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THE DEVELOPMENT AND IMPLEMENTATION PHASE OF THE STEM INSPIRATIONAL MODULE

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ABSTRACT

This paper discusses the development and assessment of STEM Inspirational Module. In this study a total of 20 students of Form One (13 years old) and two teachers become sample of the research. The module's development theory and methods are described in detail through two phases in Design and Development Research (DDR), which is the Development and Implementation Phase. This research uses a purposive sampling technique that collecting data from panel of expert (lecturer), three teachers and 20 students. Research instruments used are questionnaires and structured interviews conducted to both the teachers and the students. Data were collected and analysis of mean and percentages were carried out. The findings show that majority of the students and teachers have moderate perception towards the items tested. Through the implementation of STEM Inspirational Module, the teachers can encourage inquiry-learning.

Keywords: science; module; STEM; DDR

INTRODUCTION

Science education reforms have evolved and produced Science-Technology-Engineering-Mathematics (STEM). In order to teach conceptualization of various disciplines, new approaches, pedagogy and teaching materials are needed. This is because, solving complex problems from STEM discipline combinations require students to understand the relationship between these areas. However, Science Text Books are based on specific facts rather than methods to apply facts and concepts into new situations (Riskowski, et al., 2009).

Thus, to ensure the success of implementing STEM Inspirational Module, the researchers develop STEM Inspirational Modules based on Research Design and Development (DDR). Research is a form of systematic investigation, and in education it involves an empirical process using systematic methods (Crowl, 1996). Research development requires a variety of research methodologies, research tools, and summative assessments implemented through experimental designs (Richey, Klein & Nelson, 2004). As such, researchers develop STEM Inspirational Modules based on research design and development.

The researchers chose the Design and Development Research (DDR) model by Richey, Klein and Nelson (2004). The DDR is based on action oriented, student-centered, and collaborative concepts. There are four phases in DDR: Analysis, Strategy Design, Module Development, and, Implementation and Evaluation. This research article focuses only on the last two phases in DDR, which is the Development Phase and the Implementation and Assessment Phase. The learning modules are developed in the form and format as decided at the design stage.

AIMS OF RESEARCH

Research is aimed at discussing step by step in developing the STEM module. The theory and method of Implementation Module Development Phase and Implementation Phase and Evaluation of the STEM Inspirational Module are discussed further.

THE DEVELOPMENT OF STEM INSPIRATION MODULE

The Development Phase

The Development Phase involves the construction process of the STEM Inspirational Module based on an analysis of the strategy in teaching and learning needs that has been planned in the Strategy Design Phase. This phase involves collaboration between individuals who develop modules (researchers), users (teachers), teachers as well as pedagogical experts (Nor Aziah, 2012). In addition, she also explained that information obtained from data analysis can be used to enhance value, effectiveness, and functionality. Assessment is an important step to help researchers to get feedback on the usability of module and suggestions to improve it.

This study involves seven science teachers to help and complete the questionnaires about STEM Teaching Effectiveness Servey. Other than that, five students selected from sample to complete the STEM Learning Effectiveness. The majority of students involved in this research are bumiputras, so the socio-economic status and ethnic culture factors are also emphasized in the design of STEM Inspirational Module.

There are some tips in developing the learning module (Koneru, 2010). The first tip is to develop a learning module based on presentation and media modes as decided at the design stage. Secondly, the learning activities should promote reflective learning. Thirdly, the researcher should develop evaluation instruments to measure learning outcomes (formative and summative).

Implementation and Evaluation Phase

In order to respond to the STEM-based educational reform call, the module developed needs to be tested and to ensure that the module ables to apply knowledge, skills and STEM values through inquiry, students' daily life, the environment and society localy and globaly.

Thus, this phase is important to determine the strengths and weaknesses of integrating STEM Inspiration Module in teaching and learning science. In this phase, the researchers needs to review the instructions in modules to improve the students' understandings and it's effectiveness to help them completing activities in the module.

In this context, researchers apply the STEM Inspirational Module in Form One science classroom. The teachers were trained to apply learning module in science classroom using the guided inquiry approaches. The researcher explains the five steps of 5E Learning Cycle, and inquiry technique. Researchers also explain the precautionary measures required to ensure the successfulness of applying STEM Activity. Moreover, the students adopt the STEM Inspirational Module in an existing learning environment. Later, modifications to the module are based on comments and suggestions from them.

