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Competencies of Science Centre Facilitators

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ABSTRACT

In the era of globalization, the structures of non-formal science education, such as science centre, plays an important role in nurturing interest in science. At the same time, the interactive exhibitions reinforce understanding of science concepts. This is where the science facilitators play a significant role. Thus, the aim of this study was to identify the level of science facilitators' competencies in science centre based on the perceptions of science teachers. This study involved 202 science teachers who completed a survey designed to elicit their perceptions on the level of science facilitators' competencies. The sample was chosen through random sampling. The questionnaire was based on three main domains: pedagogical content knowledge, personal development and learning assistance. Results from the descriptive analysis showed that the level of competencies among the science facilitators was at a moderate level for all domains i.e pedagogical content knowledge (mean = 2.61), personal development (mean = 2.78) and learning assistance (mean = 2.78). The findings from multivariate analysis of variance (MANOVA) showed that there was no difference in the perceptions between the teachers who had visited and who had never visited the Science Centre towards the level of competencies of the science facilitators. This suggests that science centres need to improove the competencies of the science facilitators based on the three domain.

Keywords: Science Facilitators; Competencies; Non-Formal Science Learning; Science Centre; Pedagogical Content Knowledge; Personal Development; Learning Assistance.

INTRODUCTION

The National Philosophy of Science Education in Malaysia states that 'In consonance with the National Education Philosophy in Malaysia, it nurtures a science and technology (S&T) culture by focusing on the development of individuals who are competitive, dynamic, robust, resilient, and are able to master scientific knowledge and technological competencies' (Malaysian Ministry of Education (MOE), 2011). Thus, science curriculum has been designed to instil and develop children's creativity through learning experience and scientific investigation to acquire scientific knowledge, thinking skills, scientific attitudes and values.

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According to Eshach (2007), science education involves two types of learning processes, namely at school (formal) and outside school which can be divided futher categorised into informal and non-formal science learning. Learning science in school is focused in the classroom, and thus, due time conntrains might not fully develop students' cognitive abilities and scientific skills (Aziz & Said, 2011). Therefore non-formal science learning should be implemented to complement the formal learning that takes place in schools.

Science education in Malaysia is seen as the vehicle to develop the country's economic development. Recognising the importance of this role, the MOE introduced the 60: 40 Policy (i.e Science and Technical Stream: Arts Stream) since 1970 and the policy still continues to date (MOE, 2012a). However, the goal of this policy has not been fully achieved, where the percentage of students taking science at both school and University levels is only 29%. In addition, the achievement of science and interest of students towards science has also decreased. The quality of science education has also decreased as shown in the TIMSS result where Malaysian obtained an average score of 492 in the 1999 TIMSS, 510 in 2003, 471 in 2007 and 426 in 2011 (MOE, 2012b; IEA, 2008, 2012).

Exposure and experience in the field of S&T need to be enhanced in nurturing the desire and interest of students in S&T. Learning process based on experience involves a variety of hands-on activities and on-site learning, and this process needs to be strengthened. Non-formal learning has been introduced in the education system in Malaysia so that contextual and meaningful learning can be carried out. At the same time, it can enhance the interest of students towards science since research has shown that the interest towards science has decreased (Osman, et al., 2007; Iksan, et al., 2006). Studies showed that children spent 80% of their time outside the classroom (Eshach, 2007). Learning activities outside the classroom can have significant impact on the learning process. Hence, the non-formal science learning is experience based, inquiry based, and hands-on activities are part of learning process that can improve science literacy (FriedHoffer, 2007). Non-formal science learning also enables students to learn from the environment. Therefore, this exposure has proven that non-formal learning outside the classroom also has an important role in addressing the issue of declining students' interest in science (Mirrahmi, et al., 2011).

Non-formal science learning can also be obtained through various agencies or organizations that carry out training, in-service courses, seminars, workshops, and other planned activities. Eshach (2007) states that the non-formal science education occurs in places like science centres/museums, botanical gardens, zoos, aquaria, planetarium, industrials, interactive exhibits, and many more. Falk and Dierking (2010) found that the main source of scientific knowledge in the United States is not from school, but from the structure of non-formal education, such as science centres (museum), aquaria, mass media, and various resources involved in the exploration of science.

