Students' Level of Achievement and Communication Skills Through Project-Based Learning (PBL) Approach: 'My Roller-Coaster' In Science Learning

Sonte, Sudina Sulina[1] , Sharif, Sabariah [2] , Lokman, Hairul Faeizi[3]*

[1]Faculty of Psychology and Education, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, 88400, Malaysia
[2]Faculty of Psychology and Education, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, 88400, Malaysia
[3]Institut Pendidikan Guru Kampus Ilmu Khas, Kuala Lumpur, 56000, Malaysia\

Abstrak: In moving towards world-class education, Malaysia needs to bring about a change that will impact the world of education. Therefore, the Ministry of Education Malaysia (MOE) has examined the things that need to be implemented and strive to succeed. In line with the goals and times, KPM has implemented 21st-century learning (PAK21) starting in 2014. PAK21 is said to be a student-centred learning process. Several elements are applied as the basic standards in PAK21, namely communication, collaboration, critical thinking, creativity, and the application of values and ethics. One pedagogical approach that stimulates 21st-century learning (PAK21) is the project-based learning approach (PBP). PBP is a long-term approach that celebrates students' abilities, thinking skills, and talents by producing artefacts or products such as posters, disinfectants, construction of hurricane tanks, drama staging, and more. The main objective of this study was to identify the improvement of students' communication skills through project-based learning (PBL) approach: 'My Roller-Coaster' in science learning. This study is analyzed descriptively and uses a quantitative approach. The study sample consisted of 40 Form 3 students who took the Secondary School Standard Curriculum (KSSM). This study showed a difference in the level of achievement of Science subjects between the treatment group and the control group in the post-test with 53.4%. In contrast, the improvement in the treatment group's achievement level was more significant than the control group, with a mean difference of the treatment group (8.3) compared to the control group (4.8). The findings also showed an improvement in the communication skills of the treatment group (PBL) by 82.9%. Studies show that the PBP approach can improve students' communication skills and increase the level of achievement in science learning. Thus, the PBP: 'My Roller-Coaster' approach can be used to complement science learning in the classroom.

Key words: *21st Century Learning, Project-Based Learning Approach, Communication Skills, Ministry of Education Malaysia, Secondary School Standard Curriculum*

INTRODUCTION

The Malaysian Education Development Plan (PPPM) 2013-2025 is designed to create a clear vision and aspirations for each student and the education system as a whole for the next 13 years. In preparation for the government to develop new skills to face future challenges in line with the era of the Industrial Revolution 4.0, now and beyond should do the realignment education system. The Ministry of Education Malaysia (MOE) has introduced PPPM (2013-2025), which focuses on 21st-century learning as

Corresponding Author: Sudina @ Sulina Sonte, Faculty of Psychology and Education, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, 88400, Malaysia, 0109497337

well as ideas related to the role of teachers as facilitators (MOE, 2013). 21st-century education focuses on skills and competencies where there are four skills (4K), namely communication, critical thinking, collaboration and creativity [1]. All teachers play a crucial role in realizing this mission to achieve the best results. According to Azmi [2], knowledge needs to be conveyed integrated into learning activities. Various teaching techniques need to be applied by teachers to provide opportunities for students with diverse learning needs to unearth their most significant potential. Creativity is an essential element that strengthens the ability of teachers to generate and apply as many ideas and techniques as possible and communicate about new ideas effectively.

According to Bell [3], 21st-century skills that need to apply in learning include communication skills, teamwork skills, entrepreneurial skills, leadership and student engagement. The project-based learning (PBL) approach is a constructivist pedagogy that provides in-depth understanding by allowing students to relate an issue to daily life [4]. In addition, [5] also explained that this approach actively involves students by giving students autonomy to acquire knowledge throughout the learning process. Students will manage the learning process collaboratively, communicate, collaborate and monitor each other based on a given period. At the end of the learning process, students will produce a project that symbolizes their learning outcomes [3]. According to Baharom [6], education involves communication and interaction between individuals throughout the learning process because knowledge building should affect social aspects. Students need to interact and exchange opinions during the learning process with teachers.

