Asia Research Network Journal of Education
Vol. 1, No. 3, pp. 164 - 178, Sep. – Dec. 2021

Competencies of Science Facilitators in Non-formal Learning Contexts

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Received: 03 Nov 2021 Revised: 24 Dec 2021 Accepted: 28 Dec 2021

Abstract. Learning science in non-formal contexts is gaining attention in the effort to enculturate science literacy among the society, thus the science facilitators in institutions/agencies of non-formal learning of Science play a significant role. Therefore the purpose of this research is to identify the competency level of science facilitators and to identify the differences in the level based on gender, academic qualification, and work experience. The research sample comprised 117 science facilitators who are serving in institutions/agencies of non-formal learning of Science. Data analysis based on descriptive statistics used includes mean, frequency, standard deviation, and percentage while the inferential statistics used Multivariate Analysis of Variance (MANOVA). The Questionnaire was based on five dimensions, namely dimensions of personal quality, subject knowledge, communication skills, learning evaluation, and learning assistance with 69 items. Results from the descriptive analysis showed that the level of competency of science facilitators is high in all of the dimensions studied. Inferential findings showed that science facilitators' level of competency is influenced by the factor of academic qualification, where the facilitators with Bachelor's/Master's degree academic qualifications have higher competency compared to those with a diploma and Malaysian Certificate of Education (MCE)/ Malaysian High School Certificate (MHSC) academic qualifications. Research findings also showed significant differences in the competency dimensions of personal quality, subject knowledge, and learning evaluation based on academic qualifications. The dimensions of communication skills and learning assistance were the same for facilitators of different academic qualifications. Based on the findings, the selection of facilitators should consider bachelor's/master's degree and in the professional development programs should be continuous for facilitators in efforts to empower non-formal Science learning as a complement to formal learning of Science.

Keywords: competencies, facilitator, personal quality, subject knowledge, communication skills, learning evaluation, learning assistance

1. Introduction

Many people need to use the facilitator's skills in matters related to leadership, group cooperation, solidarity groups, to determine the goals and needs of the group to enhance the competencies of the groups (Stewart, 2006). A company requires the services of a facilitator to enhance its productivity, work quality, sensitivity to competition, and efficiency in managing change, teamwork, innovation, and a range of other requirements so that the company will be at the forefront. Competition has become more intense. People just want the best. At the insistence of modernization and globalization, people are racing to be more efficient (Hamdan et al. 2007) in every aspect of life, work, and learning especially in non-formal science learning where there is a need to obtain a more competent facilitator. Hamdan et al. (2007) define a facilitator as a special human who is entrusted with the responsibility of carrying out its duties with diligence and trust and accountability. He/she observes and analyses every action and behavior of the group. He/she should be able to interact well, be open-minded, and be sensitive to any personal changes and reactions. His/her expression and style should always encourage clients to continue talking with an unpretentious way.

The facilitator helps participants in the group, through a process of learning and effective communication, to achieve the group's goals. After going through this process, it is hoped that participants will receive a group experience as a starting point to realize that we as human beings continuously receive education either through formal or informal methods. According to Schwarz (2002), the term facilitator is used to refer to people who fulfill a variety of roles in groups, notably those of leader, mediator, content matter expert, and instructor. In general, the facilitator is responsible for assisting a group to improve the effectiveness of decision-making and solution creation to improve the process to ensure the process runs smoothly (Wan Norjihan 2003; Stewart 2006). From the above definition, it can be inferred that facilitator refers to an individual who serves as a leader and manager of a particular group, and he or she is talented, experienced, knowledgeable, and disciplined in carrying out his or her responsibilities well (Mohammad Aziz et al., 2008; Hamdan et al., 2007; Wan Norjihan, 2003; Schwarz, 2002).