However, non-formal learning is often marginalized by teachers of science in Malaysia mainly among others due to the beauracracy. According to Eshach (2007), most of the non-formal learning experiences is ineffective because students were not prepared before they embarked on the trip. In particular, they were not given proper guidance during the learning process. There is no further action done by the teacher after the learning process (Dillon et al., 2005; Kahn & Rockman, 2002). In addition, time constraint is also a cause for non-formal learning to be conducted widely and not to expose students to new experiences (Cox-Petersen et al., 2003). Thus, in order to overcome this situation, non-formal science education requires facilitators or professional educators to make sure that the learning process effective.

Agencies and organizations involved in non-formal science education typically use the services of volunteers or facilitators for all programmes organized. Hogan (2005) defines the facilitator as an individual with various skills and knowledge of people, process, technical, and experience to help a group reach the learning targets and objectives. Hamdan et al. (2007) defined facilitator or facilitators as a special person entrusted with the responsibility of carrying out their duties diligently. Facilitator refers to as an individual who acts as a leader and manager to a specific group, talented, experienced, knowledgeable, and disciplined in carrying out his/her responsibilities well. (Kadir et al., 2006; Arip et al., 2008; Schwarz, 2002; Abdullah, 2003). In addition, facilitators act as advisors whereby their focus is mainly on the learning process rather than the content of learning (Hunter et al., 2005; Paulsen, 2004; Schwarz, 2005; Thomas, 2010) Therefore, they must possess competencies to ensure their task done effectively. Competencies are defined as the basic features of an individual with knowledge and skills to work effectively and give the best performance in their tasks (Jelas et al., 2006). Competence also refers to the skills and abilities of a person should possess to perform a task (Ibrahim, 2007; Siraj & Ibrahim 2012). Thus, every facilitator must have skills and high competences or competencies to create a quality of non-formal learning environment. However, studies related to facilitators and their level of competences in Malaysia is still limited (Fairuz, 2014). Therefore, the purpose of this study was to identify the competencies level of the science facilitators from the perspective of science teachers.

Hence, in order to achieve these objectives, the research questions were as follows: (i) What are the perceptions of science teachers, who visited the science centre, towards the competencies of science facilitators?, (ii) What are the perceptions of science teachers, who had never visited the science centre, towards the competencies of science facilitators?, and (iii) Are there differences in the perceptions of science teachers who have and have not visited the science centre, towards the competencies of science facilitators?

Conceptual Framework

Non-formal learning is an approach to provide learning processes, which involves experience and reflection on concrete experiences in real situations. This reflection of the learning experience is a type of knowledge gained from outside of the classroom environment. The knowledge consists of self-exploration, experience, and linguistic concepts (Szczepanski, 2008). According to Dillon et al. (2005) non-formal learning involves students to collaborate with each other and to develop various personal skills. The acquired experience encompasses knowledge, understanding, attitudes, feelings, values, beliefs, self-development, and social development (Dillon et al., 2005; Rickinson et al., 2004).

Science facilitators working in science centres should have good competencies to produce effective non-formal learning processes. One of the main roles of a science facilitator is to reveal knowledge and concept of science to students. Therefore, it is very important for facilitators to master pedagogical content knowledge (PCK). PCK was introduced by Shulman (1987). PCK is a construct that is used to describe the integration of teacher content knowledge and pedagogy (Guzey & Roehrig, 2009; Halim & Meerah, 2002; Aziz & Said, 2011). PCK is knowledge that enables the teachers to transform the content in ways that is accessible to students. It is knowledge and skills of an effective teacher.

A science facilitator should also have good self-efficacy since they are also models to the students. Erdem, and Ozcan (2007) state self-efficacy is important in aspects of classroom management, course management, and effective communication with students. Moreover, self-efficacy in science facilitators can also increase students' motivation to learn and affect students' behaviour (Tschannen-Moran & Hoy, 2001).

In addition, a facilitator's competence is not limited to only intrapersonal skills, but it also includes interpersonal. Thus, each facilitator should encourage the participation of all students and has good relationship with the students so as to establish trust and mutual understanding with each other. Establishing this relationship will reduce the students from feeling isolated and marginalized within the group (Hogan, 2005; Hunter et al., 2005;

Paulsen, 2004; Thomas, 2005). In this respect, acquiring interpersonal competencies should be emphasized on science facilitators so as to create an effective learning environment for students. In the context of this study, self-efficacy theory (Bandura, 1977), the conceptual framework of management (Ebersöhn et al., 2007) and PCK (Shulman, 1987) were the main references in explaining the justification of the three domains chosen in the conceptual framework. The domains were adapted from the conceptual framework introduced by Bernhardsson and Lattke (2011) and Fairuz (2014).

