



**Faculty of Cognitive Sciences and Human  
Development**

**THE EFFECTS OF PROBLEM BASED LEARNING APPROACH IN  
LEARNING GEOMETRY AMONG SECONDARY SCHOOL  
STUDENTS**

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Final Year Project Report

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**THE EFFECTS OF PROBLEM BASED LEARNING APPROACH IN  
LEARNING GEOMETRY AMONG SECONDARY SCHOOL  
STUDENTS**

**MCKENZIE ANAK LIM LENG**

A dissertation submitted  
in partial fulfilment of the requirements for the degree of  
Master of Science (Learning Sciences)

Faculty of Cognitive Sciences and Human Development  
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2019

The dissertation entitled **The Effects of Problem Based Learning Approach In Learning Geometry Among Secondary School Students** was prepared by Mckenzie Anak Lim Leng and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfilment of the requirements for the degree of Master of Science (Learning Sciences).

It is hereby confirmed that the student has done all the necessary amendments for examination and acceptance.

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(DR.KARTINI BINTI ABDUL GHANI)

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## **LIST OF ABBREVIATIONS**

PBL	Problem Based Learning
PAK21	Pendidikan Abad Ke-21 (21st Century Learning)
SPSS	Inferential Statistical Software Packages for Social Science
TIMSS	Trends in International Mathematics and Science Study
HOTS	Higher Order Thinking Skills

## ABSTRACT

Problem-Based Learning (PBL) is a teaching approach in which real situations are used as the mean to stimulate the development of critical thinking skills, communication skills and problem solving abilities among students. In Malaysia, the 21<sup>st</sup> century learning (PAK21) that was formulated in the second wave of Malaysia Education Blueprint 2013 to 2025 requires that all teachers should embrace the teaching and learning approach to ensure the students are equipped with the correct skills and values for the future. This study aims to investigate the differences between problem-based learning approaches and traditional learning method in learning geometry among secondary school students in Padawan. Besides that, the perception of acceptance on the approach towards students' performance was also measured. The use of quantitative research method is to make sure that the outcome of the research can be clearly shown through objective data. The study involved sixty (60) Form Four student of Sekolah Menengah Kebangsaan Padawan. The data was obtained using the survey questionnaire that explored students' acceptance on the approach that was used during the intervention lesson. Pre and post test was conducted to measure the students' performance. The data obtained were analysed using inferential statistical software packages for Social Science Version 21.0 (SPSS). The findings from this research revealed that there was an increased in the students' achievement in learning geometry using PBL approach. This investigation has shed some insights regarding the implementation of PBL in school and other setting. Apart from that, it also enlightened the aspects that can be further improved or as a value-added to enhance learners' outcomes.

**Keywords:** Problem-based learning, 21<sup>st</sup> century learning, geometry

## **ABSTRAK**

### ***KESAN PENGGUNAAN KEADAH PEMBELAJARAN BERASASKAN MASALAH (PBM) DALAM PENGAJARAN DAN PEMBELAJARAN GEOMETRI DI KALANGAN PELAJAR SEKOLAH SEKOLA MENENGAH***

*Pembelajaran Berasaskan Masalah (PBM) adalah pendekatan mengajar di mana situasi sebenar digunakan sebagai cara untuk merangsang perkembangan kemahiran berfikir kritis, kemahiran komunikasi dan kebolehpemampuan menyelesaikan masalah di kalangan pelajar. Di Malaysia, pembelajaran abad ke-21 (PAK21) yang dirumuskan dalam gelombang kedua Rangka Tindakan Pendidikan Malaysia 2013-2025, dimana ia memerlukan semua guru harus menggunakan pendekatan pengajaran dan pembelajaran yang mana akan memastikan para pelajar dilengkapi dengan kemahiran dan nilai yang diperlukan untuk kegunaan masa depan . Kajian ini bertujuan untuk mengkaji perbezaan antara pendekatan pembelajaran berasaskan masalah dan kaedah pembelajaran tradisional dalam pembelajaran geometri di kalangan pelajar sekolah menengah di Padawan. Di samping itu, persepsi penerimaan pendekatan PBM ini terhadap prestasi pelajar juga diukur. Penggunaan kaedah penyelidikan kuantitatif juga digunakan bertujuan untuk memastikan hasil penyelidikan dapat ditunjukkan dengan jelas melalui objektif kajian yang telah ditetapkan. Kajian ini melibatkan enam puluh (60) pelajar Tingkatan Empat Sekolah Menengah Kebangsaan Padawan. Data diperolehi melalui penggunaan soal selidik kaji selidik yang meneroka penerimaan pelajar terhadap pendekatan yang digunakan semasa pelajaran intervensi, dan penggunaan ujian pra dan pasca untuk mengukur prestasi pelajar. Data yang diperolehi dianalisis menggunakan pakej perisian Statistik Inferens untuk Sains Sosial Versi 21.0 (SPSS). Hasil kajian menunjukkan terdapat peningkatan dalam pencapaian pelajar dalam pembelajaran geometri menggunakan pendekatan PBL. Siasatan ini telah memberikan beberapa pandangan mengenai pelaksanaan PBL di sekolah dan suasana lain. Selain itu, ia juga memberi pencerahan kepada aspek-aspek yang boleh diperbaiki atau sebagai nilai tambah untuk meningkatkan hasil belajar pelajar.*

*Kata kunci: pembelajaran berasaskan masalah, pembelajaran abad ke-21, geometri*

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.0 Introduction**

Globally, the learning of mathematics has always been perceived as a challenging task due to the complexity of acquiring the fundamentals arithmetic knowledge. Students tend to think that mathematical knowledge is not relevant to the real world as they may not need to know all those complicated equations and calculations. Closer to home, the situation is more or less, similar. It is rather alarming to note that Malaysia's ranking in Mathematics learning fall from 21<sup>st</sup> rank in the year 2007 to 32<sup>nd</sup> in 2011 reported in Trends in International Mathematics and Science Study (TIMSS). The poor performance in international assessments has led to many implications. One of such implications is the strong conviction that the education system in Malaysia depends predominantly on examinations and students were merely taught on how to answer specific questions. Many of the students passed through memorising mathematical steps instead of fully understand the concepts. Our students are not taught to answer similar type of TIMSS questions which focused more on Higher Order Thinking Skills (HOTS) of synthesis, analysis and evaluations. Wagner (2008), has identified seven survival skills need to be mastered by students for the 21st century based

on his research and he has put the main emphasis on critical thinking skill and problem solving skill.

With the continuous decline in TIMMS evaluation as well as more and more students are losing interests in the subject, mathematics teachers need to discover approaches that would encourage students to think beyond the “fixed syllabus” of public examinations. . As highlighted by Sansome (2016), although many students may develop procedural fluency, they often lack the deep conceptual thoughtful necessary to look into new problems or make associations between mathematical thoughts. This capacity displays a test for teacher. One suggested approach and worth to be explored in schools is problem-based learning (PBL). PBL offers opportunities for teachers to address these difficulties. PBL occurs as a teaching techniques grounded in the beliefs of constructivism and student-focused learning (Roh, 2003).