In non-formal science learning, the concept of competencies should take into account various elements and the facilitator's competencies should be viewed in a variety of contexts. Spencer and Spencer (2008) stated that competency is an underlying characteristic of a 75 individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation. Meanwhile, Zalizan Mohd. Jelas et al. (2006) defined the competencies as observable and measurable knowledge, as well as generic and transferable skills that students need in order to become successful learners and successful employees in the field of their study and work. Of the many definitions of competency discussed, the main component of competency covers the knowledge, skills, and personal characteristics (Boyantzis, 2008; Schwarz, 2011; Saedah & Mohamed Sani, 2012). A person with a high level of competence has always shown interest in influencing others, is able to take proactive decisions, and takes risks and responsibility for the actions taken. In addition, a competent person is also wise to communicate verbally and has always been able to form a positive attitude and to motivate. Halim et. al (2021) stated that, in addition to knowledge and skills, the disposition of the facilitators' such as advising and sharing, can contribute to lessening the gap between the students and facilitators.

2. Literature Review

Non-formal science learning plays an important role in overcoming the declining students' interest and performance in science (Mirrahmi et al., 2011). Therefore, the Ministry of Education Malaysia, under the Malaysian Education Development Plan PPPM 2013- 2025, aims to encourage the involvement of parents, external agencies and the private sector as partners in education. In this light, PPPM also reported that students between 7 to 17 years old only spend one-quarter of their time in school, or to be exact, 27% at school, while 73% of their time is spent at home or within their community. This indicates students spend most of their time outside of school. Eshach (2007) dan Bransford et al. (2000), also found that students only spend a fraction of their time in school while 80% of their lives are spent outside the classroom.

Non-formal learning could occur through different mediums and facilitated by various parties, including organizations and agencies whose core business is to systematically conduct training, courses, and seminars. Furthermore, according to Eshach (2007), non-formal science education could also occur infrequently visited places like science centers, museums, botanical gardens, zoo aquariums, planetarium, industrial areas, interactive exhibitions, and others. In the meantime, the study mentioned that four factors influence non-formal science education effectiveness: personal, physical, social, and learning factors. Moreover, non-formal learning can improve behavior and enhance skills (Rahman & Mamun, 2013). In the United States, the main sources of scientific knowledge is not from school but rather from non-formal education establishments, such as science centers, aquariums, mass media, or any establishments focusing on science exploration (Falk dan Dierking, 2010). Therefore, this study has focused on organizations or agencies involved in providing non-formal science learning experiences.

Non-formal science learning programs and establishments frequently use the service of volunteers as facilitators. A facilitator is someone who takes the role of a leader and a manager for a certain group. In this regard, a facilitator should possess leadership talent, be experienced, knowledgeable, and highly disciplined in fulfilling his roles efficiently (Schwarz 2002; Wan Norjihan 2003; Hamdan et al. 2007; Mohammad Aziz et al. 2008). Despite the important roles played by facilitators, there are still limited studies on the competencies. According to Tran (2008) and Plummer & Small (2013), many studies have focused on the advantages and benefits of non-formal education; however, there are limited studies on facilitators' competency. Furthermore, according to (Eshach 2007) studies found that non-formal learning has been ineffective as the students receive less guidance and there is less preparation for learning. Students received limited or no feedback or follow-up from teachers after a non-formal learning session (Dillon et al., 2005; Kahn & Rockman, 2002). This situation indirectly hinders students' enforcement of what they have learned during formal learning in schools. Therefore the level of facilitators' competency has to be studied in order to increase their effectiveness and optimize their role in supporting formal learning in schools.

Similar to the formal education context, continuous training is also imperative for facilitators of non-formal learning. In this light, the effectiveness of non-formal science learning depends on the activities planned and the professionalism of those involved, especially science facilitators. Science facilitators should be knowledgeable, intelligent, experienced, have good communication skills, and interact with students. This is because a facilitator transfers the information to the participant. He is also responsible for guiding them to find new experiences and expand their existing experience. On the other hand, the number of studies on facilitators' or educators' competency in non-formal learning of science is still limited (Plummer & Small 2013, Falk & Dierking 2000). Thus, this study

focuses on the skills and efficiency that should be possessed by every science facilitator so that non-formal learning could have a meaningful impact.