GENERAL OBJECTIVES

The study's general objective was to examine the effectiveness of the project-based learning approach (PBL): "My Roller-Coaster"to improve communication skills in science learning.

SPECIFIC OBJECTIVES

While the specific objectives of the study are as follows;
1. Identify the differences in the level of achievement of science subjects between the treatment group (PBL) and the control group (PT) in pre-test and post-test.

2. Identify the improvement of students' communication skills between the treatment group (PBL) and the control group (PT) in pre-test and post-test.

RESEARCH QUESTIONS

1. Is there a difference in the level of achievement of science subjects between the treatment group (PBL) and the control group (PT) in the pre-test and post-test?

2. Is there an improvement in students' communication skills between the treatment group (PBL) and the control group (PT) in the pre-test and post-test?

LITERATURE RESEARCH

21st-Century Learning
21st-century learning (PAK21) is said to be a student-centred learning process. Several elements are applied, namely communication, collaboration, critical thinking, creativity and the application of pure values and ethics. These elements are also referred to as basic standards in PAK21. In addition, Badrul Hisham and Mohd Nasruddin [7], stated that students need to have eight life skills to be ready to face the 21st century, namely critical thinking skills, problem-solving skills, communication skills, collaborative skills, life and career skills, study and innovation skills, skills in media, information and communication technology and mastery skills of core subjects in school.

Project-Based Learning
Project-based learning (PBL) is a learning approach in implementing 21st-century learning. The teacher serves as a facilitator to guide students through the project production process, including identifying problems, planning a plan to test the program and producing artefacts that can symbolize learning outcomes [8]. Project-based learning (PBL) is student-centred learning that requires students to be actively involved in acquiring new knowledge needed in work. This approach involves cooperative learning, active involvement and interaction between students can offer a variety of responsibilities for developing technical skills and contextual skills [4]. The definition of PBL by Blumenfield [9] explains that PBL is a project done cooperatively between students through an investigation of specific topics and presenting learning outcomes in front of a public audience. Active interaction occurs when students perform activities to seek information sources, provide views and opinions, improve products or project outcomes to achieve set learning objectives.

Traditional Learning
Traditional learning (PT) is learning that teachers teach students by giving lectures, giving exercises as reinforcement, and memorizing important facts to sit for exams [10]. According to Esah [11], learning activities are traditionally carried out systematically and arranged

by teachers, namely repetitive training, rewards and punishments to learn basic skills. Students are less likely to be actively involved in their learning, so students' skills and thinking cannot be fully developed indirectly. Repetitive activities also do not help students develop ideas and think more deeply because students only memorize important facts to sit for the exam.

Science Learning

Learning is a process of developing one's potential, and through the learning process, one can acquire better knowledge, skills and attitudes. One of the effects a person has learned is a change in knowledge (cognitive), skills (psychomotor) and a change in mood or behaviour (affective). In contrast, the meaning of Science comes from the Latin word "Scientia", which means knowledge, observing, and examining this world's existence (existence) as an object. The precise definition of Science is knowledge acquired through learning and proof or knowledge that encompasses a general truth of the laws of nature that occurs, e.g., obtained and proved through scientific work. Science learning, in principle, is an effort to systematically organise knowledge derived from experience and observation in everyday life and continue with careful thought using various methods commonly done in scientific research (observations, experiments, questionnaires, studies. Cases etc., and it causes changes in behaviour and thinking in scientific knowledge.

Communication Skills

According to Littlejohn [12], communication is a process of giving meaning and can influence a person to believe and do something as desired. Whether verbal or non-verbal, communication will involve the transfer of shared knowledge, understanding, or feelings through the messages conveyed [13]. Communication skills in the classroom impart knowledge and build interaction so that the PDP process achieves its goals. A conducive learning environment will encourage student involvement in all activities performed by teachers [14]. Communication skills need to be mastered by students to enable them to exchange ideas through discussion. In the current education system, communication skills need to be learned not only for communication but also for learning. The teaching-learning pattern now emphasizes more on students to submit their opinions. This learning pattern will indirectly affect students' academic achievement [15].

