumstances to identify the conditions necessary for successful implementation of PBL within a variety of contexts.

Keywords: problem-based learning, secondary students, learning development, geography

1. Introduction

The intensification of globalisation presents many new opportunities as well as challenges for society today, compelling individuals to attain different sets of skills and knowledge base that enables them to land a secure job in an increasingly competitive labour market. Education plays a key role in preparing young students to be capable citizens, ones who are capable to think critically and act within a wider global context. To tackle this challenge, Brunei Darussalam's Ministry of Education has implemented a national educational strategy (codenamed SPN21 or *Sistem Pendidikan Negara Abad ke-21* and, translated to English as The National Education System for the 21st Century), aimed to produce young learners with valuable 21st century skills (Ministry of Education, 2013). Introduced since 2009, the strategy has gradually shifted the teaching paradigm for primary and secondary schools, with curricula design and educational reforms prioritising a change in teaching and learning approaches in school classrooms. Besides assessing students' academic development, the SPN21 education system also aims to develop individual student's key skills, such as technological literacy, critical thinking and problem solving, which are seen to be valuable in today's global techno-centric system. The aspiration is to ensure that the young students, equipped with the relevant knowledge and skills, are able to assimilate into the labour market opportunities successfully in the near future.

The new curriculum presents a new challenge to the teaching community, as teachers will need to acquire new skills in order to carry out these objectives effectively. Through training and educational courses, teacher's professional development involves refining their pedagogical and content knowledge, as well as mastering new knowledge focusing on the new technological aspect of education (Ali et al., 2015; Matussin et al., 2015; Mundia, 2010; Norbu & Salleh, 2014; Salleh & Laxman, 2014a, 2014b). Additionally, the students' learning and the attributed psychological learning behaviours within the classroom also need to be taken into account, as there are implications for teaching (Hamid et al., 2013; Matzin et al., 2013; Matzin et al., 2015; Shahrill et al., 2013). Although the innovation of the SPN21 education system may still be at its youth stage, the fruits of SPN21 can

be harvested in the near future when teachers in Brunei are prepared adequately to successfully meet the objectives of the strategy. Thus, in the context of Brunei, adopting Problem-based learning (PBL) provides an appealing framework for teaching and learning not only in disciplines such as medicine (Barrows & Tamblyn, 1980; Koh et al., 2008) and mathematics (Adnan & Shahrill, 2015; Botty & Shahrill, 2015a, 2015b), it can also be adapted within the subject of geography.

2. PBL in Geography Lessons

The discipline of geography has been undergoing constant transformation over the past century. While traditional geographers tend to place emphasis on the examination of physical environments and regional landscapes, the 21st century saw a shifting pattern of interest within the discipline towards understanding the complex and fragile human-environment relationship (Chang, 2012). This paradigm shift in academic geography shows how geography as a subject has changed, illustrating the adaptive nature of the subject in providing a lens from which we can critically evaluate our response to the social anxiety that dominate our lifetime (Harvey, 1990).

Chang (2012) observed similar pattern of adaptation within the geography curriculum in Singapore, highlighting that "the physical–human relationships are used as the organizing theme to show how relationships between people and the environment have given rise to the distinctive character of places and environments" (p. 287). Inquiring on these dynamic yet complex issues requires an analysis on the overlapping layers of themes, and it is here where the benefits of PBL run parallel with the broad geography curricula. The emphasis on critical thinking and problem solving is an attractive draw to tackle on the issue faced by most school students where they often fail to relate what they learned in classrooms to the world beyond the school walls (Rubin, 1996).

Similar to the idea where medical students are required to analyse organs as a system in the human body, geography students need to be able to recognise the links between different aspects of the discipline, drawing insights on the concept and theories discussed previously and relate it to real world situations (Pawson et al., 2006). Concepts and theories can be discussed contextually in a systematic manner in classrooms through careful design of the problem case study for the students. For instance, questions or case studies on issues such as climate change or sustainable development discussed in class compels students to evaluate the issue holistically, requiring an analysis on the connections between the natural environmental processes and how society attempts to manage such events. These real-world issues help integrate a sense of social responsibility for individuals in safeguarding the environment.

The advantage of using real world issues, besides providing an authentic open-ended learning environment with a consistent set of information that enables students the freedom to explore all facets of it, is that it tends to motivate learners to engage more on the problem (Kaufman, 1998; Savery & Duffy, 1996). Familiarity to the setting of the real-world problem at hand signals the learner to access prior knowledge embedded in their memory and thus stimulates learning (Kaufman, 1998). Additionally, with the limited class time duration allocated typically in a school day often hinders the geography teachers in designing their geography lessons with hands on activities (Nawi et al., 2015).