In the meantime, in non-formal learning of science, facilitators' competency is not an issue that is considered significant even though they play an important role in determining the fulfillment of a program's objectives. For example, in science centers where facilitators will guide students in small groups, the learning outcome for each visit is influenced by the facilitators' personal qualities, specifically their existing experience (Grenier, 2005) and the number of facilitators (Sovik-Johnston 2011). In this regard, a facilitator's existing experience is important in ensuring the effectiveness of non-formal learning. Falk and Dierking (2000) mentioned that social interaction with peers and those with more experience could form meaningful knowledge for the students. However, Fairus (2014) and Sovik-Johnston (2011) found that experience brings no difference to a students' learning. Therefore, this study considers whether the facilitator's experience as a demographic factor will influence the facilitators' competency.

Grenier (2011) opined that a professional facilitator should be knowledgeable about the fundamental concept in a subject or field to ensure that they can translate their knowledge into practice, especially in the context of non-science learning which is often complex. In this regard, science facilitators should have adequate scientific knowledge to fulfill their responsibilities (Tran & King 2007; Scott 2006). Based on the above argument, this study will examine whether facilitators' academic background determines the level of facilitators' knowledge in non-formal science learning. The literature review showed that past studies on facilitators are more focused on knowledge, skills, or values that a facilitator must possess; however, the relationship between demographic factors such as gender and facilitators' competency has yet to be studied extensively. Therefore, this study will look into whether demographic factors like gender influences facilitators' competency in the context of non-formal science learning.

Research Objectives

i. Identify the competency level of science facilitators in the context of non-formal learning.
ii. Identify the differences between science facilitators competency levels in the context of non-formal science learning across gender, academic qualification, and working experience
iii. Determine the differences between the level of personal quality, subject knowledge, communication skills, learning evaluation, and learning support among science facilitators in the context of non-formal learning across gender, academic qualification, and working experience.

Research Questions

i. What is the level of science facilitators' competency in the context of non-formal learning?
ii. Are there any significant differences between facilitators' competency levels in the context of non-formal learning based on gender, academic qualification, and working experience?

Based on research questions (ii), a hypothesis have been formed, which is:

Ho1: There are no significant differences in the mean scores of science facilitators' competency in the context of non-formal learning based on gender, academic qualification, and working experience.

3. Conceptual framework

A study's conceptual framework serves as a guide for a researcher to determine the study's focus. This study's conceptual framework was adapted from the Facilitator Competency Model (Stewart 2006), Contextual Models (Falk & Storksdieck 2005; Falk & Dierking 2000), and Social Cognitive Theory (Bandura, 1986; 2001). (Figure 1.1).

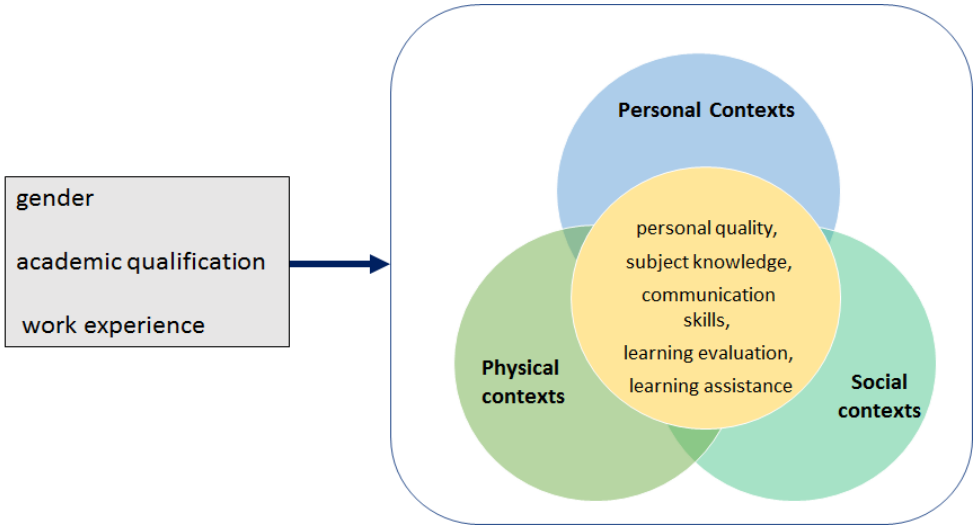

Figure 1.1 Conceptual Framework adapted from Facilitator Competency Model (Stewart 2006) and The Contextual Model (Falk & Stoksdieck 2005)