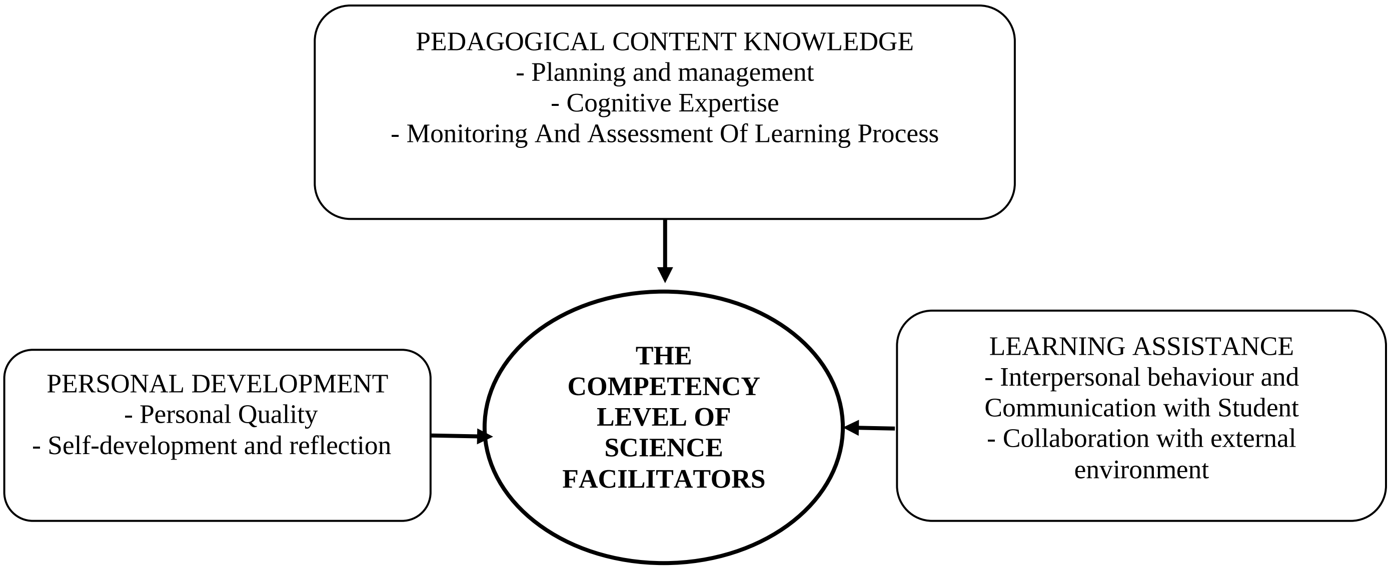

Figure 1. *Conceptual Framework* Bernhardsson and Lattke (2011) and Fairuz (2014)

METHODOLOGY

This survey research used a questionnaire as the instrument. A total of 201 science teachers from 101 primary schools and 100 secondary schools were selected through random sampling. The questionnaire consisted of three domains: pedagogical content knowledge, personal development and learning assistance. Reliability of the instrument was measured using Cronbach Alpha. Overall, the value of the Cronbach Alpha was high for each domain: pedagogical content knowledge ($\alpha = 0.870$), personal development ($\alpha = 0.954$) and learning assistance ($\alpha = 0.914$). The questionnaire used Likert scales with one (1) strongly disagree; (2) strongly disagree; (3) agree; and (4) strongly agree. In order to determine the level of competency, the mean score value was further divided into three categories: a) low level – 1.00 to 1.99, b) moderate level- 2.00 to 2.99, and c) high level- 3.00 to 4.00 (Ahmad, 2002; Chua, 2006). To identify the perceptions of science teachers towards the competencies of science facilitators, two statistical analyses were used: descriptive statistics, and inferential statistics mainly Multivariate Analysis of Variance (MANOVA). Descriptive statistics were used to answer the perceptions of science teachers of the science facilitators, while MANOVA inferential statistics was used to whether there was any differences in the perceptions towards science facilitators between teachers who had and who had not visited the science centres according to the three domains of competencies.

