Level of Knowledge and Readiness in Implementing the Brain-Based Learning Approach among Primary School Science Teachers

Nur Amirah Atikah Abu Bakar[*], Siti Nur Diyana Mahmud[**]

[*] Fakulti Pendidikan, Universiti Kebangsaan Malaysia
[**] Fakulti Pendidikan, Universiti Kebangsaan Malaysia

Abstract- Global transformation has led to the increase of training and educational programs which cater the needs of the pupils nowadays. Thus, the purpose of this survey was to find out how well Johor Bahru primary school Science teachers are prepared in implementing a strategy called the Brain-Based Learning (BBL). This study involved of 108 participants, which are all primary school Science teachers in Johor Bahru District. A set of 26 survey questions was distributed to each respondent. Descriptive and inferential statistical techniques were used to analyse the information gathered from these respondents. The results of the study showed that Science teachers were highly knowledgeable and prepared to use the Brain-Based Learning strategy. Additionally, the study demonstrated that when comparing male and female teachers, there was a substantial difference in the average degree of knowledge and readiness regarding the Brain-Based Learning strategy. Furthermore, there was some different in terms of the average level of knowledge and readiness when using the Brain Based learning strategy between the experienced teachers and the novice teachers. Therefore, Brain-Based Learning strategy must be exposed widely so that, Science teachers can implement the strategy correctly.

Index Terms- Brain-Based Learning, Knowledge, Readiness, Science Teacher, Primary School

I. INTRODUCTION

Malaysia Ministry of Education implemented a plan in 2013 called the Malaysia Education Blueprint, PPPM (2013-2025), which aims to set clear goals and aspirations for both students and the education system. One of the main objectives is to improve higher-order thinking skills among students, and it is the teacher's responsibility to find a way to achieve this goal. The search for the best Science teaching method in primary and secondary schools continues but none of the approaches has been acknowledged as the best method so far. Every teaching method or approach has its own advantages, as well as the disadvantages thus, making it quite difficult for the teachers to seek for the best teaching method. The effectiveness of each approaches relies on many factors such as the learning materials, student's background and learning objectives.

The learning process in the classroom usually involves a basic and important context that includes interaction of brain through sensory, cognitive, emotional and social experiences. The world transformation led to the creation of training and education programs that meet the students' needs. Scientific advancement has truly modified the way we approach learning. Advancement in medical research had shed light on the intricacies of the human brain, leading to a deeper understanding on how individuals acquire knowledge.

As a result, a new learning method has emerged, known as Brain-Based Learning (BBL). BBL is a student-centred method that guarantees a successful and a long-lasting learning. Brain-based learning strategy has been extensively studied in an educational environment to prove its effectiveness on the students' performances such as improving their self-motivation, academic performance and understanding in science-related subjects. Thus, conducting a study on the level of knowledge and teachers' readiness regarding brain-based learning strategy is highly significant to improve teachers' pedagogical methods in teaching Science.

Todays' education needs are very different from the previous years. In the 21st century, teachers act as the facilitators to promote learning by creating a condusive and productive learning environment for the students in order for them to gain the skills needed in the

future such as higher-order thinking skills, technological wise as well as an effective communication skills. Nevertheless, the students will be highly effected if the teachers do not want to play their role as a good facilitator.

II.   PROBLEM STATEMENT

Teachers' less effective teaching methods will impact the students such as the students are not being able to understand the content of the lesson. Jedege (2007) stated that teachers who use ineffective teaching approaches and lack of problem-solving skills may cause the students to have a difficulty in understanding the Science content (especially physics) by themselves. A study by Salmiza and Fazrin (2016) found that teachers use traditional methods such as giving practice questions without giving any sufficient explanations of concepts to the students. In fact, almost 60% says that Science lesson in schools is not interesting (Serafin, 2016).