The Facilitator Competency Model (Stewart 2006) states that a competent facilitator needs to master four main interpersonal competencies: communication skills, management skills, personal qualities, and subject knowledge. The model developed by Stewart (2006) has generally described the characteristics of a competent facilitator in the context of a small group. These studies included two additional dimensions which are learning evaluation and learning assistance (Halim et. al, 2016) and focusing on non-formal science learning, specifically facilitators working in non-formal learning organizations such as the National Science Center, National Science Center (Northern Branch), National Planetarium, Sultan Iskandar Planetarium, and Malaysian Forestry Research Center. As learning occurs during student visits where they are mostly grouped in small groups, Stewart's (2006) model was chosen because it explains the characteristics of competent facilitators in the context of small groups.

At the same time, a competent science facilitator who is knowledgeable about science pedagogies is needed to ensure effective science learning can occur. Based on this importance, the Contextual Learning Model (Falk & Storksdieck 2005) was chosen as one of the main models. This model was developed based on constructivism, cognitive, and sociocultural learning theories. (Falk & Storksdieck 2005). It also refers to the learning process occurring in non-formal science learning, specifically during visits to a museum or Science Center. In the learning process, a learner continuously interacts with the physical and socio-cultural environment. The contextual learning theory illustrates the process and the outcome of interactions from one's personal, sociocultural, and physical contexts that are constantly changing throughout their lives.

The science facilitators' competency dimensions were identified based on two models, the Facilitator Competency Model (Stewart 2006) and the Contextual Learning Model (Falk & Storksdieck 2005). These dimensions are personal quality, subject knowledge,

communication skills, learning evaluation, and learning assistance. The dimension of personal quality describes how a facilitator's personal quality influences the learning process. Meanwhile, the dimension of content knowledge refers to the extent of the scientific knowledge required by the facilitators to support the non-formal science learning process. In line with the concept of non-formal science learning which complements formal learning in school, communication skill is important to ensure the effectiveness of the learning process. The dimension of communication skills allows the researcher to determine and examine facilitators' communication skills, specifically their ability to speak clearly with suitable words, language, and tone. Furthermore, a competent facilitator can listen carefully, observe body language, and diversify their questioning techniques. Meanwhile, this study examined how a science facilitator should supervise and assess the learning process under the dimension of learning evaluation. Finally, the dimension of learning assistance refers to science facilitators' ability to support the learning process with encouragement and motivation, efficient planning and management of environment learning, and interaction with the environment.

Factors related to the facilitators and the learning environment provided by the organizations play an important role in ensuring the effectiveness of non-formal science learning. Competent facilitators need to provide and manipulate a conducive learning environment to ensure an effective learning process. This is because to ensure non-formal occurs outside of the classroom, such as in a science center, visitors need to interact and respond to the physical elements of the museum, including large-scale elements such as space, lighting, and the weather, as well as small-scale elements such as exhibits and objects being displayed (Falk & Dierking's 2000 Falk & Storksdieck 2005). As shown in Figure 1.1, this study took into account the respondents' demographic factors, which are gender (male and female), academic qualifications Malaysian Certificate of Education (MCE)/ Malaysian High School Certificate (MHSC), Diploma or Bachelor/Master), and work experience (1-3 years or more than 3 years). In addition, a review of the literature related to the competence of science facilitators in the non-formal learning context had discussed the influence of facilitators' knowledge and experience on their competence or professionalism (Grenier 2005; Sovik-Johnston 2011; Falk and Dierking 2000; Tran & King 2007; Scoot 2006).