The problem based learning approach was first used in the learning of medical field, thus most of the studies about problem based learning have been conducted in medical faculties (Hmelo-Silver, 2004). In the field of education, most of the research on problem based learning focus on its effects. For example, both Ahmad Talib and Ismail Kailani (2014) have observed on the practice of Problem Based Learning in Cooperative Situation (PBLCS) and studied its effect on the expansion of students’ personal intelligence. On the other hand, the studies by Tosun and Senocak (2013) exposed the consequences of problem based learning on the metacognitive consciousness and attitudes toward the teacher candidates with different academic qualifications.

When utilizing PBL, educators help the students to focus on tackling issues within a real-life circumstance, urging them to mirror the circumstance in which the issue exists and after that attempt to discover answers for that issue. The majority of studies on PBL focus on

its practice in schools, stresses on the use of collaborative small-group work, student-centred approach, educators as facilitator and the use of real-life problems as the arranging consideration.

In the real scenario, for the PBL approach to work, teachers have to be compelled to withstand the role of a facilitator by encouraging students to figure through every problem (Ferreira & Trudel, 2012). This role needs flexibility. Once started employing a PBL model, research conclude that elementary teachers discover that it is tough to develop an appropriate hook during which a real-life problem that doesn't have one answer or pre-determined solution and, thus, allows students to develop a variability of answers. During this sense, the worth of the matter exists in in serving students to develop both an understanding of the mathematics and therefore the capability to use it.

### **1.1 Problem Statement**

One of the topics in mathematics that requires special attention is geometry as students tend to think the topics is merely about shapes. As discovered by Jones (2002), as well as the experience shared by other teachers, the students often regard geometry as “easy”, only to discover the complexity of understanding the concepts when given specific mathematical problems related to geometry. In a typical geometry lesson, the educators tend to clarify to students the properties related with geometrical shapes and therefore the properties, and consequently, demanding the students to undertake the given exercises to point whether or not they have understood the topic that they are learning or just reacting from memorising the facts ( Jones, 2002 ). Some attempts were made in boosting the students to clarify their rational and to create the links reasonably. Emerging the learners' thinking and geometrical minds is significant and the students want this by processing a compact thoughtful of the realities in geometry. This problem can be addressed by using a

teaching approach that specifically guide students to view the topic as an authentic real world problem as explained in PBL. This approach may support learners in making the mandatory connections exploiting the varied depictions of geometrical ideas and also the knowledge domain ideas in different space of mathematics ( Schettino, 2012 ). Generally, the effects of PBL that have been studied so far include higher order mathematical thinking ability (Achmad Mudrikah, 2016; Widyatiningyas, 2015), mathematics achievement and retention (Ajai & Imoko, 2015), metacognitive awareness and attitude towards Chemistry (Tosun & Senocak, 2013), and students attitude toward Science (Ferreira & Trudel, 2012). Due to the reported outcomes of PBL in helping learners to process learning content through a more holistic understanding, it is the aim of this study to investigate its effect on the learning of geometry among secondary school students. Also, limited studies concerned with the implementation of PBL at secondary school levels in Malaysia and its usefulness remains a debateable area to be investigated. Specifically, this study will be conducted in SMK Padawan, where students are largely of average levels.

## **1.2 Research Objectives, Research Questions and Research Hypothesis**

The aim of this study is to investigate the differences between problem based-learning approaches and traditional learning method in learning geometry among Form Four students in SMK Padawan. The following objectives were used to guide the investigation:

- I. To investigate whether there is any difference between traditional teaching approach and PBL teaching approach in students' performance in Geometry topic.
- II. To measure the acceptance of PBL on students' performance in Geometry topic.

The **research questions** for this study are as follows:

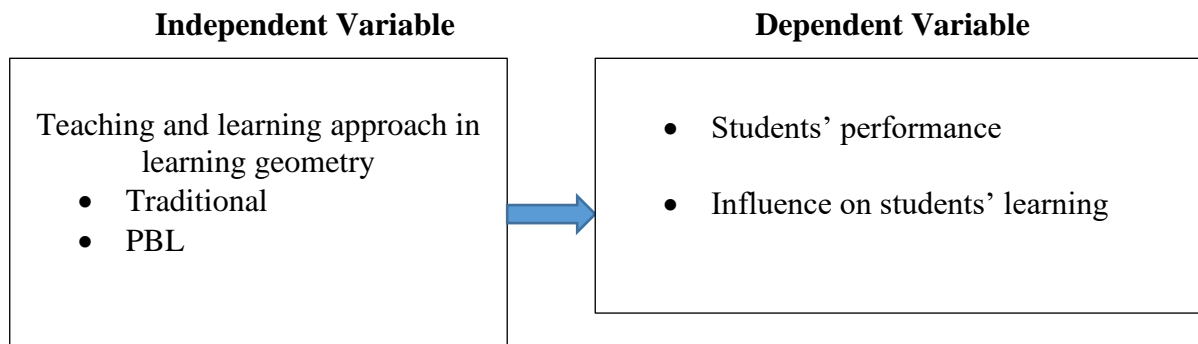
- i. What are the differences between traditional teaching approach and PBL teaching approach in determining students' result?



- ii. How does the use of PBL influence on students' performance in Geometry topic.

The **research hypotheses** of the investigation are as follows:

- i.  $H_{01}$  : There is no significant differences between traditional teaching approach and PBL teaching approach in students' performance in learning Geometry.



*Figure 1:* Correlation between independent variables and dependents variables

For the purpose of data collection, the students divided either into a comparative group and a control group. The comparative group refers to the group of students who have been taught by using problem based learning in learning geometry. Other than that, the control group refers to the group of students who were taught using traditional learning (using the conventional chalk and talk explanation by the teacher).

To investigate the performance of the students before and after the treatment (use of PBL), the study will use pre-test and post-test to investigate the differences between the two approaches in teaching and learning and its effect on students' performance/understanding the geometry lesson. The pre-test is used to access the participants' prior performance of the topic. The learning outcomes are measured by the post-test after teaching and learning process been conducted. The test items in both tests were identical and merely varied in the

order of displaying the questions and options. Table 1 shows the research design of my research.

Table 1

*Research design*

Control group	Pre-test	Traditional teaching approach	Post-test
Comparative group		Teaching and learning with the use of problem based learning approach	

## **CHAPTER TWO**

### **METHOD**

#### **2.0 Research Design**

Students from Sekolah Menengah Kebangsaan Padawan, Kuching participated in this research. A non-random convenient sampling was chosen because the groups were not randomly assigned but the groups that have already been formed in the school were used instead. The sampling method is chosen as it gives the researcher control on the type of students to be involved in the study so as to obtain meaningful data for analysis. The sample size of this study involved sixty (60) Form four (4) A and B students who took mathematics subject. The students were divided into two groups: a comparative group that use problem based learning and a control group that learn only with traditional teaching and learning approach. The consent form has been distributed to the participants to obtain their permission in becoming the sample of the study. The students were instructed to read and sign the form upon deciding on the terms and condition of the research. One consent form will be kept by the researcher whereas the other copy will be saved by the respondent.