As contemporary society has become increasingly concerned with environmental uncertainty, PBL practice in geography education can play a big role in spreading awareness of these problems to the young learners, educating them on the severity of such multidimensional issues such as global warming, and stimulating a discussion on the possibility of society, including them, living sustainability (Chang, 2012). Furthermore, through close interactions with fellow peers, this collaborative learning process can also instil physical, emotional and social skills (Chappell, 2006).

From the perspective of the teaching staff, as PBL heavily emphasises on interpretation and critical analyses of perspectives as its discourse, teachers will also be involved in the learning process as they may be presented with the opportunity to expand their knowledge base and refine their opinions on a particular topic. The convenience of PBL in improving student learning covered here does justify its growth in education over the past three decades yet it should be noted that several researches have shown evidence of frustration and failures among teachers in incorporating PBL strategies in secondary geography classrooms. Spronken-Smith et al. (2008) highlighted time constrain as a factor responsible for these struggles as teachers go through the activities with little attention given on students' needs. Students unfamiliar with such an open approach may need more time to familiarise with the technique, especially in cases where they were previously educated in a teacher-centred approach (Chappell, 2006; Pawson et al., 2006; Spronken-Smith, 2005).

As mentioned earlier, MacKinnon and Scarff-Seatter (1997) stresses on how the problem lies in teachers struggling to transform a learning theory into a theory of teaching. The focus illustrates the important function of teachers in their capacity to comprehend the needs and demands of the PBL for students' learning and

understanding. The teacher's ability to judge and balance the level of intervention to be carried out during the inquiry process plays an important factor that will greatly influence the outcome of the students' learning processes (Spronken-Smith, 2005). Thus, teachers need to appreciate the underlying principles of PBL and apply the approach accordingly in relation to the needs of a particular situation.

The role of institutional organisations and their influence on the teaching practice in a particular locality can also be an issue on PBL implementation. Eun, Knotek and Heining-Boynton (2008) highlighted how all participants need to share a common agenda as they reported cases where wider institutional factors such as national assessment practices and curriculum design caused difficulty in teachers implementing theoretical approaches into practice. However, through a healthy working relationship between teachers and students, it is possible that participants involved in the teaching and learning process can come to an understanding on the shared goals of any particular practice through constructive dialogue (Eun, 2010).

3. The Study

The purpose of this study is to explore the benefits of implementing a PBL approach, assessing its effectiveness in promoting a healthy learning environment for the students in geography lessons. The focus of this research was on the development of students' geographical content knowledge from two upper secondary geography classes of 30 students. Through classroom discussions and problem-based case study activities, students would express their queries, uncertainties, ideas and opinions on a particular content matter. These classroom engagements can help in determining the effectiveness of PBL in promoting students to get intimately involved in the learning process during lessons. Additionally, the focus of this research will also involve examining the students' perceptions of PBL to acquire information regarding students' motivation and interest levels as these indicators need to be factored in for the discussion on the benefits of PBL in geography lessons.

In order to investigate the potential benefits of implementing PBL in the context of upper secondary geography classrooms, this study will revolve in answering the research questions: What are the benefits of using a PBL approach in teaching geography lessons? And what are the students' perceptions of PBL approach in geography lessons?

4. Methodology

This research study adopted the action-research format. The focus is in determining the benefits of PBL approach on students' learning developments in geography lessons. The research was carried out in two cycles. The first cycle was conducted during the instigation phase of the research. A short pre-test exercise (refer to Appendix A) was carried out at the beginning of the cycle before the PBL case-study activities were implemented in lessons to examine students' understanding of the topic. Majority of the students' pre-tests samples collected demonstrated a lack of understanding on the geographical concept of plate tectonics with evidence indicating their struggle in comprehending the significant impacts of volcanoes on societies.

The PBL case study activities were introduced in the lessons where students individually investigated a past plate-related disaster events of their choosing. The instigation lessons brought about group discussions where students recalled ideas and knowledge learned in previous lessons while sharing new information obtained from the individual student's particular case study. As the young learners were unaccustomed to the mechanics of such open-ended case-study exercise, it was essential that the students be given time to familiarise themselves with the problem-solving and decision-making process as stated earlier by Spronken-Smith et al. (2008). The activities carried out in this stage were through close teacher supervision and framing the learning objectives systematically in a series of questions, as guidelines for the students in their investigation, assisting them in structuring and organising their inquiry process.

