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A Need Analysis for Developing Inquiry Learning – Project-Based Learning Module (*Modul PI-PBPj*) in Secondary Science Subject

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Abstract

Science Education is one of the core subjects in KBSM and KSSM, and has various objectives and goals contained to produce students who not only know the facts of the development of Science Education in Malaysia or around the world but also able to stimulate students' thinking through the learning of teachers needs to adapt High Level Thinking Skills (HLTS) or High Order Thinking Skills (HOTS), in addition to focus on inquiry-based approaches and project-based learning so that students can master the skills needed in 21st century education. This situation has encouraged the process of teaching and learning Science through study and exploration by improving inquiry thinking among students, so the objective of this study is to identify whether there is a need to develop project-based and inquiry learning modules for the implementation of teaching and learning activities. The survey study through this questionnaire will involve a total of 50 Science teachers selected through purposeful sampling techniques. The data of this study were analyzed descriptively through IBM SPSS software. The findings of this study indicate that there is a need to develop a project-based Science teaching and learning activity module in the process of teaching and learning Science, in addition to provide learning experiences through activities to form a deep interpretation and understanding among students. The implications of this study will provide preliminary information an aspects that need to be focused on such as students abilities, appropriate teaching approaches, relevant learning materials and so on in the process of developing more effective teaching and learning modules.

Keywords: Need Analysis, Inquiry-Learning and Project-based Learning Module, Secondary School Standard Curriculum, High-Level Thinking Skills, 21st Century Learning.

Introduction

The process of information explosion, technological developments, globalization, emphasis on the development of 21st century skills, and so is a major challenge for education in the 21st century. Malaysia, as a developing country, faces great challenges and pressures in the face of 21st century competition. Malaysia aspires to be a developed country according to its own mold, by 2020 which is to achieve balanced progress in terms of economic, political, social, spiritual and cultural. Malaysia also aspires to be a country with high confidence and a united society, adhering to religious, moral and ethical values as well as enjoying a

democratic, liberal and tolerant life, fair and equitable economic partnership, progressive and prosperous, and dominating the economy capable of competitive, dynamic, agile and resilient.

Various approaches have been and are being done in education to produce skilled and useful citizens as expressed and implicit in the National Education Philosophy or *Falsafah Pendidikan Kebangsaan* (FPK) to achieve Vision 2020 (*Wawasan, 2020*). The Ministry of Education Malaysia (MOE) has formulated and implemented a strategic plan that is the Development Master Plan of Malaysian Education or *Pelan Induk Pembangunan Pendidikan Malaysia* (PIPPM) 2013-2025 in an effort to strengthen and improve the quality of the national education system at the school level which focuses on six strategic thrusts namely nation building, developing human capital, empowering national schools, bridging the education gap, uplifting the teaching profession and boosting excellence educational Institute.

In order to realize the wishes and aspirations of the country, especially in the building of a balanced and harmonious intellectually, spiritually, emotionally and physically in addition to have the power of high thought, patriotic and able to balance between material values and spiritual values and humanitarian subjects Science plays a very important role. These ideal characteristics are seen as a challenge to be faced in achieving the aspirations of Vision 2020 which aims to make Malaysian a modern and developed country, a fair, moral and rational industrial society with its own personality.

Tracing the history of the development of science education in Malaysia has in fact evolved since the colonial era and is still undergoing change, rational with the development of the curriculum in Malaysia. The current generation is more fortunate because each level in all schools has Science as the core subject at the level of Integrated Primary School Curriculum or *Kurikulum Bersepadu Sekolah Rendah* (KBSR) or Integrated Secondary School Curriculum or *Kurikulum Bersepadu Sekolah Menengah* (KBSM) or has now undergone modifications to the Primary School Standard Curriculum or *Kurikulum Standard Sekolah Rendah* (KSSR) and also the Secondary School Standard Curriculum or *Kurikulum Standard Sekolah Menengah* (KSSM). This is because there is a national awareness and concern for the importance of science in line with the current globalization of the world. Imagine if it was still in 1939 where Science courses were only offered in a school that had rooms and facilities to teach Science as well as qualified Science teachers. Of course, there are still many Malaysians who are barren of Science and archaic thinking and using current technology. In line with the rationale, KSSM was introduced because there is a need to make the National Curriculum more holistic and relevant to the needs of the 21st century to produce human capital that is critical, creative and innovative and able to contribute to national development and internationally and globally competitive.