METHODOLOGY

This study uses purposive sampling techniques to collect data from three science teachers, one pedagogy experts and 20 students. Face validity is obtained from the panel of expert to ensure students readability and understanding of items in research instruments. The instrument contains 25 items that used Likert Scale (1-5).

FINDINGS

The teachers need to evaluate the module based on components of table, graphic, text, daily lesson plane, STEM Activities, theory applied, practicality and easy-to-use. Summary of analysis of findings is shown in Table 1.

Table 1: Analysis on Teaching Effectiveness

No.	Components	Likert Scales				
		1	2	3	4	5
	Figures and Table					
1	Coressponds to the Form One science knowledge content.				1 (25%)	3 (75%)
2	Helps in understanding knowledge contents.				2 (50%)	2 (50%)
3	Use the appropriate color.				2 (50%)	2 (50%)
4	Content knowledge arranged neatly.				2 (50%)	2 (50%)
	Text					
5	Neat text layout.				2 (50%)	2 (50%)
6	Clear and easy to read.				2 (50%)	2 (50%)

7	Instructions of each STEM Activities are clear and easy to understand.			1 (25%)	1 (25%)	2 (50%)
	Daily Lesson Plan					
8	Compliance with *Dokumen Standard Kurikulum Penilaian (DSKP)* for Form One Science.				1 (25%)	3 (75%)
9	Compliance with Classroom Assessment.	1 (25%)				3 (75%)
10	Compliance with Engineering Design Process.	1 (25%)			1 (25%)	2 (50%)
11	Suitable with skills that Lower Secondary Students acquired.				3 (75%)	1 (25%)
12	Lesson can be conducted in two to find periods.		1 (25%)	1 (25%)	2 (50%)	
	Activities					
13	Increases students' interest to learnt science.				1 (25%)	3 (75%)
14	Increases students' skills in managing tools and technologies.				2 (50%)	2 (50%)
15	Integrating Engineering Process skills.			1 (25%)	1 (25%)	2 (50%)
16	Integrating Mathematics to solve problems.			1 (25%)	2 (25%)	1 (25%)
	Theory Applied in STEM Activities					
17	STEM hands-on activities help to develop students' cognitive.		1 (25%)		1 (25%)	2 (50%)
18	Students' gains knowledge through inquiry-discovery process.		1 (25%)		1 (25%)	2 (50%)
19	Activities helps students to build understanding about content knowledge.				2 (50%)	2 (50%)
20	Encourage students to think creatively and innovatively.		1 (25%)			3 (75%)
	Practical and Easy-to-use					
21	Activities are organized according to learning chapters.				1 (25%)	3 (75%)
22	Guides and checklists help teachers to conducts the STEM activities.				1 (25%)	3 (75%)
23	Tools and materials are easy to finds and set up.				1 (25%)	3 (75%)

24	Tools and materials are low cost.	1 (25%)	3 (75%)
25	Activities can be conducted inside or outside laboratory.	2 (25%)	2 (25%)

The results revealed that the pedagogical expert and teachers agreed and strongly agreed to the statement in Figures and Tables components. In item 1, the result shows that the figures and tables used in the STEM Inspirational module coressponds to the Form One science knowledge content. In Item 2, they agreed that it helps them in understanding knowledges contents. In item 3, most of the respondens agree that the graphic helps in understanding knowledge contents. Moreover, in Item 4, the teachers agree that the photos, figures and table are arranged neatly.

Next, the researchers discussed about the text components that used in designing the STEM Inspirational module. In Item 5 the teachers agree (50%) and strongly agree (50%) that the texts layout in the module are neatly arranged. Findings in Item 6 show that majority of teachers (75%) agree on the statement that the directions of the activity are clear and easy to understand. Meanwhile, the remaining teacher (25%) disagree on this statement. The teachers explained that activities proposed should accompliace with learning contents. Besides, in Item 7 the teachers (75%) agreed that the instructions for each of STEM Activities are clear and easy to understand. Based on this comment, the researchers make some improvements and restructured the Lesson Plan based on the Engineering Design Process and the 5E Lesson Phase.