After a month of the instigation phase, the post-test exercise (refer to Appendix B) was carried out at the end of the first cycle. A group presentation, the underlying rationales of this exercise were to encourage students to do independent inquiries and improve on their investigation and analytical skills through a case study format (Pawson et al., 2006; Yeung, 2010). Each group consisted of 4 or 5 members chose a past earthquake event and worked together in identifying the main queries they need to investigate on, considering the facts, opinions and ideas from a range of resources available online. After the two-week inquiry period, the students structured the relevant information from their respective case study and synthesize their work in an oral power-point presentation. The presentation outcome was assessed based on a number of criteria such as content knowledge of plate tectonic theories, presentation capabilities and application of knowledge synthesis (Chappell, 2006; Yeung, 2010).

After reflecting on the outcome of the first cycle, the second cycle mainly focused on the development of

students' content knowledge. The outcome of the second cycle was a post-test exercise testing individual student's knowledge of concepts and topics covered during the duration of the research. The case study activities implemented in lessons were designed based on Vygotsky's (1978) constructivism, and Biggs and Moore (1993) 3P model adapted from Haverila (2011) to improve students' learning process. The case study activities of real-world events carried out during the classroom discussions and group presentation provided a great opportunity for the development of collaborative learning through effective instructions, where social interaction among group members in discussions and oral presentations brought about the development of individual learner's cognitive thinking and psychological capacity (Eun, 2010). The students work samples from individual test exercises were used as data to examine the impact of PBL in the students' learning development.

4.1 Participants

The study was conducted at one of the government secondary schools in Brunei involving two Year 9 classes of 30 students. The student participants, aged between 14 to 16 years old, were mixed in ability, skills and motivation. The two classes were taught the theme 'Plate Tectonics' during the duration of the research, with the topic 'volcanoes' being covered during the first cycle lasting about 5 weeks, and the topic 'earthquakes' for the second cycle lasting approximately 3 weeks.

4.2 Data Collection

The qualitative nature of the data collection focuses on gathering detailed information from the perspectives of the students, giving an honest account of their learning experience in relation to the PBL case-study approach. The three qualitative instruments employed to collect the relevant data are discussed and given below.

4.2.1 Students' Work Samples

The individual work samples obtained from test exercises were mainly collected to examine the effectiveness of PBL approach in enhancing students' understanding of the subject. To answer the first research question, the students' work samples were analysed to verify the benefits of PBL on students' cognitive thinking, problem-solving skills, and their progress in understanding the content knowledge taught in lessons and applying their knowledge accordingly. The pre-test and post-test samples will be compared to evaluate their progress over the course of the research and deduce the benefits of PBL as experienced by the students.

4.2.2 Participant Observation

Participant observations were carried out during the one-month instigation phase of the research with the aim of gaining an insight on the participants' attitudes and behaviours on PBL practices. Atkinson and Hammersley (1995) described participant observation as an observation process where the researcher plays an active participant role in the setting studied, interacting and exchanging perspectives between other participants. This principle of interaction can be applied here for this action research with the relationship between the teacher and students. Lesson evaluations were carried out at the end of each lesson where students' attitudes and engagements were observed during the PBL activities in the classes. As the instigation phase was used to familiarise the teacher and the students on the learning demands of PBL, any complexity or problem encountered were studied sensibly to improve interaction patterns between students, as well as student-teacher interactions, which allows for a more effective implementation on the following PBL activities. The evaluations from the lessons were also used to triangulate data collected from the focus groups as means to inspect consistency patterns across the datasets to ensure reliability (Mathison, 1988).

4.2.3 Focus Groups

Two groups from each class were chosen to participate in the focus group exercise. Both focus group interviews were recorded using a mobile phone voice recorder and each session lasted no more than an hour. The focus groups were carried out to provide a supportive environment for students to share and exchange their opinions in the group tasks, encouraging them to reflect on their personal and group inquiry experiences (Spronken et al., 2008), and developing constructive feedbacks on how best to improve and progress forward in relation to PBL approaches in geography classrooms. The transcripts from both interviews were then analysed and coded into emerging themes.

5. Results and Discussions

5.1 The Benefits of Using PBL Approach in Teaching Geography Lessons

Addressing the first research question on the benefits of PBL approach, the data were obtained from the students' work samples, focus group discussions and lesson observations. The work samples, together with the excerpts from the focus group discussion as well as the lesson observations were analysed in detail to create a pool of

meaning (Marton, 1986). Once established, corresponding pools with similar premises and meanings were extracted to form a theme. The bulk of the information relating to the benefits of PBL approach on the students' learning process in lessons are summarised into two main themes: Development of students' content knowledge of geographical concepts and the development of students' engagement skills.