Research Objective

This study was conducted based on the researcher's need to obtain data to produce an inquiry-learning and project-based learning module (PI-PBPj Module) for the teaching and learning of Science subjects. Needs analysis is done to identify the needs of the module before the module is developed and evaluated in the next phase (Saedah et al., 2013). Thus, the objectives of the needs analysis study are done to obtain data on the module requirements

and module specifications that will be developed to meet the needs of teachers, the objectives of the study for the needs analysis phase are as follows;

- Identify the need for appropriate modules for teachers to implement inquiry-learning and project-based learning approaches in secondary school Science subjects.

Research Questions

Based on the objectives of the above study, this research is also done to get answers to the following questions:

- What is needed to produce appropriate modules for teachers to implement inquiry learning and project-based learning approaches in secondary school Science subjects.

Literature Research

Project-Based Learning

Project-Based Learning (PjBL) is defined as a learning process that takes place through assignments with the ultimate goal of students producing a project. Through this PjBL, it is hoped that students will understand their learning goals by planning and producing a product or artifact. The learning process through the PjBL approach begins with the preparation of guided questions, understanding the concepts and core principles of the subject. Project-based learning usually goes hand in hand with the development of Information Technology. This integration opens up opportunities for teachers to use Education resources more wisely so that the teaching and learning process becomes more interesting and effective. In the context of the increasingly challenging world of education today, PjBL is seen as very suitable to be implemented in the curriculum in Malaysia (Balakrishnan et al., 2009).

The Malaysian government intends to nurture schools in the country therefore to ensure this goal is achieved then PjBL should be used as a teaching and learning practice in the classroom as well as other practices such as problem-based learning (PBL), computer-assisted learning (CAL) and century learning 21st (PAK21) (Educational Technology Division, 2010). In this study, researchers will design the Inquiry Learning and Project-Based Learning module (PI-PBPj Module) especially for KSSM Science students in primary secondary schools. According to Stephanie (2010) students will be more motivated and always motivated by curiosity when learning using the PjBL approach which is open inquiry learning. This is in line with Thomas (2000) study that PjBL approach also encourages students to find answers to challenging questions involving theories and principles in a discipline. The main basis of this PjBP method is that students build their own mental model in forming an understanding of the world around them (Papert, 1980). The production of the final product or artifact at the end of the teaching and learning process will give a more effective effect to the PjBL method, in addition PjBL will also be more effective if it can be integrated with technology and combined with collaborative learning with other students.

Daryanto (2009) states that project-based learning is a way of learning that gives students the freedom to think related to the content or teaching materials and planned objectives. Next, according to Boss and Kraus, project-based learning (PjBL) is a learning approach that emphasizes student activities in solving open problems and using students' knowledge in working on projects to produce specific natural products (Abidin, 2007). Furthermore according to Dian Curtis (2002) has stated that teaching and learning will be more effective depending on the learning methods implemented and PjBL is observed as a

learning method that has many advantages to produce effective teaching and learning. This PjBL approach or method is very suitable to be applied by all groups of students whether special education students or excellent students and it is found that the achievement of students who use PjBL is better than students who use normal or conventional methods (Curtis, 2002).

Inquiry Learning

Learning based on inquiry approach is not something new and there are various definitions associated with it. Philip (2004) states that scholars define the word "inquiry" into a variety of different definitions. The inquiry approach in learning can be seen in various forms depending on the subject area studied. For example in science subjects, inquiry may involve students in making investigations and explaining a phenomenon that is considered new to them, or students are required to test hypotheses scientifically in laboratory experiments. Based on the International Science Education Standards (National Research Council, 1996), science learning through inquiry refers to the activities performed by students in building their knowledge and understanding of scientific ideas such as the methods used by scientists to investigate the universe.

According to Sanjay (2009) inquiry learning emphasizes the process of critical and analytical thinking, in finding and finding answers to a problem in question while the opinion of Sagala (2010) inquiry learning is a learning approach that attempts to cultivate the basis of scientific thinking in students as learning subjects, therefore in the learning process students learn more on their own and develop creativity to solve problems. Next, inquiry learning is a method that stimulates students to do their own research or experiment in more detail to observe something that will happen, want to do something, ask questions, find their own answers, relate findings to other findings, and compare what they find with other students (Mulyasa, 2007).