## 2.1 Research instrument

The subtopic of Sphere was chosen as the intervention lessons as it was comprised in Form 2 topic of Geometry. PBL sessions will be held within two weeks after regular class time and students will meet twice a week. In total there are four sessions going on. The time allocated for each session is for one hour. The PBL model that was being integrated in the teaching and learning session was adopted from the model by Lee and Bea (2017). (see Figure 2)

### **Session 1: Overview, Perceive the Situation, and Examining of Information (on-going)**

- The students were given the situation and they were given time to understand and analyze the problem.
- Students are allowed to discuss in group and subsequently seeking for information individually or in group to enhance their understanding of the problem.
- Teachers as the facilitators will monitor the discussion process to ensure that students do not deviate from the learning objectives.

### **Session 2: Collecting and built solutions.**

- Students will gather all the important information from each group member, discuss in groups and preparing a draft and finally get the most accurate solution to the given problem.

### **Session 3: Group presentation and Feedback**

- Representatives from each group will present their findings within 7-10 minutes

while other students will take important notes from the presentation.

- Teachers will monitor and ensure students complete their assignments. Students are encouraged to ask related questions to reflect during the session.

*Figure 2: The design of PBL intervention.*

### **Intervention Problem**

During a study tour to a recreational park, John found a broken ceramic bowl and he believed the bowl was round. To form a replica of a complete bowl, John knew he had to look for a radius for the bursting of the broken bowl but he had a deadlock idea of how to solve the problem.

How did you and your group members help John to identify the steps in finding the radius for the broken bowl and the missing pieces?

Your assignment is to find the effective strategies on how to find the radius of the broken bowl.

As a reminder, the most correct answer (radius length) is not a must, but the answer must be logical and applicable to the presented situation. Finally, each group will present their findings along with justification to the answers given.

*Figure 3: The PBL Problem*

The interventions lessons involved two Form Four classes and the processes were implemented simultaneously and two mathematics teachers were assigned to facilitate the

whole process. During the intervention, the students in the comparative (PBL) group were divided into 4 groups for each class. Each group had to assign a leader, a presenter and writer to make sure the tasks are divided fairly among all group members. The groups were then given papers of a PBL model, a designed intervention problem and a blank A4 papers to record the findings of each group members. After that, the groups were instructed to solve the presented PBL problem based on real-life situation which is not been covered in the syllabus. The question were planned according with the important aspects of PBL which was ill structured, contextualized and related to real life situations (Hung, 2009).

During the intervention process, students were encouraged to actively participate in the group discussion and questioning session. Teachers supervised the PBL discussions among students. Apart from that, the students were recorded their findings from the discussion besides contributing ideas to be shared among group members. In addition, teachers act as facilitators to the problems discussed during the intervention session so that students do not deviate from the primary objective of PBL. The process of finding and collecting information within the group took about 25 minutes where students were allowed to refer to any source during the process of obtaining information including from textbooks and virtual search from the internet. Besides, students were also permitted to bring their assignments back home to continue the process of seeking for information. This was carried out as an on-going process. At the next meeting, the students were collaborated with colleagues in the group to collect and analyze the information they have acquired. The students then make a draft on the steps and strategies to solve the problem. During this phase every member in the group will evaluate and analyze the findings from each member of the group and subsequently decide to choose the best solution for that particular problem. Then the selected speakers from the group members present their answers within 10 minutes and at the same time the other students write their reflection about the presentation in a piece of

paper. A whole-class discussion was conducted after each presentation to allow interactions in giving constructive feedback following by a wrapping up session (Shahrill & Prahmana, 2017).

While the PBL group was doing their intervention lessons, the class for the control (traditional) group on geometry topic will adapted the methods and techniques that were commonly used by the teacher, which were teacher's description using textbooks and activity books. There was a one way communication between teachers and students during the lesson. For this intervention, the students will have limited opportunities to voice up their views and opinions due to time limitations because teachers need to complete the topics quickly according to the syllabus's requirement and there was no space for group discussion.

In this research, the instruments that will be used to study the relationship between the independent variable and dependent variable were the survey questionnaire, pre-test and post-test. This questionnaire was indicated through Likert Scale, ranging from strongly disagree, disagree, neutral, agree and strongly agree. The language used in this questionnaire is dual language and respondent answered the questions by circling the best scale that indicates their degree of agreement.

The learning outcomes were measured by a post-test after two weeks of treatment during classroom session. The test items consisted of questions that examine the students' prior knowledge on basic geometrical terms of a sphere and their procedural skills in searching the unknown angles and sides in a sphere. The marks allocated for the test was 20 marks in total and students were given forty (40) minutes to complete the answer.

## 2.2 Pilot study

The preliminary test of the instrument is to identify and eliminate problems and make corrective changes or amendments before actual collecting data from the targeted population. The purpose of the pilot study is to maximize the validity and reliability of the survey instrument. In this research, the data that has been collected from the pilot test were analyzed using Statistical Package for Social Science (SPSS). For this study, a pilot study was conducted which the participants were among different set of students at the same school and the result was analyzed using SPSS to do the validity test to examine the correlation between the instruments.

Response from the pilot test will be inform whether the respondents comprehend all the terms used in the survey questionnaire and test papers correctly, interprets the questions similarly and responding the questions properly.

## 2.3 Reliability and validity

The term reliability refers to ability of the **research instrument** to yield the same result on repeated trials (Key, 1997). Joppe (2000 as cited in Golafshani, 2003) explain of what reliability in quantitative research:

*“The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable.”*

In quantitative research, validity is concerned with the **truthfulness of the research findings** (Golafshani, 2003). Joppe (2000 as cited in Golafshani, 2003) defines validity as:



*“Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are. Researchers generally determine validity by asking a series of questions, and will often look for the answers in the research for others.”*