5.1.1 Development of Students' Content Knowledge of Geographical Concepts

Based on the data obtained from the three instruments, the research shows that one of the beneficial outcomes of incorporating PBL approach in geography lessons was in the development of students' content knowledge of the subject. This serves an important role in students' progress as any subject taught in a school curriculum aims to facilitate students' understanding of the content knowledge, which includes knowledge of concepts, models, theories and mastering a particular skill set in a subject area (Shulman, 1986). For both Year 9 geography classes, the theme being taught during the research period was 'Plate Tectonics,' covering areas on 'plate tectonic theory', volcanoes and earthquakes. The theme aims to enable students to comprehend the processes of plate movement and the impacts they have in shaping the earth's landscapes.

A large majority of the students found this topic challenging. The problem lies in the difficulty in providing first hand experiences of plate movement, and as such, students struggle to comprehend the fundamental theory of plate tectonics, the subsequent process mechanisms and consequences of volcanoes and earthquakes. Obtained from the pre-test exercise, Figure 1 highlights some of the difficulties faced by students in describing a landscape formation.

Question 1b: Explain how Fold Mountains are formed? [2marks]

LY1: Due to pressure building up in the mantle by convection current.

H3: When two plates meet the rocks on the continental plate crumples, folds and squeezed, pushing the land to form fold mountains.

Figure 1. A pre-test question focusing on the process of a landscape formation with responses made by two students

Despite involving the basic concept of plate movements, the students struggled to recall their prior knowledge and to apply them accordingly to answer this particular question accurately. Their responses showed that the use of accurate terms (convergent plate movement) was lacking which illustrates the students' poor grasp of the content knowledge. Without a thorough understanding of the mechanics of plate movements, students struggled in the later topics, which required them to explain how and why earthquakes and volcanoes occur. Figure 2 and Figure 3 illustrates these problems.

Question 1c: Explain the distribution of the Fold Mountains. [2 marks]

LY4: South American plate collides with Nazca plate forming Rocky Mountain.

Figure 2. Work sample of student LY4 in answering a pre-test question 1c

Question 2b: Why may some volcanic eruptions cause many people to leave the surrounding area? [3 marks]

LY1: Volcanic eruptions, especially by basic volcanoes are very loud, even though there is no lava flowing out. This annoys people surrounding the volcano. Volcano eruptions are also very dangerous. People who live near volcano are endangering themselves.

Figure 3. Work sample of student LY1 answer question 2b from the pre-test exercise

In both samples, students LY1 and LY4 demonstrated their difficulties in answering the questions accurately as their responses were incorrect. In Figure 3, it can be seen that despite putting in a good effort in answering the question, student LY1's response was vague and lacked clarity on the reasons why volcanic eruptions were dangerous for people living nearby. These work samples from the pre-test exercise highlighted the students' poor grasp of the content knowledge which hinders them from getting the right answers.

PBL practices were slowly introduced during lessons during the instigation phase carried out during the first

cycle of the action research to nurture and promote students' learning process in understanding key concepts and processes on the topic. Case-study activities were incorporated as means to scaffold their knowledge development and thinking capacity as supported by Biggs and Moore (1993) 3P model of learning.

By framing learning issues in a series of simple questions, the case-study activities assisted students in bridging new knowledge with their prior knowledge by forming cognitive links. From their independent research at home, students then shared their findings in class discussions and analyse the different information collectively. Participant observations of the class discussions revealed an interactive learning environment with students working keenly together, sharing their ideas more openly.

The role of the teacher was in facilitating the class discussions and ensuring that the environment for discussion promotes the building of knowledge through an active form of collaborative learning (Pawson et al., 2006; Savery, 2006). Furthermore, when the students are active during the learning process, they will then learn and discover concepts, theories and facts by themselves (Jaidin, 2009; Jawawi, 2009, 2010; Shahrill, 2009). Active involvement from the students also requires a teacher to design lessons that will make the students ask questions within the lessons (Mohd-Roslan, 2010, 2014; Jawawi, 2009; Salam & Shahrill, 2014; Shahrill, 2009; Shahrill & Clarke, 2014), and to collaborate towards achieving the agreed and desirable decisions from all involved (Damit et al., 2015; Lim et al., 2015; Sulaiman & Shahrill, 2014, 2015). Subsequently, with collaborative learning, it enables interactions among the students, as well as in constructing knowledge and in developing the critical, analytical and higher order thinking skills (Botty et al., 2015; Botty & Shahrill, 2014, 2015a, 2015b; Rashid & Jaidin, 2014; Shahrill & Clarke, 2014; Othman et al., 2015).