RESEARCH METHODOLOGY

This quantitative study was conducted in a National Secondary School in the District of Kota Kinabalu, Sabah. The results of the survey are reported descriptively to describe the findings obtained. The study involved a sample of 40 students who took KSSM Science subjects. This study uses a communication skills questionnaire adapted from Adibah [16]. Data were collected using a Likert scale of five questionnaires according to the feedback "very bad", "not good", "normal", "good", and "very good". There were five questionnaire items on each section of the communication skills variable. Data were analyzed using descriptive statistical tests to obtain frequency and mean values. The researcher used the mean from the descriptive statistical analysis. The analysis findings are displayed in tables and diagrams showing the frequency and percentage.

RESULTS AND DISCUSSION

As a result of implementing the intervention program using a project-based learning approach (PBL): "My Roller-Coaster", students have been able to master the learning of Science form 3 for the sub-topic Principles of Energy Eternity. In addition, subject teachers can also improve the teaching and learning process for Science subjects. The following are the findings of this study that has been conducted. Next, the researcher will describe the study results based on the two objectives of the study that have been framed previously.

(i) There is a difference in the level of achievement of science subjects between the treatment group (PBP) and the control group (PT) in pre-test and post-test.

Based on the analysis of documents done to students, it is clear that the project-based learning approach (PBL): "My Roller-Coaster" can help students state the Principles of Energy Eternity accurately in the chapter on Energy and Power. This is evidenced through the analysis of the study results reported based on the phases of the study conducted, that is, reinforcement given to the control group (PT) and treatment group (PBL). A comparison of the level of achievement between students in the treatment group (PT) and the control group (PBP) in the pre-test showed that all students in these two groups have initially been in the space to reach the minimum level and have not reached the minimum level compared to the treatment group (PBL) only 7 people students only. For students who have not reached the minimum level, 10 students from the control group (PT) and 8 from the treatment group (PBL). However, the treatment group (PBL) had the number of students in a good and satisfactory level of 1 student and 4 students respectively compared to the control group (PT), with only 4 students in satisfactory level and 0 students in good level.

Graph 1: Comparison of achievement level between control group (PBL) students with treatment group (PT) in the pre-test.
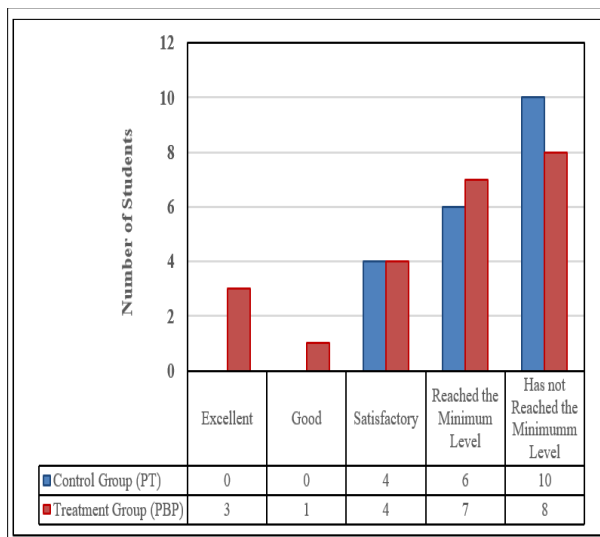
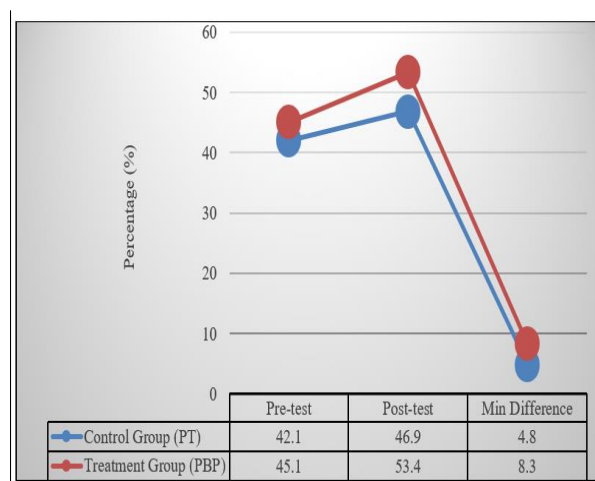|	Excellent	Good	Satisfactory	Reached the Minimum Level	Has not Reached the Minimumm Level
Control Group (PT)	0	0	4	6	10
Treatment Group (PBP)	3	1	4	7	8