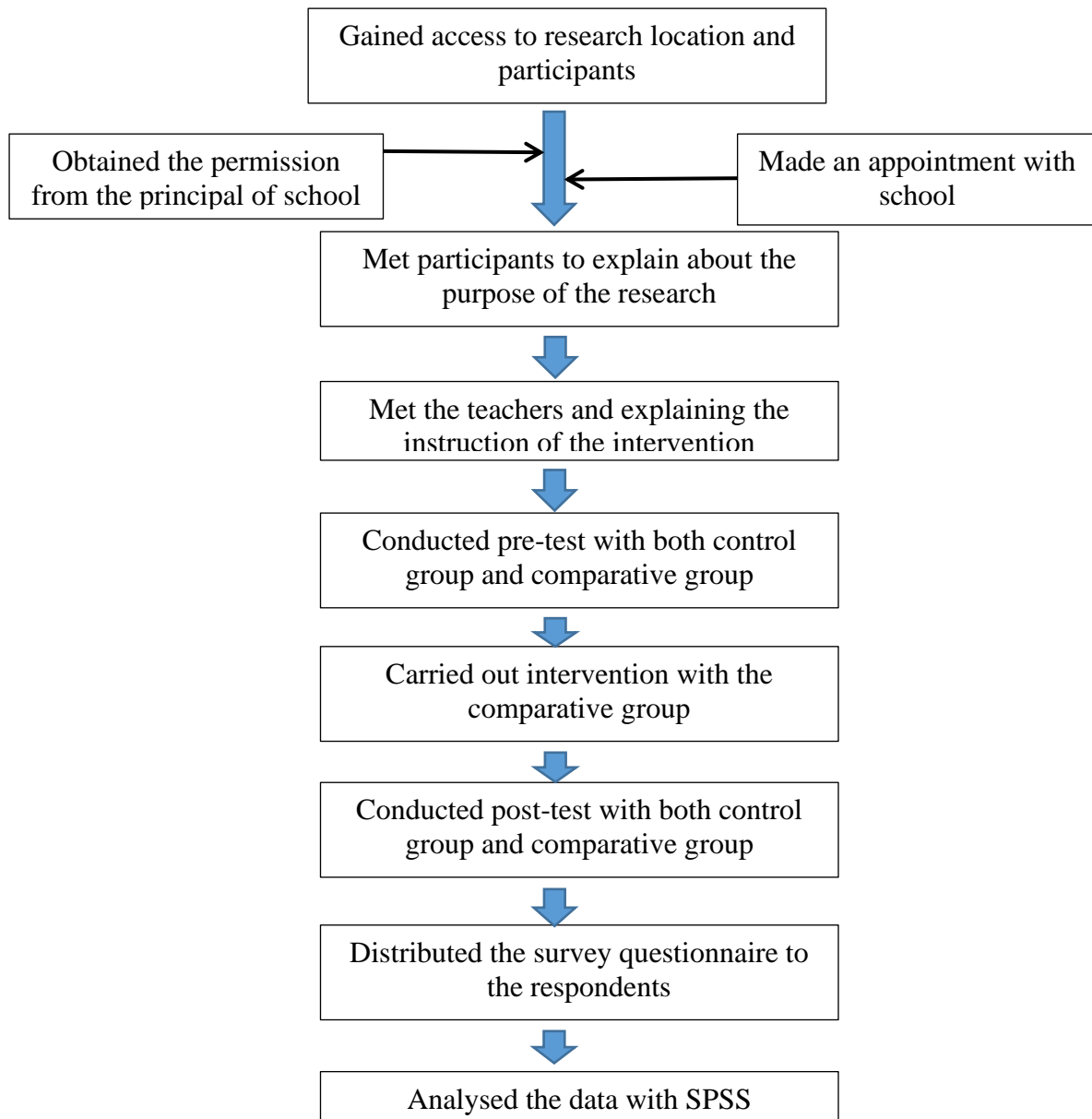
In order to validate the instruments, two well-experienced mathematics teachers with more than ten years of teaching experience in mathematic subjects were instructed to review the test questions and the interventions for the lessons. In the context of this study, the researcher referred to the expert in this field of study. Besides that, the researcher looked into the literature review and past finding to support the investigation. Other than that Cronbach’s Alpha was used to check the reliability of the study

#### **2.4 Data Collection Procedures**

The first step in collecting the data is to decide and gain admission to the research location and participants. Authorization from the principle of SMK Padawan, Kuching was obtained and an appointment was made with the school authority to conduct the research. Upon granted an access, a brief introduction of the study was presented and consent forms were distributed to each participant to get their permission in becoming the sample of the investigation.

The participant from the control group and the comparative group were required to take pre-test to access their prior knowledge. Intervention with the comparative group was carried out using problem based learning to teach the topic of geometry. The learning outcomes were measured by a post-test administered after two weeks of intervention. The questionnaires were distributed to the respondents to complete. The final stage in the data

collection procedure was to analyze the data collected with SPSS and each questionnaire and question papers was assigned with a number of coding purpose.



*Figure 4: Data collection procedure*

## 2.5 Data Analysis Procedures

Data that has been collected were analyzed by constructing a comparison table of the respondents' scores obtained before and after intervention lessons. Descriptive and inferential statistics analyses were used to analyze the data. The type of statistical analysis and test used based on specific objectives engaged in this research are obtainable in Table 2.

Table 2

*Type of statistical analysis and test used based on specific objectives*

Specific Objective	Statistical Analysis	Type of test
To investigate whether there is any difference between traditional teaching approach and PBL teaching approach in students' mathematical performance.	Inferential analysis	T-Test
To identify the relationship between acceptance of PBL approach in learning Geometry with the students' performance.	Inferential analysis	Pearson Correlation

## CHAPTER THREE

### RESULTS

#### 3.0 Main Findings

##### Normality test

For normality test, the data can be considered normal if bell-shaped distribution is formed (Neuburger & Stokes, 1991). For this study the normality test that has been used is a nonparametric test which is Kolmogorov Smirnov Test. For the data to be normal, the significant values have to be more than 0.05 ( $p > 0.05$ ), otherwise the data will be considered not normally distributed.

Table 3: Normality test for the score of comparative group's pre and post-test.

Tests of Normality			
Kolmogorov-Smirnov <sup>a</sup>			
Statisti			
	c	df	Sig.
result	.125	30	.200*

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

The above table shows the normality test for comparative group's pre and post test score. The significant values are 0.2 which is more than 0.05. This means that the difference in mark obtained for pre-test and post-test is normally distributed with Kolmogorov-Smirnov significant value is,  $p > 0.05$ .

Table 4: Normality test for the score of control group's pre and post-test.

Tests of Normality

Kolmogorov-Smirnov <sup>a</sup>			
Statisti			
	c	df	Sig.
result	.109	30	.200*

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

The above table shows the normality test for control group's pre and post test score. The significant values are 0.2 which is more than 0.05. This means that the difference in mark obtained for pre-test and post-test is normally distributed with Kolmogorov-Smirnov significant value is,  $p > 0.05$ .

**Objective 1: Analysis of the differences between traditional teaching approach and PBL teaching approach in students' performance in Geometry topic.**

Table 5: Analysis of PBL group's pre and post-test score.

	Mean	N	Std. Deviation
PreTest	10.67	30	3.273
PostTest	21.70	30	3.109

t	df	Sig. (2-tailed)
-18.635	29	.000

From the above analysis from the output, a significant difference exists between comparative group's pre and post test score. It can be concluded that there are differences between traditional teaching approach and PBL teaching approach in students' mathematical performance,  $t(29) = -18.635, p < 0.05$ . Apart from that, comparative group's degree of achievement can be seen by looking at the mean which is 10.67 for their pre-test score whereas for the post-test is 21.70.