Question 2b: Explain the processes involved in the formation of fold mountains and volcanoes. [3 marks]

H3: When two plates are moving towards each other, it is called convergent plate movement. When oceanic plate and continental plate move toward each other, one of them will sink. The oceanic which is denser will sink under the continental plate into the mantle. The oceanic plate will melt in the mantle due to extreme heat, here is called the subduction zone were the plate is turned into magma. The continental plate on the other hand might end up folding, creating fold mountains. The magma in the mantle from the subduction zone is at high pressure causing magma to force up through the cracks of the plate and out through the earth's surface. When magma rises up and exposed to the earth's surface, it is called lava. The lava will solidify and with the continual emission and solidification of lava, it will soon form a cone-shaped mountain called volcanoes.

Figure 4. Post-test work samples showing student H3's response to question 1b

The improved learning environment observed after the PBL case-study approach was incorporated produce a positive effect on students' understanding of content knowledge. Figure 4 shows a detailed answer to a question in the post-test. Student H3 demonstrated his understanding on the formation processes of volcanoes and Fold Mountains methodically with great details using appropriate geographical terms and concepts. This is in contrast to the pre-test results, which displayed poor structuring of cognitive process by the students resulting in weak responses to the questions.

Question 2c: Why do people live near volcanoes despite the dangers of eruptions? Give one example of a location where people benefits from volcanoes. [4 marks]

H3: In some volcanic areas, people tend to live or stay close to the area. This is because around the base of the volcanoes and the land near it, the soil is fertile. Its fertility is very high because whenever a volcano erupts, it also spews out minerals for gardening such as phosphorous and potassium. Plants grown here are tend to be fresher and can be grown more than once in a year. For example, in Indonesia, one of the active volcanoes, there is a rice plantation and the farmers are able to harvest the crops three times a year. This increases their income and profit.

LY4: When volcanoes erupt, they tend to give out rich minerals for healthy soil. Crops can be grown quite healthily due to the rich fertile soil around the volcano. Volcanoes also give out precious gems and stones when lava cools and solidifies. For example, people in Japan living near volcanoes may sell these gems to tourists as souvenirs and earn money.

Figure 5. Post-test work samples showing students' response to question 1c

The acquisition of the fundamental geographical theory of plate tectonics has enabled students to understand the subsequent topics on volcanoes and earthquakes more effectively. As seen in Figure 5, students H3 and LY4 have shown progress in their learning performance, as they were able to recognise the question requirements and apply their knowledge accurately to answer the question. In comparison to the performance in the pre-test, the students were able to re-establish the knowledge learned previously, relate its relevance to the question and provide a detailed explanation satisfactorily.

The case-study activities helped students appreciate the study of real places, appreciating the contextual similarities and a difference between different places, which as suggested by Kaufman (1998), facilitated learning stimulation. This developed their knowledge base by painting a broader picture of the learning objectives. The following excerpts from the focus group discussions highlighted these points on case studies.

LY1: *"Case studies are more effective and it helps in exams. With notes from teachers, sometimes the notes are incomplete, and if we actually research, there is more info and we can actually find pictures and animations to help us understand about earthquakes and volcanoes*."

LY3: "*I could relate the problems in the real world to the subject we're learning in classrooms. I can now understand why Japan had less trouble dealing with earthquake as compared to Haiti from my own research and my friend's research in the group work."*

From the discussions above, it can be established that adopting the PBL approach in lessons do help develop students' content knowledge of geographical concepts effectively. The students' work samples showed evidence of improved performance in their understanding of the topic on plate tectonics, displaying not only knowledge comprehension but also high order thinking skills in analysing and applying relevant information appropriately.

5.1.2 Development of Students' Engagement Skills

With regards to students' engagement in PBL activities in lessons, the findings revealed positive signs of progress in student interactions during discussions and group works. The student engagement analyses included the three main elements of engagement as suggested by Harris (2008), which are 1) Behavioural; 2) Psychological and 3) Cognitive. As discussed earlier, the design of the case-study activities encouraged students to independently investigate on past volcanic or earthquake events of their choice.

By allowing students the freedom to choose and pick their own case study, it enabled a sense of involvement for the students, shifting their role from passive audience to active participants in the process of constructive learning (Healey 2005; Kaufman, 1998). The excerpts below emphasised this point.

H1: *"By doing research on specific problems of our choice, we feel appreciated because we can explore more on our particular interest in the topic."*

H2: *"As a geography student, natural disaster is an interesting topic for me. To be able to research more for our class discussion, I feel more motivated to go and find out more on the topic online."*

The students' comments and responses do support Kaufman's (1998) argument of student participation. However, what Kaufman described focuses on the physical visual actions of the participating students, yet from the excerpts by students H1 and H2, as well as the lesson observation, the students' contribution goes beyond the behavioural aspect of engagement. The students were not participating in classroom engagements just to please the teacher, but because they naturally value the learning activity.