A comparison of the level of achievement between students in the treatment group (PT) and the control group (PBP) in the post-test showed that all students in these two groups were initially in the space to reach the minimum level and have not reached the minimum level compared to the treatment group (PBP) only eight people students only. For students who have not reached the minimum level, 8 students from the control group (PT) and 0 from the treatment group (PBL). However, the treatment group (PBL) has a number of students in the excellent level of 3 students while the good and satisfactory level of 5 students and 4 students respectively compared to the control group (PT) with 5 students in the satisfactory level and only 3 students in a good level, in contrast, still, no student has achieved excellent level.

Graph 2: Comparison of achievement level between control group (PT) students with treatment group (PBL) in the post-test.

	Excellent	Good	Satisfactory	Reached the Minimum Level	Has not Reached the Minimumm Level
Control Group (PT)	0	3	5	4	8
Treatment Group (PBP)	3	5	4	8	0
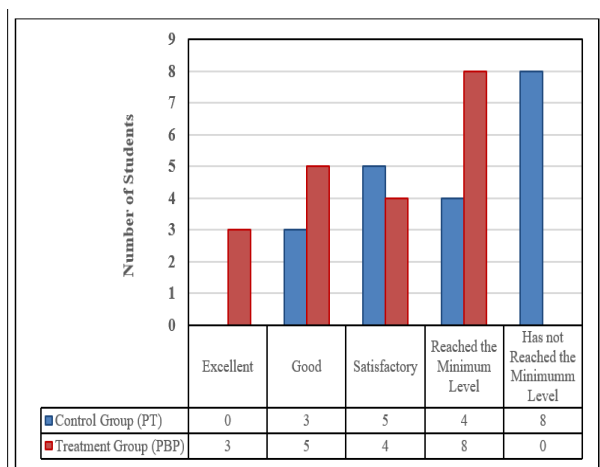
Based on Graph 3 below shows the comparison of the mean overall scores of students of the control group (PT) and control group (PBL) in the pre-test and post-test. It was found that the percentage of achievement of students in the control group (PT) in the pre-test was 42.1%, while for the treatment group (PBL) was 45.1%. Overall the treatment group (PBL) topped the achievement of the control group (PT) in the pre-test with a difference of 3.0%. While the percentage of achievement of students in the control group (PT) in the post-test was 46.9%, and for the treatment group (PBL) was 53.4%. Overall the treatment group (PBL) topped the achievement of the control group (PT) in the post-test with a difference of 6.5%.

Graph 3: Comparison of mean overall scores of students in the control group (PT) and treatment group (PBL) in pre-test and post-test.