According to Aziz (2007), understanding inquiry learning is a learning method that places and demands teachers to help students obtain data, facts, and information from various sources so that teaching and learning activities can provide maximum experience to students, in addition this experience can help students face and solve various problems in real life. Sudjana (2004), states that understanding inquiry learning is a teaching method that will create effective and conducive learning conditions, in addition it facilitates teaching and learning activities. The application of this method also requires students to learn by themselves at the maximum level and be able to develop their creativity in solving problems they face themselves as well as trying to lay the foundation and develop a scientific way of thinking.

Carin and Sund (1971) defined inquiry as indirect learning involving exploratory and discovery activities related to the process of obtaining information. It is based on questioning and problem solving in teaching and learning activities. Through these activities students will be involved in the processing of mental information to gain meaningful understanding and actively engage in their learning. While Herron (1971) has divided inquiry learning into four different levels (Table 1). These levels depend on how many roles are given to students in their learning process. The more roles students are given in their learning activities the higher the level of inquiry-based learning, and vice versa. If all problems, procedures, and answers have been provided by teachers and students only serve as recipients in their learning, then

it is not considered inquiry-based learning (*verification*). On the other hand, if problems, procedures and answers are given by the students themselves and the teacher only acts as a mentor then it is inquiry-based learning at the highest level (open inquiry). If, the teacher provides problems and procedures while students are required to find answers based on the procedures provided, then it is categorized as a structured inquiry. Next, if the teacher only provides temporary problems for the students themselves who determine the procedure and provide answers to the problems given, then the learning is categorized as guided inquiry.

Table 1:
Four Levels of Inquiry Learning (Herron, 1971)

Level	Type of Inquiry	Description
0	Confirmation	Students confirm certain principles based information activities by teachers and the results of and investigation have been known in advance.
1	Structured Inquiry	Students do research based on questions and steps that have been determined by the teacher.
2	Guided Inquiry	Students do research based on questions provided by the teachers and the selection of exploration steps is determined by the students themselves.
3	Open Inquiry	Students do research based on questions and steps constructed and determined by themselves based on specific.

Teaching and Learning Module

In the teaching and learning process, a teacher always strives to diversify teaching and learning approaches, methods and techniques in order to ensure that teaching and learning is carried out effectively and one of the methods used is the use of modules. Modules can be defined as containing a summary of material to be taught to students to facilitate students to classify the knowledge learned. This is in line with the statement of Noah and Ahmad (2005) that the module can help teachers teach a topic through various structured activities to achieve the set objectives. The use of modules can also attract school students' interest in teaching and learning as well as train school students to be praiseworthy through the application of noble values. Next, Rusell (1979) defines the module as a complete teaching unit used to achieve the stated learning outcomes to enable a student to master a unit of lesson content first before being transferred to another unit of study. The definition given by Rusell (1979) is consistent with the definition of the module stated by Husen and Postlethwaite (1985) which has defined the module as a set of teaching and learning packages complete with learning outcomes, teaching materials, learning and assessment activities as well its systematic and orderly use procedures to enable students to follow step by step learning to master a unit of study.

There are two types of modules, namely teaching modules and learning modules (Zulkepli, 2010). Teaching modules are modules specially designed for teachers that allow teachers to teach more effectively. It is equipped with the content of a subject specific to a topic. The teaching module contains strategies, actions and actions that can be maintained by the teacher along with the evaluation of the content of the subject (Norijah, 1997). While

the learning module is a self-learning guide where the user feels there is an opportunity to progress by learning on their own (Shaharom, 1994).