According to the Social Cognitive Theory (Bandura, 1986; 2001) the learning process occurs through reciprocal interactions between one's behavior, the environment, and personal factors. It suggests that human interactions play a significant role in influencing individuals. In addition, self-assessment, one of the cognitive aspects of this theory, refers to one's internal assessment of his ability to master a task. In other words, this self-evaluation refers to an individual's beliefs or perceptions of oneself to produce a task or responsibility well and effectively to achieve a set goal (Bandura, 1977). Therefore, based on this theory, the competence measured through the perception of the facilitator is an indicator that can describe the actual competence of the facilitator.

4. Methodology

This survey research used questionnaires as an instrument. A total of 117 science facilitators were randomly chosen from institutions/agencies of non-formal learning of Science involved National Science Center, National Science Center Northern Region Branch, National Planetarium, Sultan Iskandar Planetarium, Terengganu Science and Creativity Center, and Forest Research Institute of Malaysian. The questionnaire consisted of five dimensions; personal quality, subject knowledge, communication skills, learning evaluation, and learning assistance. The reliability of the instrument was measured using Cronbach Alpha. Overall, the value of Cronbach Alpha was high (α =

937) and each dimension: personal quality (α = 0.909), subject knowledge (α = 0.920), communication skills (α = 0.926), learning evaluation (α = 0.930) and learning assistance (α = 930). The questionnaire used Likert scales with (1) strongly disagree, (2) disagree, (3) moderate disagree, (4) agree, and (5) strongly agree. In order to determine the level of competencies, the mean score value was further divided into five categories (Table 1):

Table 1: Mean Score Interpretation

Mean Score	Interpretation
1.00 - 1.80	Very Low
1.81 -2.60	Low
2.61 - 3.40	Moderate Low
3.41 - 4.20	High
4.21 - 5.00	Very High

(Source: Tschnnen-Moran, M.& Gareis, C.R., 2004)

5. FINDINGS

To identify the competencies level of science facilitators, descriptive statistics used include mean, frequency, standard deviation, and percentage. To identify the differences in the level of competencies based on gender, academic qualification, and work experience, inferential statistics Multivariate Analysis of Variance (MANOVA) were used. The respondents' socio-demographic profiles are summarized in Table 2.

Table 2 Respondent Profile

Profile		Frequency (f)	Percent (%)
Gender	Male	63	53.8
	Female	54	46.2
Academic Background	Bachelor / Master	48	41.0
	Diploma	39	33.3
	MCE/MHCE	30	25.6
Age	21-25	35	29.9
(Year)	26-30	39	33.3
	>30	43	36.8
Working experienced	1-3	57	48.7
(Year)	>3	60	51.3

The sample (n=117) comprised 53.8% male 46.2% were female respondents. In terms of academic background, 41.0% had a Bachelor's or Master's degree, followed by Diploma 33.3% and MCE/MHCE 25.6%. Among respondents, 36.8% were aged >30 years, 33.3% were aged 26-30 years, and the rest 33.3% were aged 21-25 years old. In terms of working experience, 51.3% had working experience of more than 3 years and the rest had 1-3 years working experience.

The level of competencies among science facilitators

The level of competencies among science facilitators is measured based on the five dimensions of competencies by self-report. Table 3 shows the mean score, standard deviation, and interpretation of scores for each dimension namely learning assistance, personal quality, communication skills, subject knowledge, and learning evaluation.

Table 3 The level of competencies among science facilitators

Dimension	Mean	Standard Deviation (SD)	Interpretation
learning assistance	4.00	0.447	High
personal quality	3.97	0.434	High
communication skills	3.94	0.434	High
subject knowledge	3.83	0.471	High
learning evaluation	3.73	0.474	High
Overall	3.89	0.339	High

Table 3, shows that the overall level of competencies among science facilitators in non-formal learning for all dimensions is high (mean = 3.89, SD = 0.339). According to the finding, there are no dimensions in the category 'very high'. The learning assistance dimension showed the highest level (mean = 4.00, SD = 0.447) followed by the personal quality (mean = 3.97, SP = 0.434); communication skills (mean = 3.94, SD = 0.434); subject knowledge (mean = 3.83, SD = 0.471) and learning evaluation showed the lowest level of competence (mean = 3.73, SD = 0.474).