This form of engagement falls under the two elements of psychological and cognitive, which includes the intrinsic values of engagement such as enjoyment, motivation, thinking processes, purposeful learning and valuing learning (Harris, 2008). For this particular example, it was the student's fixation on the natural disaster phenomenon and its devastating effects on communities. As a consequence of such perspectives and thought process, the engagement in learning from the students with this mind-set was evident with increased interactions and exchanging of ideas and findings in a lively driven discussions with their classmates. This enhanced their perceptions of the learning environment (Biggs & Moore, 1993).

The group presentations at the end of the first cycle of the research provided a great opportunity for students to work collaboratively in groups on a chosen case study. This challenged the students to work together collectively in organising the strategy of collecting information, analysing the data obtained and delivering their presentations after the two-week inquiry phase. Based on the participant observations, students were actively engaged on the task collectively, contributing in discussions and raising queries when in need of assistance. The group leaders did particularly a great job in taking responsibility for their efforts in organising members' role, and ensuring the group carried out the task accordingly. Assigned by the teacher at the start of the assignment,

the role of being a group leader received mixed responses as explained by LY3 and LY5.

LY3: *"It is not too difficult. It gives me great experience working with my teammates. But to be tagged as a captain, I felt more responsible. But I do believe with more experience, I can do a better job in leading a group. Everything can be improved but it takes hard work and dedication."*

LY5: *"It is challenging. You have to take great responsibility within the group, taking the most effort to manage the group member's task, collecting information and making sure our presentation was completed in time."*

Despite the positive outcomes of the group works, student LY5's comment highlighted a problem in the group work assignment. While some groups and its members were actively participating and contributing in completing the task, there were members in other groups who were less involved in carrying out the assignment. This resulted in uneven contribution of the group work during discussions and during the gathering of information stage, which consequently affected the delivery of the final presentations for their groups.

With an extensive group task that spanned for two weeks, several participating members needed more support and motivation to work competently. Unfortunately, this problem was not foreseen until the presentations were delivered. This stressed the important role of facilitator in meeting individual student's needs in the inquiry process to ensure a productive form of collaborative learning environment can be established (Bonk & Cunningham; 1998; Botty et al., 2015; Botty & Shahrill, 2014, 2015a, 2015b; Kaufman & Holmes, 1996; Matzin et al., 2015; Pawson et al., 2006; Rashid & Jaidin, 2014; Savery, 2006; Shahrill & Clarke, 2014; Sulaiman & Shahrill, 2014, 2015).

5.2 Students' Perceptions of PBL Approach in Geography Lessons

In answering the second research question, the data from the three instruments were used for the analysis. The results revealed mixed perceptions from the students with regards to the PBL approach in lessons. These perceptions are categorised into the two following themes: Stimulates students' motivation and interest, and the struggles and difficulties faced by the students.

The effects of students' perception of the learning environment on quality learning were evaluated based on the Biggs and Moore's (1993) 3P model of learning. The students' motivation and interest in the learning process were briefly discussed in the analysis on student engagement skills presented earlier.

The PBL approach did promote the students' level of motivation and interest through the class discussions, case-study activities and group presentations. By providing real world problems and cases, students' attention was captured, which helped brought about engaging classroom interactions. By making the lessons interesting and relevant to the learners, the PBL activities were designed in meeting with the needs of the students without compromising on the values of the task. Thus, promoted an effective environment to meet and support the students' learning needs. The following excerpts illustrate students' perception on the PBL-led class discussions:

LY2: *"We gain more information, and also a good personality with each other. Working together, we try to cooperate with the best attitude. "*

LY3: *"It was a fun activity. I can share my findings with our classmates, which helps to boost our confidence."*

Being motivated in lessons, the students benefit from their close interactions with their peers and learn to recognise and appreciate different ideas and information. This helped improve their grasp of the subject matter, which can be seen in their improved performance in the post-test exercise as shown in the work samples. Similarly, the group presentation task was also warmly received by some of the students who enjoyed working together. Once the task was completed, it provided a sense of satisfaction and achievement for the students, which Newman (1996) attributed to the value of recognition for the students' work personally, aesthetically or socially. Student H3 summarised this point nicely, quoting:

H3: *"At first we thought it would be better and easier to do this activity alone. With individual work, there is less complication to achieving a good result. But in the end we saw the product, what we did and contributed together, this is great!"*

The students' positive perception of PBL in increasing their motivation and interest in their learning of the subject as discussed here do provide a strong argument in favour of PBL approach. It helped expands the case on the benefits of PBL further with its role in actively enhancing students' perception of their learning environment. However, there were some negative perceptions as well on certain aspects of PBL incorporated in the lessons.