Discussion continued with the analysis of Daily Lesson Plan component. The findings of Item 8 shows that teachers (75%) and pedagogical expert (25%) agreed that the module adhered to the *Dokumen Standard Kurikulum Penilaian (DSKP)* for Form One Science. Furthermore, in Item 9 the majority of teachers (75%) agreed that module was in conjunction with classroom assessment requirements and *Engineering Design Process*. However, the pedagogical expert (25%) disagrees with these statements. According to her, the module should be accompanied with scoring rubric. Based on this suggestion, one of the researchers develops the scoring rubric that compliance with lessons learning outcomes and classroom assessment. This to encourage teachers to integrate STEM Inspirational module in science classroom and also helps them to assest students' level of mastery according to the classroom assessment requirements.

Other than this, the researchers investigate the impacts of module in developing skills that needed in STEM learning. Analysis of Item 13 show that all teachers and pedagogical expert agree that module is able to attract students' interest to science. In Item 14, all assessors also agreed that module improves students' skills in using equipments and technologies. In Item 15, most of the teacher (75%) agree to the statements that the module able to integrates Engineering Process skills. However, the pedagogical expert has different point of view, she disagrees with statements in Item 15. Thus, one of the researchers make design a flowchart to helps student records their observation, activities and findings based on step in Engineering Designt Proses.

Other than this, in Item 16 pedagogical expert (25%) less likely to agree on the statement that the module integrates mathematical skills. Based on this comment, one of the researchers makes some changes to the task guides. For examples, the researcher creates a record of materials cost for each project. This will help students to develop mathematics skills in determining the cos of production of each activity. However, it should be understood that not all mathematical learning content in secondary schools can be integrated into the engineering design approach. Furthermore, secondary school students lack cognitive ability to combine mathematical thinking in the design of engineering-based solutions (Kelley & Knowles, 2006).

The researchers also investigate the suitability of theory that applied in developing the module. Analysis of Item 17 show that most of the teachers (75%) agree with the statement that the STEM hands-on activities help to develop students' cognitive. However, one (25%) of the teachers disagree with this statement. Besides, in Item 18, all of the teachers except the pedagogical experts (25%) agreed that the students acquire knowledge through inquiry-discovery processes. This statement was also supported by Mao, Chang, and Barufaldi (1998) that the inquiry-based learning method was able to enhance students' understanding of learning concepts and achievement in questions involving high level cognitive skills compared to traditional teaching methods.

Moreover, analysis on Item 19 found that all of the teachers and pedagogical expert agreed that the module helps students to develop an understanding of the topic. This is because inquiry learning was anticipated to bring good results and have been proven that by Pine et al., (2006) that the students which has been exposed through inquiry learning get better results in TIMSS rather than the students that taught through text only.

Moreover, in Item 19 the pedagogical expert (25%) thought that the module unable to encourage the students to think creatively and innovatively. She explained that this module is like 'recipe book' and does not encourage students to think creatively and innovatively. Based on this comment, the researchers modified the activities guidelines that can facilitate students to build concepts rather than rigid and absolute guidance in producing the products. The purpose is to enable students to become independent and creatively in producing STEM learning products. Thus, the students will have opportunity to identify product weaknesses and find a way to overcome it.

Lastly, the researchers discussed the practical and easy-to-use aspects. Analysis of Item 21 shows that all respondents (100%) agree that the activities are organized according to the learning chapters. This finding replicated in Item 22, all the teachers agree that the guidelines and checklists help teachers to conducts the STEM activities. In addition, Item 23 and item 24 show that all of the respondents (100%) state that the apparatus and materials used in the activity is low cost and easy to be prepared. The findings show that the module achieved it purpose to provide learnings materials that affordable for all of the students. Additionally, all respondents (100%) agree on Item 25 that the module can be conducted without the used for a Science Laboratory.

EVALUATING THE EFFECTIVENESS OF STUDENT LEARNING

The effectiveness of students' learning is evaluated from four main components which are; Content Knowledge, Learning Effectiveness, Practical and User Friendly. The data collected in this research were interpreted to three parts, ie negative (scale 1.00-2.99), moderate (3.00-3.99) and, positive (4.00-5.00). Table 2 shows the analysis findings for 20 students.