Previous studies have shown that educators continue to use one-way teaching methods. One-way teaching is a traditional method and is usually teacher-centered. In this method, the teacher uses an authoritarian approach in his teaching. Students must listen and follow all instructions and knowledge that have been given without asking anything. One-way teaching method has plenty of useless effects in the classroom, include causing a boring lesson (Rose Niza, 2021). Study by Mohd. Meerah and Syed Mustapa (2017) found that traditional teaching methods are outdated since they do not help the students reach their full potential and only involve teachers in providing information. Abdul Razak and Salleh (2011) also stated that poor teaching quality can cause students to feel bored and not interested to learn. Lack of student's cooperation and focus on learning happened due to the teacher's teaching style (Tschannen and Woolfolk, 2001). It is important to address this issue because students' interest and motivation in learning Science during their school year plays an important role in shaping their educational path and future career (Maltese & Tai, 2010).

Therefore, the Brain-Based Learning (BBL) approach can help to deal with the existing issues. The Brain-Based Learning approach emphasizes the importance of active student involvement during the learning process. Although one-way learning may depend on passive acceptance of information, the Brain-Based Learning Approach emphasizes interactive elements such as discussions, hands-on activities and problem-solving tasks to encourage greater engagement and deeper learning. According to Hafiza, Uzma & Afifa (2020), the three Brain-Based Learning Approach strategies which are practical simulation, problem solving and cooperative learning are effective in improving the learning performance of students at the primary level.

In addition, the field of education now emphasizes on the efforts towards increasing the pupils' interest together with the pupils' motivation in learning Science. Increased interest and motivation can be achieved through effective teaching strategies, student-centered learning and taking into account the conceptual structure of students (Bawaneh, Abd Ghani, Salmiza & Khoo, 2011). Therefore, in order to attract students' interest as well as increase students' motivation, an appropriate teaching approach needs to be carried out during the teaching and learning process. Brain-based learning is a teaching approach that prioritizes the use of the brain during and after teaching and learning (PdP). The Brain-Based Learning approach also prioritizes the state of the brain by giving students meaningful experiences, challenging environments, and the ability to consolidate and understand the information.

Every teacher needs to have a lesson plan before they implement the lesson in class. Teaching strategies that suit students also need to be focused on. Even if the teacher has been teaching for a long period of time or still new in the field of education, lesson plan needs to be done before a lesson is implemented. A study by Tschannen-Moran and Hoy (2002) found that the effectiveness or efficiency of experienced teachers (who have taught for more than 5 years) is at a higher level compared to the novice teachers (who have taught for less than 5 years). Self-efficacy theory is about the confidence level of the individuals towards their capability in performing a task. (Bandura 1997).

Besides, different levels of teachers' impact can affect the outcomes for each person. Norhasliza and Hazalizah (2016) support this idea by describing that training and teachers' gender affect the teacher self-efficacy. The result showed that male teachers and graduated teachers are more motivated than female teachers and non-degree holder teachers. However, a study conducted by Syed Kamaruzaman Syed Ali, Mohd Zaki Che Hassan and Julismah Jani (2017) explained that the gender of teachers does not affect their level of self-efficacy. Therefore, this study will examine whether the gender will affects the teachers' level of readiness and knowledge in implementing Brain-Based Learning (BBL) approach.

III.   RESEARCH OBJECTIVES

Specifically, the objectives of the study are:

1.   To identify the level of knowledge of primary school Science teachers in Johor Bahru district regarding the Brain-Based Learning approach.

2.   To identify the level of readiness of primary school Science teachers in Johor Bahru district towards the Brain-Based Learning approach.

3.   To determine the difference in the level of knowledge and level of readiness of primary school Science teachers in Johor Bahru district regarding the Brain-Based Learning approach based on the gender and years of teaching experience.

IV.   RESEARCH QUESTIONS

The research questions are as follows:

1.   What is the level of knowledge of primary school Science teachers in Johor Bahru district regarding the Brain-Based Learning approach?

2.   What is the level of readiness of primary school Science teachers in Johor Bahru district towards the Brain-Based Learning approach?

3.   Is there a difference in the level of knowledge and level of readiness of primary school Science teachers in Johor Bahru district regarding the Brain-Based Learning approach based on gender and years of teaching experience?