The results of the study found that teachers accept the use of modules because it can make it easier for them to make plans provided the modules produced are good and appropriate. Teachers also feel not tied to the use of modules and even they say the teaching is more structured, students ask a lot, and students think a lot. Modules can also help teachers in planning lessons in addition to it is more organized (Sidek, 2005). Furthermore, teaching and learning modules have been recognized as beneficial in the teaching and learning process (Noordin & Chin, 1991) are as follows:

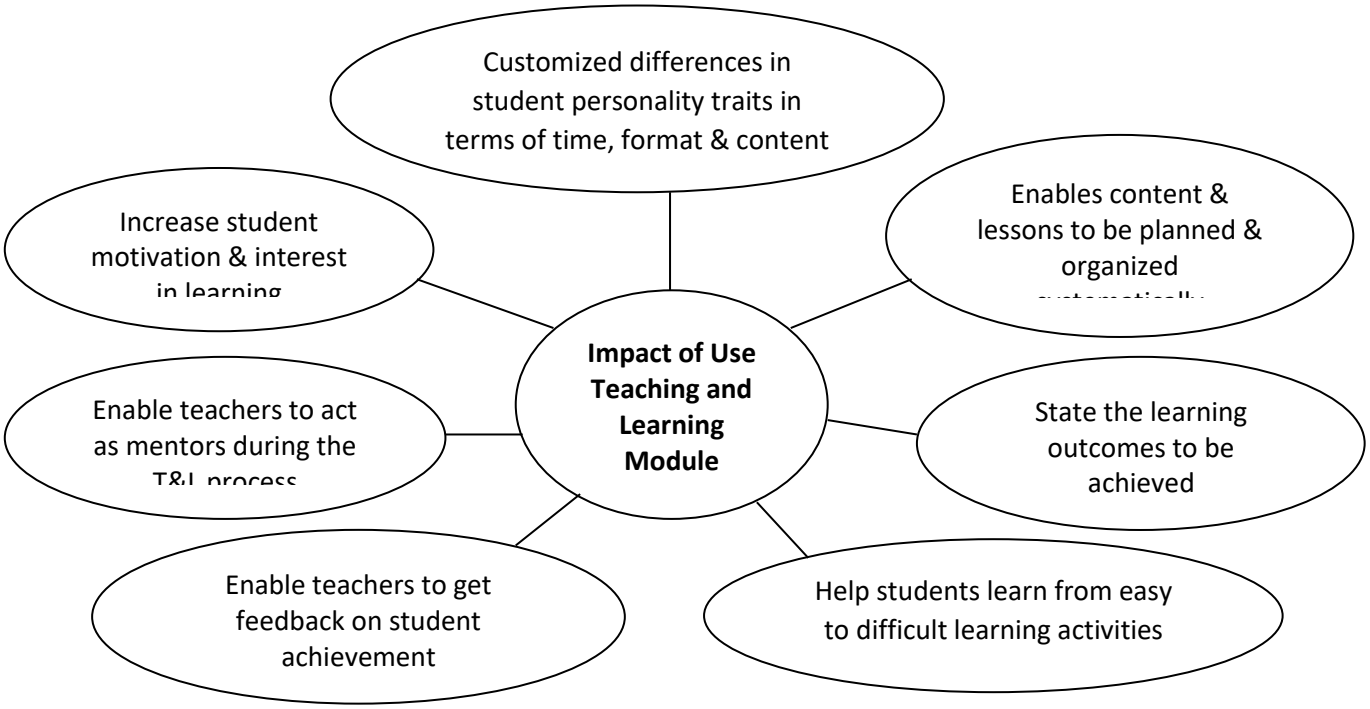

Figure 1: Benefits of Teaching and Learning Modules in the teaching and learning process (Noordin & Chin, 1991)

Needs Analysis

Needs analysis aims to identify existing issues and the need to develop the PI-PBPj Module. The designed module is expected to serve as a practical guide, how the pedagogy of the PI-PBPj Module can help teachers meet the needs of students to attract their interest in learning science through interesting and user-friendly methods. According to Witkin (1997) needs analysis is a method used to identify the gap between the current situation and the target situation. Whereas McKillip (1997) states that needs analysis is the value of judgment for certain groups that have problems that need to be solved. Needs analysis in this study will be conducted through survey techniques to identify the need for the construction of PI-PBPj Module based on the views of teachers. Study participants will be given a set of research questionnaires to get feedback on the requirements of the PI-PBPj Module.