Table 2: Results of Evaluating the Students' Learning Effectiveness

No	Components	Mean	SD	Interpretation
	Contents Knowledge			
1	Improve the skills of calculating, measuring and arranging patterns.	4.40	0.74	Positive
2	Promotes inventions, designing skills, invents and generates new products.	3.93	1.10	Moderate
3	Teach me to design steps to solve a problem.	3.87	0.99	Moderate
4	Help me get a good result in Classroom Based Assesment.	4.13	1.06	Positive
	Learning Effectiveness			
5	I enjoyed participating in STEM activities.	3.80	1.42	Moderate
6	Increasing achievement in science test.	3.60	1.40	Moderate
7	Increase my interest in careers in STEM-related fields.	3.47	1.30	Moderate
	Practicality			
8	I can complete the task for each STEM Activities within the specified time frame.	3.47	1.06	Moderate
9	Can create interactions between students-teachers.	3.67	1.35	Moderate
10	Module encourages students to try new ideas.	3.73	1.28	Moderate
11	Knowledge learned can be used in real life.	3.87	1.30	Moderate
	User Friendly			
12	The instructions contained in the module are easy to understand.	3.67	1.05	Moderate
13	The materials and tools used in the module are easy to prepare.	3.80	1.32	Moderate
14	The module promotes group activities.	4.13	1.23	Positive

The analysis of Content Knowledge component shows that the students have positive and moderate perceptions. In Item 1 (m=4.40, SD=.74), the students agrees that the module can improve mathematical skills such as calculating, measuring and arranging patterns. The integration of mathematics into the science curriculum is critical to developing quantitative process skills to meet the needs of modern science (Depelteau et al., 2010). In this context, the researchers try to inculcate the skills in calculating the cost of the material for each product it produces. Combining mathematical analysis in STEM practice is necessary to evaluate design solutions as well as to rationalize students to learn mathematics and to see the relationship between what is learned in school with STEM Career skills (Burghardt & Hacker 2004).

Other than this, in Item 2 (m=3.93, SD=1.10) the students also agreed that the module helps them to acquire technology skills such as designing, creating and producing new products. The skills are important because the manipulation of materials and equipment is capable in developing the students' interpretations and thoughts on the practical issues faced (Nurzatulshima, 2010). To meet this goal, technology literacy in curriculum content should create opportunities for students to think critically about technology, and not as objects (Kelley & Knowles, 2006). In the context of this research, educators should give students the opportunity to think and make technology as a vehicle to bring about changes and positive impacts on culture, society, politics, economy, and the environment.

Furthermore, in Item 3 (m=3.87, SD=.99) the students agreed with the statements that the module can help them in designing problem-solving steps. In the context of this research, students are given the Engineering Design Process Flow Chart to help them plan and manage the exploration of knowledge systematically and effectively. This step is implemented in parallel with the statement by Kelley and Knowles (2006) which stated that engineering design creates the opportunity to apply science and investigative knowledge as well as provide authentic context to learn mathematical thinking in making informed decisions during the design process. With this, the students can build their own experiences by giving them the opportunities to build science and mathematical knowledge through scientific design and investigation analysis. Besides, in Item 4 (m=4.13, SD=1.06) the students state that they are confident of achieving good results through STEM activities. This is because they are getting self-esteem as a result of problem solving-based activities (Zhe et al., 2010).

Additionally, students found that they had a moderate perception towards Learning Effectiveness component. In Item 5 (m=3.80, SD=1.42) the students show moderate perception towards STEM activities. This is because there are also students who act as observers and are not directly involved in science-based activities (Filmer & Poh, 1997). This phenomenon occurs because of the lack of student interest in the activity, or does not consider practical activities as an important (Noor Akmar, 2007). However, the researchers examined the TIMSS report (2007) which found that students' attitudes and values towards science and mathematics were high.

Even so, in Item 6 (m=3.60, SD=1.40) the students also moderately agree that through STEM activities, the science’s academic performance grades will improve. The findings supported TIMSS (2007) that found the students’ confidence in science and mathematics was low. This clearly shows that students find it hard to achieve excellent results in science and mathematics (Fatin et al., 2014). In the context of this research, the inquiry activities can improve student achievement and reduce the achievement gap for students that came from low socioeconomic status families (Von Secker & Lissitz, 1999 in Degenhart 2007).