V.   METHODOLOGY

Research Design

Research design is a term used which refers to a qualitative or quantitative study that conducts a survey towards a population or a sample (Creswell, 2015). The researcher has chosen a quantitative survey design and use an online questionnaire instrument known as Google Forms. The questionnaire was sent to Science teachers in primary schools in Johor Bahru district, Johor. Survey research design was chosen since this design is suitable to answer the research questions.

Sampling

This study involves of primary school teachers in Johor Bahru district. The respondents only consist of Science teachers who teach in primary schools. This study involves 150 primary school Science teachers in Johor Bahru district. This population was chosen because research regarding the BBL approach among primary school Science teachers is very few. The researcher chose this location because it is easily accessible. This can indirectly help the researcher manage the data. The Krejcie and Morgan (1970) table serves as the basis for the sample selection which enable the use of simple random sampling techniques. Out of the 150 people who make up the population, only 108 people were required as the sample according to the Krejcie and Morgan (1970).

Research Instruments

The measuring tool used to assess the results obtained from the data collection is known as a research instrument (Creswell and Creswell, 2022). In this study, the instrument used is a set of questionnaires entitled "Survey Study on the Level of Knowledge and Readiness in Implementing Brain-Based Learning". This questionnaire was adapted from previous research studies such as those used in the study by Sumarni and Zamri (2018). The constructed items have been divided into three main sections, namely:

• Section 1: Demographic information such as age, gender, years of teaching experience, and teaching options.
• Section 2: The level of teacher's knowledge about the Brain-Based Learning approach.
• Section 3: The level of teachers' readiness to apply the Brain-Based Learning approach in the classroom

Data Collection and Analysis Procedures

The questionnaire has been distributed online through social media platforms such as WhatsApp and Telegram via Google Form to conduct the study. The researcher chose the online method to collect and analyse the data since it is very easy, accurate, and effective in reducing the paper usage so that the nature is well preserved.

The design of this study is quantitative study which aim to obtain descriptive statistical data such as mean and standard deviation. Since numerical data requires precise measurement, the researcher used the Statistical Packages for the Social Sciences (SPSS) version 27.0 program. Accurate and precise data analysis can be conducted using this program. Descriptive analysis is used to

assess the knowledge and readiness of primary school Science teachers in using the Brain-Based Learning approach. For gender and years of teaching experience, inferential statistics, namely the MANOVA Test, were used to assess the knowledge and readiness level of primary school Science teachers to use the BBL approach.

VI.   FINDINGS AND DISCUSSION

(A)   Respondent Demographics

Table 1 presents the background data of the respondents based on gender, age, option or non-option Science teacher and teaching experience. As shown in the table below, a total of 108 teachers from Johor Bahru district primary school responded to the questionnaire, representing various age groups and teaching experience level. The demographic analysis of the respondents is displayed in Table 1, which includes the frequency and percentage values.

Table 1. Demographic Analysis of Respondents

Variable		Frequnecy (N)	Percentage (%)
Gender	Male	27	25.0
	Female	81	75.0
Age	21 – 30 years	24	22.2
	31 – 40 years	30	27.8
	41 – 50 years	40	37.0
	> 51 years	14	13.0
Option/Non-option Science Teacher	Option Science Teacher	59	54.7
	Non-option Science Teacher	49	45.3
Teaching Experience	1 – 5 years	38	35.3
	6 – 10 years	0	0
	11 – 15 years	4	3.7
	> 16 years	54	50.0

(B)   The Level of Knowledge on Brain-Based Learning

Table 2 shows the percentage and frequency of Science teachers' knowledge level regarding Brain-Based Learning (BBL). Based on the table, the overall mean for the level of Science teachers' knowledge regarding Brain-Based Learning (BBL) is a mean of 4.20, which is at a high level. From the overall mean of 4.20, it can be concluded that:

I.   developing students' emotions by giving them encouragement can stimulate their brain function
II.   using kinesthetics, musical, and visual medium can enhance students' brain function
III.   continuous drill can strengthen students' memory.