On the other hand, the group presentation task was not well received by some of the students who felt that the

division of labour in the data-collecting process hindered their understanding. While some students do work well together, there were some groups consisting of members who did not cooperate fully, which caused disruptions on the group's progress. This negatively impacted the learning process experienced by the other members.

With regards to the group presentation, it should also be noted that not all student groups were able to blend the bulk of information successfully. Student LY1 highlighted the struggle faced by his group.

LY1: *"We divided the topic to several smaller subtopics, and we asked our teammates to research for information before summarising it up together into the presentation. But, I think that we made our presentations too long. There was too much slides and jumbled information. Summarising our research was a challenge."*

While LY1's group was very informative, the presentation took too long, and this resulted in majority of their peers losing interest towards the end. The group tried to include too much information without taking into account the allocated 15 minutes time period for their presentation. The group's struggle again underlines the significant role of teachers as facilitators during the student group discussions, and while advices were provided guiding them in their thinking process, it may not have been done in the best possible manner for certain groups such as LY1's.

Despite the guidelines outlined at the start of the task, it is vitally important for teachers to regularly remind students on the context of the exercise and its content matter to ensure students select and handle appropriate materials. Lee (2008) stressed on the importance of moulding students' critical thinking skills when dealing with technology tools such as the Internet to ensure a careful and analytical approach is adopted by students to make critical decisions when focussing or selecting resources. Consequently, another negative perception experienced by the students in this study revolves around the use of technology. The limited Internet connectivity in schools and individual student's home caused unwanted disruptions in the learning process. Students H1 and H3 clarified this point, stating:

H1: *"We did have time to discuss but some of us does not have Internet at home so it was kind of hard for us to do it better. Library is not always available so we have to rush to get information when it is available."*

H3: *"Internet is not always available at home for me as well. I have a lot of those info books on natural disasters so I use them instead. It does provide useful information but with the Internet, we can get more information quickly. It is more limited and time-consuming with books as we have to search it manually."*

The last challenge falls in the teacher's capacity to carry out the role as a facilitator, as this greatly influenced the learning outcome of the students. Consequently, as evident during the course of this study, the students' perception could have been improved through a more systematic and effective lesson management. The incorporation of technology in classrooms needed to be mediated according to the students' needs.

The overall findings do suggest an encouraging prospect of incorporating PBL approach in secondary geography lessons. The benefits on the development of students' content knowledge, the cognitive process, personal engagement skills, and increased perception of the learning environment are encouragingly consistent as examined from the dataset across the three instruments. Several factors did highlight some obstacles that negatively impacted on the students' learning outcome during the lessons, which consequently affected their perceptions of the PBL approach. These drawbacks, however, could potentially be resolved through progressive cycles. However, it was beyond the scope of this current action research study.

6. Conclusions

The purpose of this action research was to determine the applicability of incorporating PBL approach in the teaching and learning of geography. The findings reported in this study do illustrate a positive impact on the students' development in their understanding of geographical content knowledge. Through the discussion-led case-study activities, the results showed an improved performance in the post-test exercises as students displayed high order thinking skills in applying the knowledge learned in lessons to answer questions satisfactorily. Their performance revealed good comprehension of the contents with detailed analyses and application of information. Additionally, student engagements during the case-study activities were encouraging with signs of progress in behavioural, psychological and cognitive engagements observed in their learning process. The students were motivated in carrying out independent inquiries and the interactive nature of class discussions can be attributed to their appreciation of the learning activity. Their increased perception in the learning environment during lessons further reinforces their understanding of the subject.

The PBL approach received good response from the students as well. The case-study activities captured the students' interest and they were motivated to carry out independent research individually and collaboratively in groups. The active learning activities provided a platform for students to work cohesively together in sharing and exchanging ideas and information, fostering their learning experience. However, some students did highlight some struggles in the group activities, particularly the group presentation task. Poor time-management, uncooperative group members, and difficulty in assimilating the bulk of information were some of the problems faced by the students, which addresses the critical role of teachers in facilitating the learning experience.

The purpose of identifying the benefits of the approach and gathering students' perceptions and experience of PBL was met adequately. Taken together, the benefits of PBL approach in geography lessons do show an encouraging framework for interactive learning experience for students. Through better preparation in lesson planning and planning execution from the participating teacher and students, PBL approaches can produce an effective learning experience for both teachers and students in the teaching and learning of geography lessons.