This statement was also supported by Mao, Chang, and Barufaldi (1998) that the inquiry-based learning method was able to enhance students' understanding of learning concepts and achievement in questions involving high level cognitive skills compared to traditional teaching methods.

In the meantime, in Item 7 (m=3.47, SD=1.30) the students also demonstrate a moderate perception towards module’s ability to increases theirs’ interests in careers that related to STEM fields. The responses are inline with previous research that the STEM program has been a contributing factor in the selection of courses in college (Zhe et al., 2010). Thus, this is a factor that contributes to career aspirations in the STEM field.

Analysis founds that students showed a mild perception towards practicality aspect of module. Result on Item 8 (m=3.47, SD=1.06) shows the students agree that they are able to perform STEM Activities within the prescribed time. However, in the previous researchs, it is pointed out that teaching based on the theory of Constructivism takes a long time to be implemented compared to the time allocation for each learning topics (Airasian & Walsh, 1997). The findings support previous research that mentioned the studentes agree that their group members can complete the exercises within the prescribed time (Nurzatulshima & Lilia, 2014). Thus, the findings prove that the STEM Activities can be applied in classroom.

Other than this, in Item 9 (m=3.67, SD=1.35) the students show moderate perceptions to the statement that the module can create interactions between students-teachers. This is important because the students build knowledge based on existing knowledge and experience gained while engaging in active collaboration in learning activities (Taber, 2001).

On the otherhand, in Item 10 (m=3.73, SD=1.28) the students agree with the statement that the module encourages them to try new ideas. From the point of view of the students, they hope that the teachers will be more creative while delivering knowledge using various teaching aids (Begum & Gnanamalar, 2016). This is because the science laboratory learning environment only gives little freedom in generating new ideas (Ahmad, Osman & Halim, 2010). Besides, in Item 11 (m=3.87, SD=1.30) the students agree that the knowledge learned can be used in real life. From previous research, it is found out that the students failed to relate the concepts learned with daily life aspects (Aziz & Aimi, 2010). Thus, the findings prove that the STEM Inspirational module has potential to promote knowledge that can be used in students’ daily life.

Continued from the above discussion, the researchers examined students’ perception towards the User-Friendly component. In Item 12 (m=3.67, SD=1.05), students’ shows moderate perceptions towards the statement that the modules were easy to understand. The same finding is also obtained for Item 13 (m=3.80, SD=1.32), which is about the convenience of providing the materials and equipments that needed in conducting STEM activities. These findings show that the module achieved it purpose to provide learnings activities that suitable for all students with no regard to theirs’ familys background. This is important because the students with higher economic background eventually will get high academic achievement (Stewart, 2008; Navarro, Flores & Worthington, 2007). By adapting ‘Education for All’, the researchers hope to decrease the achievement gap among students with different socio-economic background.

In the meantime, the students also demonstrated a positive perception of Item 14 (m=4.13, SD=1.23) with statement that the module promotes group activities. Peer-to-peer interaction and behaviors can encourage student learning (Britner & Pajares, 2006). While conducting the activities the students collaborate in groups and complete assignments using Inquiry and Collaborative approaches with other partners (National Research Council, 2000).

Overall analysis shows that majority of the students had a positive and mild perception towards learning effectiveness components of the module. However, statistical analysis found a significant Standard Deviation values between 0.74 - 1.35. The results also shows that majority of the items have a standard deviation value of greater than one. This indicates that there is a very clear dispute between students. For example, some of the students strongly agree with the statement "I'm happy to join STEM activities" while some do not agree with this statement.

ASSESMENT OF TEACHER'S TEACHING EFFECTIVENESS

The questionnaires for STEM integration in the teaching of science was completed by two teachers. Both, Teacher A and Teacher B use STEM Inspirational Module for their lesson. There are four components tested in the questionnaire which are Content of Knowledge, Effectiveness of Teaching, Practicality, and User Friendly. Table 3 shows the findings on Teachers' Evaluation towards STEM Inspirational Module.