	Pre-test	Post-test	Min Difference
Control Group (PT)	42.1	46.9	4.8
Treatment Group (PBP)	45.1	53.4	8.3

In addition, the level of student achievement is assessed according to five components: an accomplishment that shows excellent, good, satisfactory, reached the minimum level and has not reached the minimum level. The level of student achievement using the PBP approach: 'My Roller-Coaster' for the treatment group and the traditional learning approach for the control group in the pre-tests and post-tests were analyzed. Table 1 shows the level of student achievement using the project-based learning approach (PBL) in the post-test; a total of 3 respondents (15.0%) got excellent results. A total of 5 people got good results, and the most number reached the minimum level of achievement, which is 8 people or 40.0%. Meanwhile, in the pre-test, only 1 respondent or 5.0%, got a good level. A total of 4 people got a satisfactory level. The most significant number has not reached the minimum level, 8 people or 40.0%. These findings show an increase in the number of study respondents who obtained the achievement of excellent level, good and reached the minimum level

while no respondents have not reached the minimum level in the post-test compared to the pre-test.

Table 1. Level of student achievement in science subjects for the control group (PT) and treatment group (PBL) for pre-tests and post-tests.

Group	Test	N	Excellent	Good	Satisfactory	Reached the Minimum Level	Has not Reached the Minimum Level
Control (PT)	Pre	20	0(0.0%)	0(0.0%)	4(20.0%)	6(30.0%)	10(50.0%)
	Post	20	0(0.0%)	3(15.0%)	5(20.0%)	4(20.0%)	8(40.0%)
Treatment (PBP)	Pre	20	0(0.0%	1(5.0%)	4(20.0%)	7(35.0%)	8(40.0%)
	Post	20	3(15.0%)	5(25.0%)	4(20.0%)	8(40.0%)	0(0.0%)

2. There is an improvement in communication skills between the treatment group (PBL) and the control group(PT) pre-test and post-test.

Based on the observations conducted by the researcher throughout the teaching and learning process through project-based learning approach (PBL), can describe communication skills of students in the treatment group based on the following Table 2:

Table 2. Communication skills of students in the treatment group (PBP)

No	Statement	Very Good (SB)	Good (BK)	Normal (BS)	Not Good (TBK)	Very Bad (STBK)
1	Able to communicate orally clearly, fluently and accurately.	7	9	3	1	0
2	Able to convey ideas, information and opinions or questions.	7	10	2	1	0
3	Able to write ideas, information, opinions or questions clearly and easily understood.	5	12	2	1	0
4	Able to convey, review and receive information accurately.	7	9	2	2	0
5	Able to give accurate and meaningful feedback during discussions.	6	11	2	1	0
6	Able to understand the purpose based on the information presented.	7	10	3	0	0
7	Able to deliver presentations/ information sharing sessions well and confidently.	9	7	3	1	0

Source BTP KPM 2006

Based on the findings, Table 2 shows that the percentage of students' communication skills is 80% to 85%, above 50% for all the statements listed. Statements numbered 1, 4, and 7 respectively showed 80% related to communicating orally clearly, fluently and accurately, presenting, reviewing and receiving information accurately, and delivering presentations or information sharing sessions competently and confidently. Next, the statements of numbers 2, 3, 5 and 6 respectively show the percentage of 85% related to being able to convey ideas, information and opinions or questions, being able to write ideas, information, opinions or questions clearly and easily understood, being able to give accurate responses and meaningful during the discussion and be able to understand the purpose based on the information presented. Overall this analysis shows that students can communicate well through a project-based learning approach (PBL): 'My Roller-Coaster' with a total percentage of 82.9%.

Figure 1: PBL - 'My Roller-Coaster'

Figure 2 : PBL – 'My Roller-Coaster

Table 3. Communication skills of students in the control group (PT)

No	Statement	Very Good (SB)	Good (BK)	Normal (BS)	Not Good (TBK)	Very Bad (STBK)
1	Able to communicate orally clearly, fluently and accurately.	5	11	3	1	0
2	Able to convey ideas, information and opinions or questions.	4	11	3	2	0
3	Able to write ideas, information, opinions or questions clearly and easily understood.	4	11	3	2	0
4	Able to convey, review and receive information accurately.	6	7	4	3	0
5	Able to give accurate and meaningful feedback during discussions.	5	10	3	2	0
6	Able to understand the purpose based on the information presented.	6	9	3	2	0
7	Able to deliver presentations/ information sharing sessions well and confidently.	7	7	4	2	0