7. Recommendations

Due to the time constraint in carrying out this research, the data collected was not extensive. The limited coverage and scope of this study restricted the results to the specific contextual settings of this study. Future research should include a broader scale of focus to allow for a more consistent and reliable data collection. The time factor needs to be taken into account to ensure teachers and students are given enough time to adapt and accommodate the PBL approach in lessons effectively to avoid problems as observed in this study.

Future research should actively examine experiences from teachers in PBL applications, discussing the unique circumstances in place to pinpoint the conditions necessary for successful implementation of PBL within various subject contexts. This would allow future comparative research to be undertaken which may help in appreciating the potential value of PBL for education across the different disciplines. It would also be worthwhile to examine circumstances in which PBL is not successful from the perspective of students, teachers and curriculum planners and administrators. These aspects of PBL deserve more exposure among education academics as we seek to promote and develop an efficient framework within our education systems.

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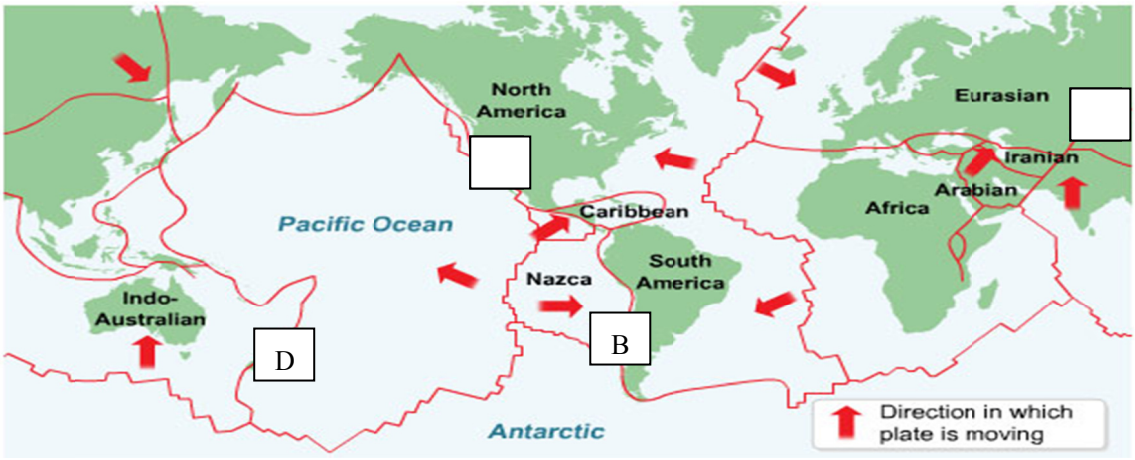
Appendix A

The Pre-Test Exercise

1a: The following figure shows the world distribution of Fold Mountains.



Fill in the names of the Fold Mountains that are labelled A – D in the blanks provided below. [4 marks]

A: _____ C: _____

B: _____ D: _____

1b: Explain how Fold Mountains are formed? [2marks]

_____

_____

1c: Explain the distribution of the Fold Mountains. [2 marks]

_____

_____

2a: How do you define a volcano? [1 mark]

_____

2b: Why may some volcanic eruptions cause many people to leave the surrounding area? [3 marks]

_____

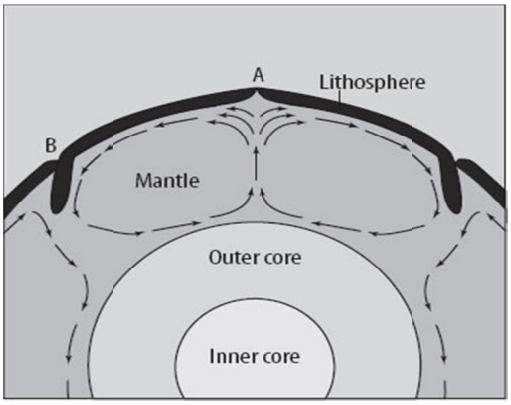
_____

_____

Appendix B

The Post-Test Exercise

1a: The diagram below shows the convection current in the mantle and its effects on plate movements. Name a feature, which can be found at locations A and B. [2 marks]



A: _____

B: _____

1b: Describe the plate boundaries found at A and B. [2 marks]

_____

_____

2a: What is folding? [1 mark]

_____

2b: Explain the processes involved in the formation of Fold Mountains and volcanoes. [3 marks]

_____

_____

_____

2c: Why do people live near volcanoes despite the dangers of eruptions? Give one example of a location where people benefits from volcanoes. [4 marks]

_____

_____

_____

_____