FINDINGS and DISCUSSION

This study aimed to determine the competencies of science facilitators from the perspectives of teachers. The samples that assessed the competencies of facilitators consisted of two groups of teachers. The first group was teachers who had visited science centre with students (140 teachers), while the second group was teachers who never led any student trip to any of the science centres (61 teachers) (Table 2). The results indicated that more than 50 percent of the samples had visited the science centre with students. The places they visited are either close or easily reached by the schools. Although the schools in the study were considered to be located in rural areas, the schools were found to be close to the science centre facility.

Table 1. *The number of teachers who had visited and never visited the science centre with students*

Visit Science Centre	Numbers Of Teacher	Percent
	N	%
Had Visited	140	69.3
Never Visited	61	30.7
Total	201	100

In this study, the level of competencies of science facilitators from the perspectives of teachers was measured based on three main domains: (1) the pedagogical content knowledge; (2) personal development, and (3) learning assistance. The mean score and standard deviation of the perceptions of teachers who had visited and had never visited the science centre towards the competencies of science facilitators is shown in Table 2.

Table 2. *Mean scores and standard deviation of the competencies of science facilitators according to the perceptions of science teachers*

Competencies of Science Facilitators	Perceptions of Science Teachers			
	Had visited		Had never visited	
	Mean	S.D	Mean	S.D
Domain 1: Pedagogical Content Knowledge	2.38	0.67	2.36	0.63
Domain 2: Personal Development	2.50	0.58	2.51	0.59
Domain 3: Learning Assistance	2.56	0.57	2.56	0.59

Overall, the perceptions of science teachers toward the level of competencies of science facilitators were moderate (Table 2) for both groups of sample; those who had visited or had not visited the science centre. This showed that with or without visiting to the science centre did not affect the perceptions of science teachers. It also indicates that teachers are not confident in science centres providing effective and meaningful science learning. Table 3 shows the level of competencies of science facilitators in detail based on the three domains.

Table 3. *The competencies level of science facilitators from the perceptions of Science teachers*

Competencies of Science Facilitators	Perceptions of Science Teachers											
	Had Visited						Had Never Visited					
	Lower		Intermediate		Excellent		Lower		Intermediate		Excellent	
	N	%	N	%	N	%	N	%	N	%	N	%
PCK	15	10.7	57	40.7	68	48.6	5	8.2	29	47.5	27	44.3
Personal Development	6	4.3	59	42.1	75	53.6	3	4.9	24	39.3	34	55.7
Learning Assistance	5	3.6	52	37.1	83	59.3	3	4.9	21	34.4	37	60.7

It is interesting to note that the level of PCK of science facilitators is perceived to be moderate and low for both teachers. Alternatively, the competencies related to Learning Assistance appear to be seen as a competency that is highly acquired by science facilitators. As argued by Cox-Petersen et al., (2003) science centres are seen more as playing an entertainment role rather than focussing on providing learning to students.

Pedagogical Content Knowledge

Pedagogical content knowledge (PCK) is an important aspect to be mastered by a science facilitator. According to Spencer, and Spencer (2008), a science facilitator should have knowledge about the curriculum or the basic concepts of certain area. Overall, the level of competencies among science facilitators for this domain was moderate with mean scores 2.38 and 2.26 (Table 4). Generally, studies have shown that museum facilitators are academically well trained and experts in their fields (Tran, 2007; Kidd, & Kidd, 1997). With the knowledge and understanding of the subject, it is assumed that the facilitators would be able to give a clear example of any abstract concepts and relate to students' daily lives. However, Shulman has argued that subject matter specialists are not necessarily good pedagogue. In addition, when analysed by sub-constructs, it also showed that the level of competencies among science facilitators was moderate. This domain consisted of three sub-constructs: planning and management, cognitive expertise, and monitoring and assessment of learning process.

Planning and Management

There were four items in this sub-construct. The results showed that all items were at a moderate level (Table 4).