Traditional Group

	Mean	N	Std. Deviation
PreTest	8.94	30	2.756
PostTest	13.29	30	2.452

t	df	Sig. (2-tailed)
-9.607	30	.000

As can be seen from the output, a significant difference occurs between control group's pre and post test score. It can be concluded that there are differences between traditional teaching approach and PBL teaching approach in students' mathematical performance,  $t(29) = -9.607, p < 0.05$ . Apart from that, control group's level of achievement can be measured by looking at the mean which is 8.94 for their pre-test score whereas for the post-test is 13.29.

Table 6: Analysis of control and comparative group's pre-test score.

1. Pre-test result between control and Comparative group

Table 6.1: Descriptive Statistics on Pre-Test between Control and

Comparative Groups		N	Mean	Std. Deviation
Pre-Test	Control Group	30	8.20	3.089
	Comparative Group	30	10.67	3.273

Table 6.2: Independent Samples Test on Pre-Test for Control and Comparative Groups

		Levene's Test for Equality of Variances			
		F	Sig.	t	df
Pre-Test	Equal variances assumed	.024	.877	-3.002	58
	Equal variances not assumed			-3.002	57.808

As significant, p-value for Levene Test for equality is greater than 0.05 ( $p > .877$ ), so equal variances were assumed. From table 2, we can see that the differences in the mean score of pre-test between control and comparative groups are statistically significant,  $t(58) = -3.002$ ,  $p < 0.05$ . Further investigation of table 1 shows that control group scored less ( $M = 8.20$ ,  $SD = 3.089$ ) than comparative group ( $M = 10.67$ ,  $SD = 3.273$ )



Table 6.3: Independent Sample Test on Pre-Test for Control and Comparative Groups

		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Pre-Test	Equal variances assumed	-3.002	58	.004	-2.467	.822	-4.112	-.822
	Equal variances not assumed	-3.002	57.808	.004	-2.467	.822	-4.112	-.822

2. Post-test result between control and comparative group

Table 6.4: Descriptive Statistics on Post-Test for Control and Comparative Groups

Group		N	Mean	Std. Deviation
Post-Test	Control Group	30	14.83	3.611
	Comparative Group	30	21.70	3.109

Table 6.5: Independent Samples Test on Post-Test for Control and Comparative Group

		Levene's Test for Equality of Variances			
		F	Sig.	t	df
Post-Test	Equal variances assumed	.035	.852	-7.893	58
	Equal variances not assumed			-7.893	56.746

The significant, p-value for Levene's Test is greater than 0.05 ( $p > .852$ ), so equal variances assumed. From independent sample t-test result (table 4), the difference in mean score of post-test between control and comparative groups is statistically significant,  $t(58) = -7.893$ ,  $p < 0.05$ . From table 3, we can see that comparative group obtained higher score for post-test ( $M = 21.70$ ,  $SD = 3.11$ ) compared to control group ( $M = 14.83$ ,  $SD = 3.61$ ).

Table 6.6: Independent Samples Test on Post-Test for Control and Comparative Group

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Post-Test	Equal variances assumed	-7.893	58	.000	-6.867	.870	-8.608	-5.125
	Equal variances not assumed	-7.893	56.746	.000	-6.867	.870	-8.609	-5.124

**Objective 2: Analysis of the acceptance of PBL on students’ performance in Geometry topic.**

Correlations

		PostTest	MeanAccept
PostTest	Pearson Correlation	1	.104
	Sig. (2-tailed)		.584
	N	30	30
	<hr/>		
MeanAccept	Pearson Correlation	.104	1
	Sig. (2-tailed)	.584	
	N	30	30
	<hr/>		

The output confirms the results of the scatterdot hypothesised negative relationship between post-test results and mean influence ( $r = .104$ ,  $n = 30$ ,  $p > .05$ ). Therefore, students’ performances in geometry topics are not associated with the influence of PBL approach.

## **CHAPTER FOUR**

### **DISCUSSION**

#### **4.0 Discussion and Conclusion**

This study aims to investigate the difference between PBL approaches with the traditional learning method in learning geometry among secondary school students. Besides, it also defines PBL as one of a family of experiential learning approaches and how the students facilitate their learning using this method. From the investigation, there are some strong evidences about the knowledge construction or perhaps problem-solving skills as the nature of PBL, but there are some issues to be considered during the planning and implementation of PBL especially on mathematics subjects.

Through the research, the researcher found that most of the students who involved in learning using PBL method have gained excitement from the whole learning process of PBL. This is because the characteristics of the PBL itself provide space and opportunities for the participants to explore the situations and problems given to them. Apart from being able to learn new learning techniques, they can also enhance communication skills among themselves accordingly with the pedagogy's style in PBL which requires the participants to openly engage in communication to make sure the learning outcomes achieves. In addition, almost all participants who involved in the learning process using the PBL method gained an

increase in their post-test results as they were able to relate the techniques during the intervention process to answer the post-test questions. But, some students find that it was harder to give opinions and suggestions during the group discussion which can be defined as “unwilling to speak; not expressing as much as is known or felt” (Summers D, Ed Director, 1987). This is because of hesitation and low self-esteem among them only because of taught that they are the weaker in the group and maybe their suggestion might not be accepted by good students in the group. It is not uncommon to see the students on PBL class are only dominated by good students.

In every PBL practices the participants will be seen as those who have a personality that can work independently, which can make decisions based on the given situation or respond to other students and even with the facilitator during the discussion session. However, the findings show that there is no relationship in students’ acceptance between learning using PBL and traditional learning approach. This is because of the common learning techniques used by students in their intervention that they are hard-pressed to adopt new techniques of PBL-based learning in the way they have been used so far. On the other hands, teachers' preparations as facilitators are also important in leading the PBL process so that students acquired better understanding regarding the PBL process so that it will help students to excel in mathematics.

The ministry of education have greater beliefs that PBL approach can boost students’ capabilities in problem solving, along with their communication skills in preparing them for 21<sup>st</sup> century learning. However, the reality is that the expected evidence and the actual outcomes form PBL do not happened as what we hope for. This is because in term of knowledge acquisition, the real educational results learned from PBL do not appear to be well than those learnt from a conventional ways of teaching. From the researchers’ perspective, this is maybe due to the conventional learning trends that have been used during interaction

in the classroom and when PBL approach are implemented in their learning process, this may indirectly cause confusion in their learning practices over the years as this is not a normal practice for them. As we know that the implementation of PBL in classroom setting requiring deep commitments and also good logistics support, but in Malaysia we are lack of skilled PBL facilitator especially in government school and in rural schools we are far behind in term of facilities to support PBL. The classrooms have more students than one person can easily facilitate and learning to facilitate is a challenge (Derry et al., 2001).

Due to time constraints the students were briefly given an instruction on how the PBL will be implemented during the intervention lesson. The students were instructed to read a paper in the characteristics and nature of PBL as their home task. But, many of the students are not doing their part and as a result, only little response was detected in the interaction during the earlier part of the lesson. Hence, as a suggestion to overcome this problem, a session of introduction about PBL approach need to be addressed properly to both students and teachers to ensure better understanding regarding this practice in the classroom (Dion L, 1996). Another limitation regarding time factors was the time frame of the last session of interventions lesson and the post test in which it was administered only in one week time.