The difference of facilitators' competencies based on gender, academic qualification, and work experience

To analyze the differences in the level of facilitators' competencies based on gender, academic qualification, and work experience, inferential statistics using three-way Multivariate Analysis of Variance (MANOVA) were conducted. The results of the multivariate test in Table 4 showed that the main effect of academic qualification was significant at $p < 0.05$ i.e. $F(10, 202) = 2.262$, $p = 0.016$; with a large size (partial eta squared = 0.101). This indicates that there is a significant difference in the mean competency scores of facilitators based on academic qualification. While the main and interaction effects for gender and working experience showed no significant difference with a $p > 0.05$.

The results of the univariate test in Table 5, shows that the main effect of academic qualification was significant at the level of $p < 0.05$ on the three dimensions namely personal quality $F(2, 111) = 5.487$, $p = 0.005$; with a moderate size effect (partial eta squared = 0.095), subject knowledge $F(2, 111) = 7.417$, $p = 0.001$; with a moderate size effect (partial eta squared = 0.124) and learning evaluation $F(2, 111) = 7.695$, $p = 0.001$; with a moderate size effect (partial eta squared = 0.128). While the other two dimensions did not show a significant value at the level of $p > 0.05$, namely communication skills $F(2, 111) = 1.027$, $p = 0.362$; with small size effect (partial eta squared = 0.019) and learning assistance $F(2, 111) = 1.802$, $p = 0.170$; with a moderate size effect (partial eta squared = 0.033).

Table 4 Multivariate test for facilitators' competencies based on gender, academic qualification, and work experience

Source	Wilks' Lambda	F	df1	df2	Sig.	Partial eta squared
Gender	0.945	1.171	5	101	0.329	0.055
Academic qualification	0.809	2.262	10	202	0.016	0.101
Working experience	0.924	1.659	5	101	0.151	0.076
Gender*Academic qualification	0.963	0.380	10	202	0.954	0.018
Gender*Working experience	0.986	0.289	5	101	0.918	0.014
Academic*Working experience	0.884	1.283	10	202	0.242	0.060
Gender* Academic qualification *Working experience	0.942	0.610	10	202	0.805	0.029

Table 5 Tests of between-subjects effects within academic qualification on the dimension of facilitators competencies

Competencies dimension	Sum of Squares	df	Mean Square	F	p	Partial eta squared
Personal quality	1.889	2	0.945	5.487	0.005	0.095
Subject knowledge	2.913	2	1.456	7.417	0.001	0.124
Communication skills	0.388	2	0.194	1.027	0.362	0.019
Learning evaluation	3.114	2	1.557	7.695	0.001	0.128
learning assistance	0.700	2	0.350	1.802	0.170	0.033

**$p \leq .05$

Since there was a significant effect on academic qualification in competencies dimension for personal quality, subject knowledge and learning evaluation, Post hoc analysis was conducted using Bonferroni test to compare the facilitators' competencies based on academic qualification (Table 6).

Table 6 Paired comparison of facilitators' competencies based on academic qualification

Competencies dimension	Academic qualification (I)	Academic qualification (J)	Mean (I-J)	Standard deviation (SD)	Sig	95% Confidence Interval	
						Lower Bound	Upper Bound
Personal quality	MCE/MHCE	Diploma	-0.2572	0.1007	0.036	-0.5023	-0.0120
	MCE/MHCE	Bachelor degree/ Master	-0.3012	0.0965	0.007	-0.5362	-0.0663
	Diploma	Bachelor degree/ Master	-0.0441	0.0894	1.000	-0.2617	0.1735
Subject knowledge	MCE/ MHCE	Diploma	-0.3249	0.1076	0.010	-0.5867	-0.0631
	MCE/ MHCE	Bachelor degree/ Master	-0.4571	0.1031	0.000	-0.7080	-0.2062
	Diploma	Bachelor degree/ Master	-0.1322	0.0955	0.508	-0.3646	0.1002
Learning evaluation	MCE/ MHCE	Diploma	-0.2779	0.1092	0.037	-0.5437	-0.0121
	MCE/ MHCE	Bachelor degree/ Master	-0.4359	0.1047	0.000	-0.6907	-0.1812
	Diploma	Bachelor degree/ Master	-0.1581	0.0969	0.318	-0.3940	0.0779