Based on this study, it was found that the level of knowledge among Science teachers regarding the Brain-Based Learning (BBL) approach is high. This is in line with the study by Mohd Qhairil and Zamri (2018), which stated that a teacher must have detailed knowledge of the subject that he or she taught or the method to be applied in the teaching and learning process.

Table 2. Science Teacher's Level of Knowledge on Brain-Based Learning

No	Item	Frequency and Percentage (%)				
		SD	D	N	A	SA
A1	Brain activity can be stimulated if the classroom is cheerful and has optimal lighting.	0 (0)	0 (0)	0 (0)	45 (41.7)	63 (58.3)

A2	Fragrances and calming musical toys in the classroom can have a positive effect on the brain during teaching and learning sessions.	0 (0)	4 (3.7)	18 (16.7)	56 (51.9)	30 (27.8)
A3	Making a pre-exposure to the topic, repeating existing knowledge, mind mapping, and setting learning goals can help the students' brains prepare for learning.	0 (0)	0 (0)	0 (0)	70 (64.8)	38 (35.2)
A4	Giving words of encouragement and praise can stimulate students' emotions, thereby enhancing their brain function.	0 (0)	0 (0)	0 (0)	0 (37.0)	68 (63.0)
A5	Extreme punishment methods or imposing unreasonable time constraints for students to solve problems.	30 (27.8)	27 (25.0)	16 (14.8)	26 (24.1)	9 (8.3)
A6	The challenges given can enhance the learning process.	0 (0)	0 (0)	0 (0)	79 (73.1)	29 (26.9)
A7	Teaching activities need to involve the simultaneous use of both the left and right brain, incorporating activities such as counting, drawing, designing, and predicting in the learning process.	0 (0)	0 (0)	8 (7.4)	60 (55.6)	40 (37.0)
A8	Activities that involve movement can stimulate brain development.	0 (0)	0 (0)	0 (0)	64 (59.3)	44 (40.7)
A9	The learning process needs to involve the entire physiology of the human senses, including hearing, sight, and smell.	0 (0)	4 (3.7)	8 (7.4)	50 (46.3)	46 (42.6)
A10	Effective learning involves applying problem-solving outside the classroom.	0 (0)	4 (3.7)	9 (8.3)	79 (73.1)	16 (14.8)
A11	Effective learning requires diverse activities that are suitable for the students' abilities.	0 (0)	0 (0)	8 (7.4)	65 (60.2)	35 (32.4)
A12	The brain function of students can be enhanced through the use of visuals (charts, illustrations), audio (music), and kinesthetic (body movements).	0 (0)	0 (0)	0 (0)	61 56.5)	47 (43.5)
A13	Teachers need to provide various active learning experiences both inside and outside the classroom.	0 (0)	0 (0)	4 (3.7)	73 (67.6)	31 (28.7)
A14	Rote memorization techniques alone are ineffective; teachers must emphasize the process of acquiring information in learning.	0 (0)	4 (3.7)	92 (85.2)	12 (11.1)	4 (3.7)
A15	The students' focus is highest during the beginning and middle of the learning session.	0 (0)	4 (3.7)	0 (0)	69 (63.9)	35 (32.4)
A16	The reinforcement of students' memory can be enhanced with drillings.	0 (0)	0 (0)	0 (0)	47 (43.5)	61 (56.5)
	Overall Mean 4.20					

(C)   The Level of Readiness on the implementation of the Brain-Based Learning Approach in Learning Science.

Readiness is a process that involves the integration of emotional, cognitive, and physical aspects of a person in the execution of a task (Ain, 2021). The readiness of teachers in the aspect of teaching can help to attract students' interest during the teaching and learning process. In this study, the level of readiness of Science teachers is measured based on their preparedness for the implementation of the Brain-Based Learning approach in Science lesson. Based on Table 3, the overall mean for the readiness level of Science teachers is a mean of 3.95, which is at a high mean level. Based on the analysis of the mean, frequency, and percentage, it can be concluded that:
    I.   the readiness of teachers to implement the BBL concept is high.