Table 4. *Mean score and interpretation of planning and management domain*

Item	Mean Score (Had Visited)	Interpretation	Mean Score (Had Never Visited)	Interpretation
Adapt teaching to the needs of the target group	2.89	Moderate	2.87	Moderate
Lesson plans based on available resources (time, place, and other equipment)	2.99	Moderate	2.84	Moderate
Teach the concepts based on student achievement	2.78	Moderate	2.87	Moderate
Monitor and review the delivery of quality teaching	2.79	Moderate	2.80	Moderate
Overall Mean Score	2.86	Moderate	2.84	Moderate

Table 4 shows that the third item, 'Teach the concepts based on student achievement' had the lowest mean score according to teachers who had visited science centres. This means that the science facilitators did not take into consideration of the students' achievement during learning process and this may be due to lack of experience and pedagogical training. The fourth item, 'Monitor and review the delivery of quality teaching' also showed the lowest mean score from the perspective of teachers who had never visited science centres. They felt that the science facilitators did not monitor and evaluate their teaching quality. Therefore, competencies for these items with moderate level should be emphasized and given attention.

Cognitive Expertise

There were six items in this sub-construct. The results showed that most of the items were at a moderate level (Table 5).

Table 5. *Mean score and interpretation of cognitive expertise domain*

Item	Mean Score (Had Visited)	Interpretation	Mean Score (Had Never Visited)	Interpretation
Have expertise in the field of science teaching	2.93	Moderate	2.89	Moderate
Have knowledge of disciplines related to their own expertise	2.90	Moderate	3.00	High
Using special teaching methods in the field of teaching	2.81	Moderate	2.85	Moderate
Enable students to apply what they have learned	2.96	Moderate	3.03	High
Constantly update their knowledge and skills	2.93	Moderate	3.02	High
Update the domain-specific knowledge and skills at their own initiative	2.88	Moderate	2.97	Moderate
Overall mean score	2.90	Moderate	3.00	High

Table 5 shows that the third item, ‘Using special teaching methods in the field of teaching’ had the lowest mean score according to the teachers who had visited the science centres. This means that the science facilitators were perceived not using specific teaching technique that was suitable with the students’ achievement and this might be due to lack of knowledge in teaching methods. Therefore, a science facilitator should have knowledge in pedagogy in order to use teaching method according to students' abilities.

Monitoring and Assessment of Learning Process

There were six items in this sub-construct. Overall, the findings showed that all items in this sub-construct showed a moderate level (Table 6).

Table 6. *Mean score and interpretation of monitoring and assessment of learning process construct*

Item	Mean Score (Had Visited)	Interpretation	Mean Score (Had Never Visited)	Interpretation
Assessing students’ needs	2.61	Moderate	2.57	Moderate
Analyze barriers to student learning	2.58	Moderate	2.54	Moderate
Monitor the learning process	2.70	Moderate	2.57	Moderate
Assessing learning outcomes	2.58	Moderate	2.61	Moderate
Diagnose students' learning capacity	2.56	Moderate	2.59	Moderate
Diagnose students' learning attitude	2.53	Moderate	2.61	Moderate
Overall mean score	2.60	Moderate	2.58	Moderate

Both group of teachers felt that the Science facilitators had moderate level of competencies in monitoring and assessment of learning process. Item on ‘Diagnose students' learning attitude’ had the lowest mean score according to the teachers who had visited the science centres, and item ‘Analyze barriers to student learning’ from the teachers who had not visited the science centres. Thus, the science facilitators should increase these competencies to generate meaningful learning. Competencies in monitoring and assessment of learning process are very important constructs for all facilitators to assess learning process and the learning outcomes.

In summary, the facilitators need to be exposed to educational training and professional development courses to enhance their pedagogy. Trainings should also emphasize on inquiry approach to encourage active learning. Continuing education for facilitators can be carried out through courses, seminars, and workshops, as well as the involvement of experienced teachers in helping to improve the competencies.

Personal Development Domain

Personal characteristics of a competent facilitator are possessing the capability of organizing and having foresight (Bernhardsson, & Lattke 2011; Stewart, 2006). This includes having high intellectual agility seen as quick thinking on their feet and understanding information quickly. They should gain high levels of trust from the clients and groups, self-confident with strategies to manage their weaknesses, very emotionally resilient and stress tolerant (Stewart, 2006). Bernhardsson, and Lattke (2011) characterize the personal qualities based on the ability of having a steady emotion, one that is resistant to pressure, open-minded, able to analyse barriers to student learning and proceed wisely on structured learning. The findings showed that the level of competencies among science facilitators under personal development domain was at a moderate level, whereby the mean score for both categories of teachers were 2.50 and 2.51 (Table 2). The analysis based on the sub- constructs also showed that the competencies levels were moderate and high for all the sub-constructs in this domain. There were two sub-constructs for this domain, i.e. personal quality, and self-development and reflection.