For the future research on PBL in schools setting, it was recommended that this process need to be implemented in much extended period. This situation will benefit every party who facilitate the process in a way that they can make it as general practice and familiarize themselves with the PBL setting efficiently.

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## APPENDIX A : APPROVAL FROM THE MINISTRY OF EDUCATION MALAYSIA



KEMENTERIAN PENDIDIKAN MALAYSIA  
BAHAGIAN PERANCANGAN DAN PENYELIDIKAN DASAR PENDIDIKAN  
ARAS 1-4, BLOK EB  
KOMPLEKS KERAJAAN PARCEL E  
PUSAT Pentadbiran Kerajaan Persekutuan  
62604 PUTRAJAYA

TEL : 0388846591  
FAKS : 0388846579

Ruj. Kami : KPM.600-3/2/3-eras(3288)  
Tarikh : 28 Februari 2019

MCKENZIE ANAK LIM LENG  
NO. KP : 830626135373

NO.15 TAMAN LAVENDER HILLS,  
BT 13 1/2 JLN.KUCHING SERIAN, 93250 KUCHING  
SARAWAK

Tuan,

**KELULUSAN UNTUK MENJALANKAN KAJIAN DI SEKOLAH, INSTITUT PENDIDIKAN GURU, JABATAN PENDIDIKAN NEGERI DAN BAHAGIAN DI BAWAH KEMENTERIAN PENDIDIKAN MALAYSIA**

Perkara di atas adalah dirujuk.

2. Sukacita dimaklumkan bahawa permohonan tuan untuk menjalankan kajian seperti di bawah telah diluluskan.

**" AN EXPLORATORY STUDY ON THE USE OF PROBLEM-BASED LEARNING APPROACH IN LEARNING GEOMETRY AMONG SECONDARY SCHOOL STUDENTS "**

3. Kelulusan adalah berdasarkan kepada kertas cadangan penyelidikan dan instrumen kajian yang dikemukakan oleh tuan kepada bahagian ini. Walau bagaimanapun kelulusan ini bergantung kepada kebenaran Jabatan Pendidikan Negeri dan Pengetua / Guru Besar yang berkenaan.

4. Surat kelulusan ini sah digunakan bermula dari 11 Februari 2019 hingga 28 Februari 2019 .

5. Tuan dikehendaki menyerahkan senaskhah laporan akhir kajian dalam bentuk *hardcopy* bersama salinan *softcopy* berformat pdf dalam CD kepada Bahagian ini. Tuan juga diingatkan supaya mendapat kebenaran terlebih dahulu daripada Bahagian ini sekiranya sebahagian atau sepenuhnya dapatan kajian tersebut hendak diterbitkan di mana-mana forum, seminar atau diumumkan kepada media massa.

Sekian untuk makluman dan tindakan tuan selanjutnya. Terima kasih.

**"BERKHIDMAT UNTUK NEGARA"**

Saya yang menjalankan amanah,

Ketua Sektor  
Sektor Penyelidikan dan Penilaian  
b.p. Pengarah  
Bahagian Perancangan dan Penyelidikan Dasar Pendidikan  
Kementerian Pendidikan Malaysia

salinan kepada:-

JABATAN PENDIDIKAN SARAWAK

\* SURAT INI DIJANA OLEH KOMPUTER DAN TIDAK TANDATANGAN DIPERLUKAN \*

## APPENDIX B : APPROVAL FROM THE JPN SARAWAK



KEMENTERIAN PENDIDIKAN MALAYSIA  
Jabatan Pendidikan Negeri Sarawak  
Jalan Diplomatik, Off Jalan Bako  
Petra Jaya, 93050 Kuching, Sarawak

Tel : 082-473445  
Faks : 082-473684  
Emel : [unitlatihan007@gmail.com](mailto:unitlatihan007@gmail.com)

Ruj Kami : JPNSW.SKPP.LAT.600-1/1/1Jld4( 32 )  
Tarikh : 4 Mac 2019

### Mckenzie Anak Lim Leng

No.15 Taman Lavender Hills  
Bt 13 ½ Jln Kuching Serian  
93250 Kuching  
Sarawak

Tuan,

### **KEBENARAN UNTUK MENJALANKAN KAJIAN DI SEKOLAH-SEKOLAH, INSTITUT- INSTITUT PERGURUAN, JABATAN PENDIDIKAN DAN BAHAGIAN-BAHAGIAN DI BAWAH KEMENTERIAN PENDIDIKAN MALAYSIA**

Dengan hormatnya saya merujuk kepada perkara di atas

2. Sukacita dimaklumkan bahawa pada dasarnya Jabatan Pendidikan Negeri Sarawak tiada sebarang halangan untuk membenarkan tuan menjalankan kajian bertajuk :

**" An Exploratory Study on the Use of Problem-Based Learning Approach in Learning  
Geometry among Secondary School Students "**

3. Diingatkan bahawa sepanjang tempoh kajian tersebut, tuan adalah tertakluk kepada peraturan yang sedang berkuatkuasa dan menjalankan kajian seperti tajuk yang diluluskan oleh Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, Kementerian Pendidikan Malaysia bil. KPM.600-3/2/3-eras(3288) bertarikh 28 Februari 2019. Surat kelulusan ini sah digunakan bermula dari 11 Februari 2019 hingga 28 Februari 2019.

4. Jabatan ini memohon agar sesalinan laporan kajian dihantar ke Unit Latihan Dan Kemajuan Staf, Jabatan Pendidikan Negeri Sarawak sebaik sahaja selesai untuk tujuan rekod dan rujukan.

Sekian, terima kasih.

**"BERKHIDMAT UNTUK NEGARA"**

Saya yang menjalankan amanah,

**[KUSWADY BIN CHIL]**  
Sektor Khidmat Pengurusan Dan Pembangunan  
b.p Pengarah Pendidikan  
Jabatan Pendidikan Negeri Sarawak

"MENJULANG PENDIDIKAN NEGERI SARAWAK"  
"FLY KENYALANG FLY,FLY HIGH"

## APPENDIX C : INFORMED CONSENT FOR PARTICIPATION



### UNIVERSITI MALAYSIA SARAWAK FACULTY OF COGNITIVE SCIENCES AND HUMAN DEVELOPMENT

#### THE EFFECTS OF PROBLEM BASED LEARNING APPROACH IN LEARNING GEOMETRY AMONG SECONDARY SCHOOL STUDENTS

#### INFORMED CONSENT FOR PARTICIPATION

This study aims to investigate the differences between problem based-learning approaches and traditional learning method in learning geometry among Form Four students in SMK Padawan and its effect on students' performance.

Your participation in this study is voluntary. You are free to withdraw and discontinue your participation at any time. In the event you choose to withdraw from the study, all information you provided will be omitted from the final paper.