II.   Science teachers in Johor Bharu district are ready to diversify their teaching methods. Science teachers are ready to include pedagogical information to enhance students' understanding and motivation

III.   Science teachers want to know more about BBL

IV.   Science teachers believe that BBL is effective in schools.

Table 3. Science Teacher's Level of Readiness on the implementation of the
Brain-Based Learning Approach in Science Learning

No	Item	Frequency and Percentage (%)				
		SD	D	N	A	SA
B1	I am ready to diversify my teaching methods.	0 (0)	0 (0)	5 (4.6)	83 (76.9)	20 (18.5)
B2	I am ready to enhance my pedagogical knowledge to improve students' understanding and motivation.	0 (0)	0 (0)	5 (4.6)	75 (69.4)	28 (25.9)
B3	I would like to know more about the Brain-Based Learning approach.	0 (0)	0 (0)	0 (0)	80 (74.1)	28 (25.9)
B4	I am willing to allocate time outside of school sessions to attend briefings/workshops/sharing sessions on the Brain-Based Learning approach.	0 (0)	0 (0)	22 (20.4)	70 (64.8)	16 (14.8)
B5	I am positive that the Brain-Based Learning (BBL) approach can enhance students' understanding and motivation.	0 (0)	0 (0)	16 (14.8)	72 (66.7)	20 (18.5)
B6	I am ready to implement the BBL approach in teaching and learning at school if provided with relevant guidelines or modules.	0 (0)	0 (0)	22 (20.4)	62 (57.4)	24 (22.2)
B7	I agree if the implementation of the BBL approach is carried out in my school as a pilot project. .	0 (0)	8 (7.4)	46 (42.6)	38 (35.2)	16 (14.8)
B8	I would like to know more about the effectiveness of the approach that has been implemented in other schools.	0 (0)	0 (0)	0 (0)	84 (77.8)	24 (22.2)
B9	The existing teaching strategy that I implement is more engaging and easier.	0 (0)	0 (0)	27 (25.0)	77 (71.3)	4 (3.7)
B10	I am ready to be a mentor in the implementation of the BBL approach at my school if given the opportunity.	0 (0)	13 (12.0)	62 (57.4)	21 (19.4)	12 (11.1)
	Overall Mean 3.95					

Meanwhile, the level of readiness among teachers to apply the BBL approach is high. The readiness of teachers is important because the BBL approach can have a positive impact on students in particular. This is because the BBL approach provides learning experiences in various forms, namely visual, audio, and kinesthetic (Salmiza, 2010). Based on Fullan's 2001 Educational Change Theory, the level of teacher readiness depends on many factors. Among them are the teachers' knowledge about a certain change, the teachers' ability to apply it, the teachers' own attitude, support from the community around the school, and finally, complete facilities. Therefore, all these factors need to be given attention so that the level of readiness is always at its best.

(D)   The level of knowledge of the Brain-Based Learning (BBL) approach and the level of readiness to apply the Brain-Based Learning (BBL) approach in teaching and learning according to gender

Table 4 shows the distribution of the mean and standard deviation of the level of knowledge of the BBL approach and the level of readiness to use BBL in teaching and learning according to gender. The level of BBL knowledge among males is higher than that of females (Mean=4.22, SD=0.44). The minimum readiness level to use the BBL approach is higher for men than for women (Mean=4.27, SD=0.56).

Table 4. The comparison of the average level of knowledge of the Brain-Based Learning (BBL) approach and the level of readiness to apply the Brain-Based Learning (BBL) approach in teaching and learning based on gender.

	Gender	n	Mean	Standard Deviation	Level
Level of knowledge	Male	27	4.22	0.44	High
	Female	81	4.20	0.28	High
	Total	108	4.20	0.33	High
Level of Readiness	Male	27	4.27	0.56	High
	Female	81	3.84	0.38	High
	Total	108	3.95	0.47	High

This study found that male teachers have a better understanding of the components or ideas of Brain-Based Learning (BBL) compared to female teachers. This contradicts Ermertah's (2018) research, which found that female teachers are more skilled in using inventive thinking in the classroom compared to male teachers. Similarly, the study results indicate that male teachers are more willing to use the BBL approach compared to female teachers. The study by Azalida and Norazilawati (2018) shows that male teachers have a greater interest in implementing modern learning. Therefore, an appropriate initiative needs to be developed to enhance male teachers' readiness to implement the introduced reform strategies.