Table 3: Teachers' Evaluation Towards STEM Inspirational Module

No	Item	Likert Scales				
		1	2	3	4	5
	Contain of Knowledges					
1	The module is consistent with its goal of integrating science knowledge with the concept of Engineering, Mathematics and Technology.				1	1
2	The module has innovative elements in terms of teaching techniques.				1	1
3	STEM activities are appropriate for the implementation of Classroom Based Assessment.				2	
	Effectiveness of Teaching					
4	The hands-on activity in the module can attracts students to be involved in STEM integrated learning.				1	1
5	The module facilitates teachers to plan activities according to the lesson.				2	

6	The module is effective in enhancing students' understanding in science subject.	1	1	
	Practicality			
7	Rubrics scoring for each activity facilitates teachers to conducts Classroom Based Assessment.		1	1
8	Lesson can be completed within 2-5 hours.	1	1	
9	Modules can create student-teacher interactions.		2	
10	Modules are flexible and can be modified according to the student's learning level.	1	1	
	User Friendly			
11	Lesson plans provided in the module were easily applied in classroom.		2	
12	Easy to prepare materials and apparatus used in STEM activities.	1	1	
13	Easy to implement STEM activities.		2	
14	Some activities can be conducted inside classroom without the needs to go to laboratory.		2	

Analysis showed that both teachers have positive perceptions towards content knowledge components. Item 1 shows that both teachers positively agree on the statement that the module meets the objectives of integrating STEM in science learning. Furthermore, in Item 2 both of the teachers agreed that the module promotes innovation of teaching techniques. Innovation of teaching techniques is a requirement of self-development of teachers as an effort to improve science teaching and learning performance (Halim et al., 2006).

In addition, Item 3 showed the teachers agree to the statement that the STEM activities are appropriate for the implementation of Classroom Based Assessment. To reduce teacher burden, the STEM Inspirational Module is integrated with Classroom Based Assessment. Through this innovation, teachers can implement STEM activities and the learning products are assessed and given score.

Furthermore, the researchers discussed about the Effectiveness of Teaching component. In Item 4 showed that the teachers agreed to the statements that the hands-on activity in the module can attracts students to be involve in STEM integrated learning. This is because the approach of Constructivism aims to create learning excitement and produce creative students (Henson, 2004). In this context, the teachers play a role as facilitator and give students the opportunity to discover or apply ideas based on their creativity in solving problems.

Besides, in Item 5 showed that the teachers agreed on the statement that the module facilitates teachers to plan activities according to the lesson. This finding is in accordance to reports by Richard, Laufer and Humphrey (2002) that found that teachers wanted more teaching kits as well as the development of professionalism in using STEM teaching kits. In this context, the Teaching Kit is used during science teaching sessions in the classroom. Through these learning activities, the engineering process works were linked to mathematical concepts with science to solve problems in the real world.

Besides, in Item 6 it is found that one of the teachers have positive perceptions towards the statement that the module helps students understand the topic being tested. This is because, when students perform STEM activities, they use the senses to obtain information and analyze the findings obtained through observation. Through material manipulation activities, students can remember the concepts and facts related to the material more effectively (Nurzatulshima, 2010).

However, in Item 6 another teacher notes that students have difficulty completing STEM assignments within the stipulated time. When asked further, these teachers concluded that the failure of the student to complete the assignment indicates that the students did not master the concept of science for the topic being tested. This due to students with low cognitive skills may find that the inquiry-based learning is difficult and eventually breaks down on the basis (Kuhn et al., 2000). Nonetheless, teachers are responsible for planning and organizing teaching and learning so as to attract students to science. Learning depends on the teacher's perception of teaching methods, and their efforts to instill inquiry skills to their students (Degenhart, 2007).

Analysis of the Practicality component shows that the teachers have mixed perception from moderate to strongly agree with the statements. In Item 7, both teachers showed positive perception towards the scoring rubric for the implementation of Classroom Based Assesments. This show that science teachers need self-help in diagnosing and assessing students' performance (Halim et al., 2006). However, one of the teachers disagrees with the statement that STEM activities can be completed in 2 to 5 teaching periods. This might be due to teachers' inefficiency is managing time thus led to inability to complete activities in specific time (McBride et al., 2004). For example, some teachers might experience problems in managing time during the transition of learning phases or change in learning materials.