Research Methodology

Needs analysis is done on Science subject teachers who aim to assess their needs in developing Inquiry-Learning - Project-Based Learning Module (Pi-PBPj Module). Needs

analysis also aims to identify existing issues and the need to develop the PI-PBPj Module. The designed module is expected to serve as a practical guide, how the pedagogy of the PI-PBPj Module can help teachers meet the needs of students to attract their interest in learning science through interesting and user-friendly methods. According to Witkin (1997), needs analysis is a method used to identify the gap between the current situation and the target situation. Whereas McKillip (1997) states that needs analysis is the value of judgment for certain groups that have problems that need to be solved. Needs analysis in this study will be conducted through survey techniques to identify the need for the construction of PI-PBPj Module based on the views of teachers. Study participants will be given a set of research questionnaires to get feedback on the requirements of the PI-PBPj Module.

This needs analysis study will use a set of questionnaires for data collection. The questionnaire was modified from the study of Jamil et.al. (2013). The questionnaire used a five-point Likert scale of 1 = strongly disagree, 2 = disagree, 3 = disagree, 4 = agree, and 5 = strongly agree. This questionnaire contains 4 sections. Section A deals with demographic factors which contain 4 questions related to career as a teacher. Section B deals with teachers' perceptions of Science teaching. Section C deals with perceptions of teaching methods based on the recommended Curriculum and Assessment Standard Document (*Dokumen Standard Kurikulum dan Pentaksiran* - DSKP). Section D deals with the level of knowledge and skills of teachers on inquiry and project-based learning approaches. While Section E measures the level of acceptance to apply the Inquiry-Learning and Project-Based Learning Module (Modul PI-PBPj)

The respondents of the study consisted of teachers who teach Science subjects in the State of Sabah which involves 2 districts, namely Kota Kinabalu and Penampang. A total of 50 respondents were involved in the study which was managed by the researcher himself. The data obtained were analyzed through descriptive statistics using SPSS software. Descriptive statistics are used in this study because the data generated will be able to be considered as a summary of the entire data set. It is also able to provide information directly and easily (Walsh, 1990; Pallant, 2007). The descriptive statistics used were frequency, percentage, mean and standard deviation. Interpretation of mean score based on Pallant (2007) is as follows: mean score 0.00-1.66 is at low level, mean score between 1.67 - 3.33 is at medium level while mean score between 3.33 to 5.00 is at high level. Among the analyzes performed using descriptive statistics include percentage, frequency and mean score. This analysis is also used to show the composition of respondents and demographic characteristics of teachers such as gender, teaching experience, level of understanding and implementation of teachers on inquiry and project-based learning approaches. Interpretation of mean scores to determine teachers' agreement on the construction requirements of the Science PI-PBPj Module is shown in Table 2.

Table 2:
Interpretation of Teacher Consent Mean Score

Teachers Efficacy Mean Score	Level
1≤ M ≤ 1.66	Low
1.67≤M ≤ 3.33	Medium
3.34≤ M ≤ 5.00	High

Findings of the Study and Discussion

The discussion related to the results of this study focuses on the needs analysis in the development of Inquiry-Learning – Project-Based Learning Module (PI-PBPj Module). The scope of further discussion of the study will refer to the demographics of the study respondents which includes gender, teaching experience, level of knowledge and understanding of teachers on inquiry learning approach and project-based learning. Next, we will also discuss the findings related to teachers' perceptions of Science teaching methods and also Science teaching based on the Secondary School Standard Curriculum (KSSM). The level of teacher acceptance of the PI-PBPj Module in terms of performance expectations, attitudes and also the desire to use this module will also be analyzed in more detail. Based on the expected findings from the study questions, it will be possible that the PI-PBPj Module can be used as one of the support tools in the teaching of Science subjects. Through these findings, it is also possible to implement the PI-PBPj Module in support of teaching and learning teachers so that it is more effective and more interesting for students to follow the teacher teaching and learning sessions conducted more systematically and in turn it will increase the interaction between teachers and students.

Conclusion

It is hoped that the findings of this preliminary study will enable researchers to obtain a specific picture of the development needs of a teaching and learning module by suggesting improvements and focusing on important aspects in the process of developing effective teaching and learning modules based on empirical research data meaningful learning can be implemented through more effective approaches. Therefore, the findings of this study are also expected to provide an initial overview of the need to develop an inquiry-based teaching and learning module and a more practical project in the process of teaching and learning Science.

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