Insights gathered from you and the other informants will be used in writing a qualitative research paper and will be presented in the **KML6066 Research Paper** course in Masters in Learning Sciences Programme. The paper will also be published in a journal that will be identified by me and my supervisor. Though direct quotes from you maybe used in this paper, your name and other identifying information will be kept anonymous.

It is hoped that the research findings can be used as a reference to the Malaysian Ministry of Education and other relevant parties to evaluate the effectiveness of Problem Based Learning (PBL) in school setting.

If you have any questions or concerns, please contact the researcher, **Mckenzie Ak Lim Leng** at **010-5492639**.

Thank you for your participation.

The Researcher,

**Mckenzie Ak Lim Leng**  
**Student's ID: 17030203**  
**Faculty of Cognitive Sciences & Human Development**  
**Universiti Malaysia Sarawak**

---

By signing this consent, I \_\_\_\_\_ agree to the terms of this agreement.

( \_\_\_\_\_ )

Signature

( \_\_\_\_\_ )

Date

## APPENDIX D : SURVEY QUESTIONNAIRE



### UNIVERSITY MALAYSIA SARAWAK FACULTY OF COGNITIVE SCIENCES AND HUMAN DEVELOPMENT

#### THE EFFECTS OF PROBLEM BASED LEARNING APPROACH IN LEARNING GEOMETRY AMONG SECONDARY SCHOOL STUDENTS

#### SURVEY QUESTIONNAIRE

---

Dear Sir / Madam / Miss,

Please complete the survey questionnaire in 30 minutes.

I, as a student of Master of Science (Learning Sciences) from Faculty of Cognitive Sciences and Human Development would like to complete this survey on the respective title. Every data will be kept confidential and will only be used for academic purposes.

The objective of this survey questionnaire is to investigate the differences between problem based-learning approaches and traditional learning method in learning geometry among secondary school students, specifically to determine:

- III. The differences between traditional teaching approach and PBL teaching approach in learning geometry.
- IV. The acceptance of problem based-learning (PBL) on students' performance in learning Geometry topic.

**Sila lengkapkan soal selidik ini dengan membulatkan pada skala yang telah disediakan dalam kotak di bawah.**

*Please complete the survey questionnaire by circling the following scale for each of the statements to indicate your degree of agreement.*

1	2	3	4	5
Sangat tidak setuju <i>Strongly disagree</i>	Tidak setuju <i>Disagree</i>	Neutral <i>Neutral</i>	Setuju <i>Agree</i>	Sangat setuju <i>Strongly agree</i>

**Bahagian I : Perbandingan antara penggunaan kaedah pembelajaran berasaskan masalah dan kaedah pembelajaran tradisional dalam pembelajaran geometri.**

*Part I : Differences between traditional teaching approach and PBL teaching approach in learning geometry.*

	Pernyataan/Statement	Skala/Scale				
		1	2	3	4	5
1	Penggunaan kaedah pembelajaran berasaskan masalah tidak mempengaruhi pemelajaran saya untuk tajuk geometri. <i>Instruction with problem based-learning does not affect my learning of Geometry topic.</i>	1	2	3	4	5
2	Tidak terdapat perbezaan antara kaedah pembelajaran berasaskan masalah dengan kaedah pembelajaran tradisional. <i>There is no difference between instruction with problem based-learning and traditional method.</i>	1	2	3	4	5
3	Belajar topic Geometri dengan kaedah pembelajaran berasaskan masalah adalah tidak diperlukan. <i>Learning Geometry topic with problem based-learning method is unnecessary.</i>	1	2	3	4	5
4	Saya dapat mengenal pasti kesilapan saya dalam pembelajaran geometri melalui kaedah pembelajaran berasaskan masalah. <i>I see my misconceptions in learning geometry via problem based-learning method.</i>	1	2	3	4	5
5	Pada pendapat saya, keadah pembelajaran berasaskan masalah adalah tidak mencabar. <i>In my opinion, the use of problem based-learning is too superficial.</i>	1	2	3	4	5
6	Penggunaan kaedah pembelajaran berasaskan masalah membantu saya untuk melihat topik geometri dari sudut yang berbeza. <i>The use of problem based-learning helps me to see the topic of geometry from different angles.</i>	1	2	3	4	5

**Bahagian II : Penerimaan kaedah pembelajaran berasaskan masalah(PBM) mengikut pencapaian pelajar dalam pembelajaran topik geometri.**

*Part II : Acceptance of problem based-learning(PBL)on students' performance in learning geometry topic.*

	Pernyataan/Statement	Skala/Scale				
1	Penggunaan kaedah pembelajaran berasaskan masalah membantu untuk meningkatkan prestasi saya dalam topik Geometri. <i>The use of problem based-learning increases my academic performance for geometry topic.</i>	1	2	3	4	5
2	Penggunaan kaedah pembelajaran berasaskan masalah membuatkan saya lebih bersemangat dalam pembelajaran topik geometri. <i>The use of problem based-learning method makes me more enthusiastic in learning Geometry topic.</i>	1	2	3	4	5
3	Penggunaan kaedah pembelajaran berasaskan masalah dalam pembelajaran topik geometri membenarkan saya untuk berfikir secara kritis. <i>The use of problem based-learning improves my critical thinking skill in learning geometry.</i>	1	2	3	4	5
4	Penggunaan kaedah pembelajaran berasaskan masalah membuatkan pembelajaran geometri lebih menyenangkan. <i>The use of problem based-learning makes learning geometry more enjoyable.</i>	1	2	3	4	5
5	Saya mendapat pengetahuan baharu melalui penggunaan kaedah pembelajaran berasaskan masalah. <i>I gain new knowledge via the use of problem based-learning method.</i>	1	2	3	4	5
6	Belajar geometri dengan menggunakan kaedah pembelajaran berasaskan masalah membuatkan penyampaian lebih berkesan. <i>Learning geometry using problem based-learning method makes instruction more effective.</i>	1	2	3	4	5
7	Belajar geometri dengan menggunakan kaedah pembelajaran berasaskan masalah menggembirakan saya. <i>Learning geometry by using problem based-learning method excites me.</i>	1	2	3	4	5
8	Penggunaan kaedah pembelajaran berasaskan masalah dalam pengajaran geometri menarik perhatian saya. <i>The use of problem based-learning method in learning geometry attracts my attention.</i>	1	2	3	4	5