(E)   The level of knowledge of the Brain-Based Learning (BBL) approach and the level of readiness to apply the Brain-Based Learning (BBL) approach in teaching and learning according to teaching experience.

Table 5 shows the distribution of the mean and standard deviation of the level of knowledge of the Brain-Based Learning (BBL) approach, as well as the readiness to use the Brain-Based Learning (BBL) approach in teaching and learning according to the teaching experience period. The minimum level of BBL knowledge is 4.69, with a standard deviation of 0.00, for teaching periods between 11 and 15 years. This is different from the teaching period of less than 1 year (Min 4.27, SP 0.24), 1 to 5 years (Min 4.23, SP 0.31), and 16 years or more. The readiness level to use the Brain-Based Learning (BBL) approach is highest for teaching periods between 11 and 15 years (mean 4.80, SD 0.41) compared to teaching periods of less than 1 year (mean 4.57, SD 0.44), 1 to 5 years (mean 3.93, SD 0.41), and more than 16 years (mean 3.76, SD 0.33).

Table 5. The comparison of the average level of knowledge of the Brain-Based Learning (BBL) approach and the readiness to apply the Brain-Based Learning (BBL) approach in teaching and learning based on teaching experience duration.

	Teaching Experience (year)	n	Mean	Standard Deviation	Level
Level of knowledge	< 1 year	12	4.27	0.24	High

	1-5 year	38	4.23	0.31	High
	11-15 year	4	4.69	0.00	High
	>16 year	54	4.13	0.34	High
	Total	108	4.20	0.33	High
Level of Readiness	< 1 year	12	4.57	0.44	High
	1-5 year	38	3.93	0.410	High
	11-15 year	4	4.80	0.00	High
	>16 year	54	3.76	0.33	High
	Total	108	3.95	0.47	High

Finally, this study found that teachers with more than eleven years (or more) of teaching experience have a better understanding of the Brain-Based Learning (BBL) approach compared to younger teachers. This aligns with the findings of a study conducted by Mohd Khairuddin Abdullah (2010), which found that teacher experience has a significant impact on the success of the most effective student-centered teaching. Furthermore, Zarina (2017) states that teachers with more than twenty years of teaching experience possess sufficient knowledge to apply certain skills in teaching. Therefore, it is appropriate for these more experienced teachers to become mentors to younger teachers by sharing their knowledge and experience.

VII.   RECOMMENDATIONS AND CONCLUSION

After all, the level of knowledge of Johor Bahru district Science teachers towards the Brain-Based Learning (BBL) approach is high while the level of readiness of Johor Bahru district Science teachers to apply the BBL approach is also at a high level. The results of this study are an initial step towards the implementation of the BBL approach in schools by using the right techniques, concepts and strategies to improve the quality of teaching and ultimately have a positive impact on students.

In addition, research can improve teacher competence, increase the use of appropriate teaching approaches and encourage further research. This study has its limitations, which is that this study only involves primary school science teachers in the Johor Bahru, Johor area and the results of this study cannot be generalized to all primary school science teachers throughout Malaysia. The suggestion of further research is to conduct research in different locations such as repeating studies in different locations to test the validity and usability of findings. geography, demographics and culture are diversified to see how far findings can be generalized.

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AUTHORS

First Author – Nur Amirah Atikah Abu Bakar, Universiti Kebangsaan Malaysia (UKM),
P130095@siswa.ukm.edu.my

Second Author – Siti Nur Diyana Mahmud, Universiti Kebangsaan Malaysia (UKM),
diyana@ukm.edu.my

Correspondence Author – P130095@siswa.ukm.edu.my