Personal Quality

There were five items in this sub-construct. The results showed that two items reached high level and three items were at moderate level (Table 7).

Table 7. *Mean score and interpretation of personal quality construct*

Item	Mean Score (Had Visited)	Interpretation	Mean Score (Had Never Visited)	Interpretation
Have humour	2.73	Moderate	2.62	Moderate
Pay attention to the visitors	2.99	Moderate	2.92	Moderate
Friendly	3.04	High	2.98	Moderate
Willing to help/answer questions asked by students easily	3.17	High	3.16	High
Emotionally stable (not irritable, always smiling, etc.)	3.01	High	3.00	High
Overall mean score	3.00	High	2.94	Moderate

Table 7 shows that the first item, ‘Have humour’, had the lowest mean score according to the teachers who had visited and never visited the science centres. This means that the science facilitators did not have any sense of humour during the learning process and this may be due to lack of teaching skills to make the learning process interesting. Elements of humour in teaching sessions are important to attract students’ interest, and at the same time, to make sure that non-formal learning is effective. Roberts, and Antioch (2004), and Grenier (2005) state that a good facilitator should have character and personal qualities, such as kindness, humour, patience, responsibility, confidence, and civic leadership . Therefore, the science facilitators can be encouraged to develop some sense of humour.

Self- Development and Reflection

There were twelve items in this sub-construct. The results showed that most of the items reached high and moderate levels (Table 8).

Table 8. *Mean score and interpretation of self-development and reflection construct*

Item	Mean Score (Had Visited)	Interpretation	Mean Score (Have Never Visited)	Interpretation
Using their own life experiences in the learning environment	2.86	Moderate	3.07	High
Identify their own learning process	2.83	Moderate	2.93	Moderate
Set their own learning goals	2.79	Moderate	2.92	Moderate
Curious	3.01	High	2.97	Moderate
Creative	3.13	High	3.07	High
Flexible	3.06	High	3.13	High
Reflect on their own professional role	2.99	Moderate	3.00	High
Evaluate their own practices	2.79	Moderate	2.80	Moderate
Self-confident	3.06	High	3.13	High
Committed to their own professional development	2.83	Moderate	3.08	High
Face criticism wisely	2.89	Moderate	3.02	High
Handle stress effectively	2.85	Moderate	2.95	Moderate
Overall mean score	2.92	Moderate	3.00	High

Table 8 shows that the third item, ‘Set their own learning goals’ and ‘Evaluate their own practice ‘ had the lowest mean score according to both group of teachers. This means that the science facilitators had ‘self development and reflection’ at moderate level. Grenier (2005), through his qualitative research, 'How Museum Docents Develop Expertise' found that formal training, continuation of their studies, informal education, and experience indirectly helped in the creation of a museum facilitator expert. Therefore, self -development competencies is a competence which is very important for the facilitators of science so as to produce effective learning (Roberts, & Antioch 2004; Roberts et al., 2006).

Learning Assistance Domain

Learning assistance domain included two sub-constructs, i.e. (i) interpersonal behaviour and communication with students, and (ii) collaboration with external environment. Overall, the mean score of the domain of learning assistance was at a moderate level. The mean values obtained from these two categories of teachers were similar; 2.56 (table 2). Meanwhile, the analysis based on the sub-constructs also showed different levels of competencies.

Interpersonal Behaviour and Communication with Students

There were five items in this sub-construct and most of the items were at high level (table 9).

Table 9. *Mean score and interpretation of interpersonal behaviour and communication with students construct*

Item	Mean Score (Had Visited)	Interpretation	Mean Score (Had Never Visited)	Interpretation
Motivate students	3.01	High	3.05	High
Inspire	3.04	High	2.97	Moderate
Use appropriate body languages	3.04	High	3.00	High
Clear in communicating	3.01	High	3.13	High
Managing groups dynamically	2.97	Moderate	3.00	High
Overall mean score	3.01	High	3.03	High

Table 9 showed that there were two items with moderate level, 'inspire' and 'managing groups dynamically'. The science teachers felt that the science facilitators were less inspiring and could not manage groups dynamically. Therefore, the facilitators should make teaching science exciting and they should acquire the ability to inspire and motivate students. Moreover, science facilitators should also have good group management skills. There are various theories, such as theories by Ebersöhn et al., (2007), which can help improve group management skills among the facilitators to create a conducive learning environment for students.