Source BTP KPM 2006

Based on the findings, Table 3 shows that the percentage of students 'communication skills is 70% to 80% over 50% for all the statements listed. Statements number 2, 3,5 and 6 respectively show 75% related to being able to convey ideas, information and opinions or questions, being able to write ideas, information, opinions or questions clearly and easily understood, being able to give accurate and meaningful current responses discussion and be able to understand the purpose based on the information presented. Next, statement number 1

can communicate orally clearly, fluently and accurately by 80%, and in statement number 4 only 65% can convey, check and receive accurate information. 3. Statement number 7 can show only 70% related to making an information-sharing session presentation well and confidently. Overall though, this analysis shows that students cannot communicate well through traditional learning approaches (PT), with a total percentage of 73.5% lower than the treatment group (PBP).

Table 4. Percentage of overall communication skills of students in the treatment group (PBL) and control group (PT)

Group	Answers Option / Percentage (%)				
	Very Good (SB)	Good (BK)	Normal (BS)	Not Good (TBK)	Very Bad (STBK)
Treatment (PBP)	34.5	48.6	12.1	5.0	0.0
		82.9		17.1	
Control (PT)	26.4	47.1	16.4	10.0	0.0
		73.5		26.4	

Supporting the study's findings, Figure 1 shows a more precise and more detailed picture based on respondents' responses to the statement (%) of students in communication skills. This indicates that the respondents' response to the excellent level is 48.6%, while the excellent statement is 34.5%. The number of respondents of 60.0% can write ideas, information, opinions or questions clearly and easily understood. In comparison, 55.0% of respondents can give accurate and meaningful impressions during the discussion, and 50.0% of respondents can understand the purpose based on information presented during the presentation or sharing relevant information with projects generated using the PBP approach. Respondents' feedback for the statement made presentations and information sharing sessions competently and confidently by 45.0% higher than the percentage of other statement responses. This proves that the PBP approach has produced a very encouraging success, and it should continue in the future [17]. According to Tan Oon Seng [18], PBL has been able to positively impact students' academic achievement and communication skills in understanding the content of teaching better and this opinion is also supported by Holm [19].

Figure 3 : Results of respondent's responses to the statement (%) of students' communication skills in the treatment group (PBL)

Students' Communication Skills in the Treatment Group (PBP)
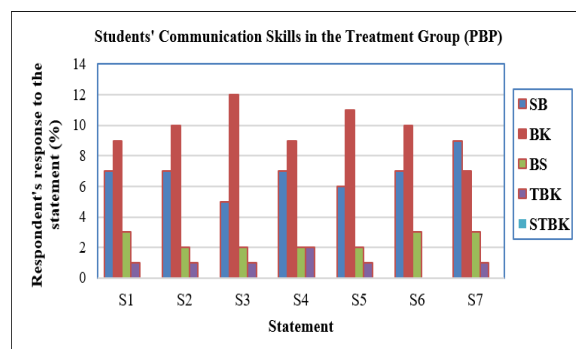
CONCLUSION

This research study has discussed students' level of achievement and communication skills through a project-based learning approach (PBL): 'My Roller-Coaster' in science learning. Findings showed an increase in the level of student achievement in the treatment group (PBL) compared to the control group (PT) in terms of post-test scores. In addition, the findings also show an improvement in students' communication skills in science learning in several aspects, namely: i) communicate orally clearly, smoothly and accurately, ii) present, review and receive information accurately and iii) perform information sharing sessions presentations well and confidently. In conclusion, the PBL approach provides opportunities for students to perform a variety of engaging, interactive and fun activities that can enhance students' communication skills and interest in learning through innovation in learning. The implication is that in teaching and learning Science, in particular, the selection of appropriate activities and strategies can ensure the smooth and effective delivery of knowledge. The planning of PBL activities that emphasize student-centred learning must consider the existing factors so that teaching and learning activities run smoothly and effectively.

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