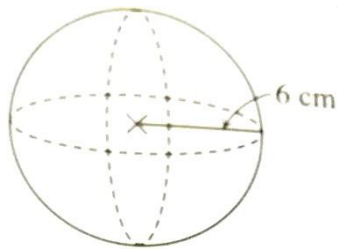
9	Penggunaan kaedah pembelajaran berasaskan masalah dalam topik geometri adalah membosankan. <i>Geometry topic with problem based-learning method bore me.</i>	1	2	3	4	5
10	Pembelajaran topik geometry dengan menggunakan kaedah pembelajaran berasaskan masalah adalah membosankan. <i>Learning geometry topic via problem based-learning method is boring.</i>	1	2	3	4	5
11	Ahli kumpulan saya tidak mahu berkongsi maklumat dengan saya. <i>My group members are not sharing information with me.</i>	1	2	3	4	5
12	Belajar geometri dengan menggunakan keadah pembelajaran berasaskan masalah adalah lebih susah bagi saya. <i>It is harder for me to learn geometry using problem based-learning method.</i>	1	2	3	4	5
13	Ahli kumpulan saya tidak mendengar apabila saya membentangkan dapatan saya. <i>My group members are not listening when I am presenting my findings</i>	1	2	3	4	5
14	Masalah komunikasi menyukarkan saya dalam menggunakan keadah pembelajaran berasaskan masalah <i>Communication problem are restricting my ability to perform well in PBL discussions.</i>	1	2	3	4	5

APPENDIX E : PRE AND POST-TEST

TAJUK : BENTUK GEOMETRI TIGA DIMENSI  
SUBTOPIK : SFERA dan HEMISFERA  
NAMA : \_\_\_\_\_  
KELAS : \_\_\_\_\_

(A) Bulatkan jawapan yang betul. (Guna  $\pi = \frac{22}{7}$ )

1.



Rajah 1

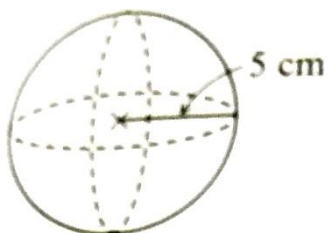
(i) Hitungkan luas permukaan bagi Rajah 1.

- |    |        |    |        |
|----|--------|----|--------|
| A. | 453.89 | C. | 423.98 |
| B. | 452.57 | D. | 422.75 |

(ii) Hitungkan isipadu bagi Rajah 1.

- |    |        |    |        |
|----|--------|----|--------|
| A. | 905.44 | C. | 901.54 |
| B. | 950.14 | D. | 915.54 |

2.



Rajah 2

(i) Hitungkan luas permukaan bagi Rajah 2.

- |    |        |    |        |
|----|--------|----|--------|
| A. | 323.67 | C. | 331.89 |
| B. | 318.24 | D. | 314.28 |

(ii) Hitungkan isipadu bagi Rajah 2.

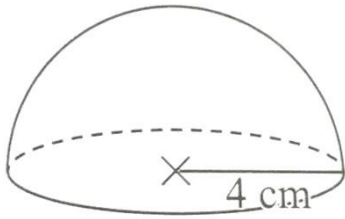
A. 523.81

C. 578.09

B. 554.67

D. 582.13

3.



Rajah 3

Hitungkan isipadu bagi Rajah 3.

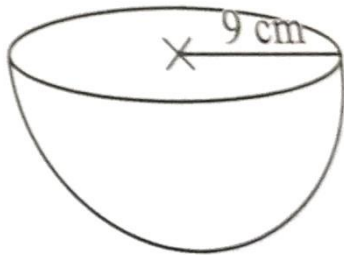
A. 134.10

C. 137.24

B. 135.09

D. 139.21

4.



Rajah 4

Hitungkan luas permukaan bagi Rajah 4.

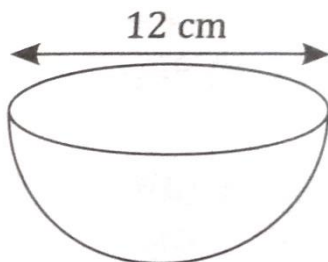
A. 731.09

C. 758.12

B. 743.91

D. 763.71

5.



Rajah 5

(ii) Hitungkan luas permukaan bagi Rajah 5.

A. 1357.71

C. 339.43

B. 1810.29

D. 3620.57

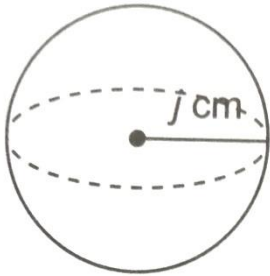
(ii) Hitungkan isipadu bagi Rajah 5.

- A. 75.43
- B. 452.57

- C. 301.71
- D. 452.57

(B) Jawab di dalam ruangan yang disediakan. (Guna  $\pi = 3.142$ )

6.



Rajah 6

Diberi isipadu bagi sfera dalam Rajah 6 ialah  $1437 \frac{1}{3} \text{ cm}^3$ .

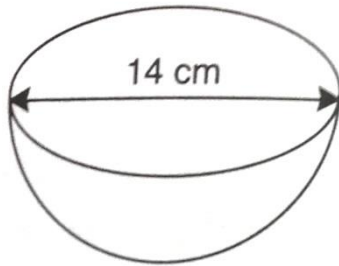
Hitungkan

(a) jejari,  $j$  cm, bagi sfera ini

(b) diameter sfera ini

(c) luas permukaan

7. Rajah 7 menunjukkan sebuah hemisfera.



Rajah 7

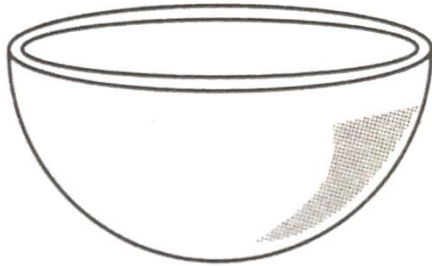
Hitungkan

(a) jejari hemisfera,

(b) luas permukaan bagi hemisfera tersebut,

(c) isipadu hemisfera tersebut.

8. Sebuah mangkuk berbentuk hemisfera boleh memuatkan 2048 ml.



Rajah 8

Hitungkan

(a) diameter mangkuk, dalam cm, betul kepada dua tempat perpuluhan.

(b) luas permukaan mangkuk itu, dalam cm.

9. Isipadu udara di dalam sebuah bola keranjang ialah  $905\frac{1}{7}\text{ cm}^3$ .

Hitung

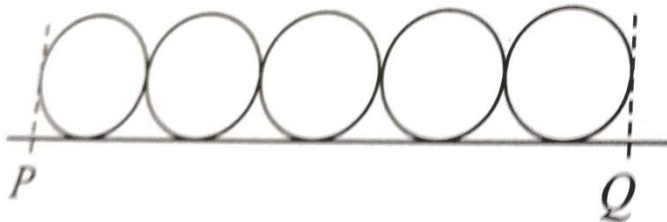
(a) jejari, dalam cm, bagi bola itu.

(b) luas permukaan , dalam  $\text{cm}^2$ , bagi bola itu.

10. Sebuah kubus logam dengan sisi 8 cm dilebur untuk membentuk lima biji bebola logam.

Cari jejari, dalam cm, bebola logam itu. Beri jawapan betul kepada dua tempat perpuluhan.

11. Rajah 11 menunjukkan keratan rentas bagi lima bola yang sama dan bersentuhan satu sama lain.



Rajah 11

Jika isipadu bagi setiap bola itu ialah  $65.45 \text{ cm}^3$ , hitung panjang, dalam cm, bagi  $PQ$ .