Collaboration with External Environment

There were three items in this sub-construct, most of the items were at a moderate level (Table 10).

Table 10. *Mean score and interpretation of collaboration with external environment construct*

Item	Mean Score (Had Visited)	Interpretation	Mean Score (Had Never Visited)	Interpretation
Look at the subjects that are taught in the context of a wider community	2.74	Moderate	2.93	Moderate
Identify the role of science centres to the subject taught	2.89	Moderate	2.93	Moderate
Work with various stakeholders, such as schools	2.87	Moderate	3.03	High
Overall mean score	2.83	Moderate	2.97	Moderate

Table 10 shows that the item related to 'look at the subjects that are taught in the context of a wider community' had the lowest mean score. This finding suggests that the facilitators did not take into consideration of a wider community during the teaching and learning process. As a competent facilitator, cooperation with the external environment should be enhanced and emphasized. The facilitator should encourage the involvement of students in their learning process to improve their learning outcomes by providing a safe learning environment and encouraging learning process (Chin, 2010; Hunter, & Thorpe 2005; Kolb et al., 2008; Thomas, 2010). Grenier (2005) also found a museum facilitator should have good interpersonal skills and communication skills with visitors. They also should have knowledge about all the materials in the science. Thorpe (2013) has also stressed that communication competency with a group is one of the most important competencies for a science facilitator.

Different Perceptions of Teachers

In order to identify if there are differences between the perceptions of teachers who had visited the science centres and teachers who had never visited the science centre towards the competencies of science facilitators, the multivariate analysis of variance (MANOVA) was carried out. MANOVA test was used to determine the differences in mean and the results are shown in Table 11.

Table 11. *MANOVA test analysis*

Effect	Wilks' Lamda (λ) Value	F Value	D.K Between Group	D.K In Group	Sig. Level
Science teachers visits	0.990	0.668	3	197	0.572

Table 11 shows the comparison of mean scores between the two types of teachers group with Wilks' Value (λ) = 0.990, F (3, 197) = 0668, and p = 0.572, where p> 0.05. This indicates that there was no significant difference in the perceptions of the level of competencies among the science facilitators between the two groups of teachers for all of the three domains. Even if there were teachers who had never visited the Science Centre, their perceptions on the competencies level of the science facilitators had still been at a moderate level. This means that visiting the science centres is not the main factor in influencing the teachers' perception. This also suggests that the experience felt by teachers who had visited the science centres was not encouraging.

According to study conducted by Corbos, and Popescu (2014), they found that 81 % of visitors who had visited the museum with more satisfaction had the desire to re-visit the place. Therefore, in the case of this study, perhaps the offerings by the science centres is not effective or interesting, in particular the role of the science facilitators in providing effective learning experiences. This is because if the experience is seen to be fruitful then teachers are encouraged to bring students to visit science centres and teachers can collaborate with the facilitators who work there to ensure that learning takes place during the tour because science centre is a major source of acknowledgement in science (Falk & Dierking, 2010). Hence, teachers and students with the experience of visiting the science centres would form the intention to revisit and thus the non-formal science education would help to enhance students' interest and learning in science.

CONCLUSION and IMPLICATIONS

Science teachers' perceptions on the level of competencies among the science facilitators were found to be at a moderate level. This shows that science facilitators have not reached a satisfactory level and this gives an overview of the effectiveness of learning science in a non-formal environment. Even if there are teachers who had never visited, they shared the same perception of teachers who had visited science centres. Both groups of teachers agreed that the competencies of the facilitators were indeed very important to produce an effective non-formal learning science environment for students. All the three domains were at a moderate level, while the domain of knowledge of pedagogy had the lowest mean score. Therefore the PCK domain has to be enhanced through a variety of trainings or professional development programmes. The competencies investigated in this study can be used as a guide line for the science centres to gauge the competency level of their science facilitators. Future work on the science facilitators' competencies could be investigated from the perspective of the students themselves and their parents. It will serve a more holistic view of their competencies and better training program can be developed. This is important so that science centres as non-formal science education organization can play a more effective role in order enhancing the interest among students towards science, and thus, to build a scientific literacy community.

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