In the meantime, in Item 9 both teachers agreed that the module was able to create interactions between teachers and students. The concept of teachers as information disseminator and students as passive listeners have long ago outdated (Kumar, 2006). When applying the STEM Inspirational Module, teachers act as facilitators to guide and communicate with students in learning activities. Teachers need to establish good relationships with students so that the knowledge they learn is meaningful (Henson, 2004).

On the otherhand, in Item 10 the teachers show moderate to positive perceptions towards the statement that the module is flexible and can be modified according to the student's learning level. As such, the STEM Inspiration Module is developed to enable students to build their own knowledge during STEM activities. Through this activity, students are free to build knowledge and collaboration among themselves. In this context, teaching is done based on the principle of scaffolding. That is, the teacher acts to support student learning and then reduce the support or assistance after the student has confidence or master the skills (Taber, 2009).

This discussion continued with the findings of the User-Friendly components. In Item 12, both of the teachers agree on the statement that the materials and apparatus that needed in conducting the STEM activities are easily to be prepared. Previous research in the problem statement mentioned that the materials and apparatus inside science laboratory was incomplete (Rubiah et al., 2003 & Mat Rashid, 2014). Moreover, the absence of laboratory assistants complicates teachers in providing materials and apparatus for experiments (Halim et al., 2006). These researchers also claimed that it would result in the teacher's lack of teaching time. This finding shows that the STEM Inspirational Module can overcome the problems due to shortness of laboratory assistants in school.

In this context, the researchers set up the STEM Inspirational Kit which is a box that contains the basic materials required to complete the STEM Activities. For example, in Solar Cooker activity, the teacher only needs to ask the students to bring empty shoes box or Pizza box from home. Other materials such as scissors, cellotape, plastics wraps, aluminum papers, biscuits and chocolates are provided in the STEM Inspirational Kit.

Although teachers are provided with STEM Inspirational Kit, Teacher B still feels that the modules are less flexible and not suitable for all students. This further influences Teacher B to disagree in Item 13 with the statement that the activities in the module are easy to implements. When asked to look into this issue, Teacher B explained that the activity was difficult because the students did not carry the material needed during the day that she plans to conduct the STEM activities. For example, Teacher B state that the students did not provide a box for the Solar Cooker activity. Teacher B explained that only certain classes with good discipline can complete STEM activities.

To overcome this problem, the teacher may ask the students to prepare the materials earlier and collects it a week before the targeted date to conduct the STEM activities. Discussions between teachers and researchers have brought together a list of materials and tools to be included in the STEM Inspirational Module for students. This is because, preparing a module manual that includes a list of tools and materials need for STEM activities will helps the students to complete practical work (Din-yan & Yung, 1998). The goal is to ensure that the students know the type and quantity of equipments needed in each STEM activities.

Other than this, both teachers agree with item 14 that some of the activities can be conducted inside classroom without the needs to go to laboratory. Previous reseachers show that there was an infrastructure problem that was lacking in science laboratory facilities, apparatus, and materials (Halim et al., 2016). These findings show that the STEM Inspirational Module has potential in dealing with the lacks of laboratory’s apparatus and materials.

CONCLUSION AND RESEARCH IMPLICATIONS

The STEM Inspirational Module is intended to encourage inquiry-learning. Through this effort, it is hoped that teachers will no longer feel overwhelmed to spend time providing teaching and learning materials. The goal is to create an effective learning and improve science achievement. At the same time, to encourage students to choose their STEM career. Moreover, STEM's workforce is seen as a strong indicator of the country's ability to generate ideas towards creating innovative products and services (Chew, Noraini & Leong, 2014).

This requirement has caused the researchers to implement DDR in developing the STEM Inspirational Module. This step is taken to document the module's development procedures systematically and regularly. Overall, it can be concluded that the implementation of STEM Inspirational Module requires teachers to have time management skills and ability to discipline the students. Both of these skills are important for teachers to successfully conduct STEM-based practical activities in science education. This is because, the teacher is the manager inside the laboratory or classroom. As such, a good time management aspect influences the success of practical implementation.

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