Finding in Table 6 shows that there was a significant difference found for personal quality factor between the group of facilitators with MCE/MHCE academic qualification, and the group with Diploma qualification (mean =-0.2572, SD = 0.1007; Sig. = 0.036). Facilitators with MCE/MHCE academic qualification also show significant differences, and the group with Bachelor degree/Master (mean =-0.3012, SD = 0.0965; Sig. = 0.007). These findings are also similar with other competencies namely subject knowledge and learning evaluation factors where there was a significant difference between the group of facilitators with MCE/MHCE academic qualification, and the group with Diploma qualification (Subject knowledge: mean =-0.3249, SD = 0.1076; Sig. = 0.010, Learning evaluation: mean =-0.2779, SD = 0.1092; Sig. = 0.037).

Also between the group of Facilitators with MCE/MHCE academic qualification, and the group with Bachelor degree/Master (Subject knowledge: mean =-0.4571, SD = 0.1031; Sig. = 0.000, Learning evaluation: mean =-0.4359, SD =0.1047; Sig. = 0.000). These findings indicated that the higher academic level attained by the facilitators implies a high degree of competency in terms of personal quality, subject knowledge, and learning evaluation.

6. Discussion

Overall, the level of competencies for science facilitators in non-formal learning is high and the learning assistance dimension is the highest. These findings align with the relationship management domain, the fourth domain in the competency framework developed by the National College (2010). According to the National College, it is easiest to assess facilitators' competency in the fourth domain, which also includes team-building practices. In this light, facilitators who demonstrate team cooperation will be more likely to work together to achieve a common goal. Cooperation with friends allowed them to share knowledge and complement each other. Collaborating also allows facilitators to support each other and exchange experiences (Steward 2006). They will be able to learn something from the experience of their peers or senior colleagues as stated by Bandura's cognitive theory that learning involves several processes such as observing, imitating, and modeling. Subsequently, collaborative practices allow facilitators to improve their competencies under this dimension. Competent facilitators should be able to plan lessons based on students' achievements. These findings indicate that facilitators need to improve skills in this aspect. According to Baker and Fraser (2005), the 'Appropriate Group Process Plan' is a core competency for a facilitator. Thus, any group planning must be based on suitability from all aspects, including student achievement. This aspect is also important in the Contextual Model by Falk & Dierking (2000), which states that the learning process can be very personal and strongly influenced by existing knowledge, interests, and individual beliefs, which affect learners. Therefore, a competent facilitator needs to wisely plan his lessons based on student achievement. Although the overall show that the facilitators studied have this competence, this aspect needs to be given attention in the training of facilitators for improvement and enrichment.

The second-highest dimension of facilitator competence is the personal quality dimension. The competent facilitator should demonstrate personal characteristics like being organized, far-sighted, and the ability to have stable emotions (Bernhardsson & Lattke 2011; Stewart 2006). Thus, a competent facilitator should be resilient to stress, open-minded, able to determine and overcome student learning barriers and provide structured learning. These findings are supported by Kamolpattana et al. (2015), Saedah and Mohamad Sani (2012), Bernhardsson & Lattke (2011), Boyatzis (2008), and Steward (2006), who placed personal quality as an important dimension for a competent facilitator. This finding is also in line with studies by Husin et al. (2015), Roberts & Dyer (2004), and Grenier (2011), which stated that a good facilitator should have personal traits and qualities such as being kind, funny, patient, responsible, confident and possess leadership skills.

The third highest dimension of facilitator competency is communication skills. According to Bernhardsson and Lattke (2011), a facilitator needs to communicate clearly, manage group dynamics, and address any conflicts within a group. Stewart (2006), stated that individuals with good personnel competencies would demonstrate cultural awareness, be able to work in groups, and exhibit empathy and sympathy towards other group members. In order to show empathy, the facilitator needs to

communicate according to the visitor's social status and academic background. According to Bandura's cognitive social theory, language ability is important to ensure understanding of information and to influence one's personality. Halim et. al (2021) stated that, other than knowledge and skills, abilities in advising and sharing, can contribute to lessening the gap between the students and facilitators. Thus, facilitators with good communication skills could motivate one's behavior.

The subject knowledge dimension of a facilitator's competency level recorded a mean of 3.83. The findings show that overall, the science facilitators studied have a high level of subject knowledge. This finding is supported by Grenier (2011), who found that expert docents have knowledge of the subject and relate general knowledge and specific knowledge in the context of non-formal learning (museum) to achieve learning goals. These findings are also in line with competency models that place subject knowledge or knowledge of facilitators 'areas of expertise wherever the organization they serve is an important competency (National College 2010, Saedah and Mohamad Sani 2012, Bernhardsson & Lattke 2011, Boyatzis 2008 and Stewart 2006). Facilitators need to evaluate their students' existing achievements or knowledge (Tran 2007) and further encourage students to expand their existing ideas or concepts to new situations. This is important as science and technology are highly dynamic and full of innovations in line with globalization and rapid technological and scientific development. Therefore, a facilitator needs to guide the students to constantly develop ideas.

Comparison of Science Facilitator Competency Levels in terms of personal qualities, subject knowledge, communication skills, learning evaluation, and learning assistance based on demographic factors

The study's findings showed that gender and work experience do not affect the level of facilitators' competence. This finding is in line with Fairuz (2014) study, which found that teachers' teaching experience does not affect the level of science teachers' competencies. On the other hand, there are significant differences between the competency levels of facilitators with different academic qualifications. The differences could be observed between the MCE/MHCE, Diploma, and Bachelor/Master groups. The mean scores indicated that facilitators with Bachelor's/Master's academic qualifications have higher competencies compared to facilitators with a diploma and MCE/MHCE academic qualifications.

Furthermore, the study's findings show significant differences in personal quality, subject knowledge, and learning evaluation based on academic qualifications. However, the dimensions of communication skills and learning assistance are the same for facilitators with different academic qualifications. Science facilitators with a bachelor's/master's degree have higher levels of competencies in personal qualities, subject knowledge, and learning evaluation than facilitators with MCE/MHCE and diplomas. This finding contradicts the study of Bailey (2006) and Plummer & Small (2013) study, which reported that while non-formal Science facilitators do not necessarily have a degree, they usually improve pedagogical skills through daily work experience as most did not receive specialized education training. Nevertheless, facilitators with a bachelor's/master's degree have experienced the learning environment in higher education. This experience gives them the advantage to learn quickly from the daily work experience. This finding is in line with Grenier (2011), who argued that an expert docent should have diverse learning experiences, including formal training, continuing non-formal education, and incidental learning. In this context, facilitators who have a bachelor's/master's degree have undergone formal education in their

respective areas of expertise, so it is an advantage for these facilitators to demonstrate competence in aspects of personal quality, subject knowledge, and learning evaluation.
In the meantime, the level of communication skills and learning assistance are similar for facilitators across different academic qualifications. This finding means that academic qualifications do not affect their communication skills and learning assistance competencies. Grenier (2011) stated that communicating, conveying information, and reading and adapting to the audience is a requirement for a docent. Meanwhile, Tran (2002) stated that professional facilitators come from diverse academic backgrounds and range from experts to non -experts. It is clear here that the language of the facilitator's academic qualifications does not affect the competence in communication skills. Moreover, communication skills are learned from experience. Hence, higher interaction would lead to better communication skills. In terms of learning assistance, academic qualifications do not affect the level of competence of the facilitator. This shows that the facilitator can create a safe learning environment, motivate students to take responsibility for the next learning process, and encourage collaborative learning even if they do not have high academic background. This aligns with the Contextual Model, which states that individuals constantly interact with the physical and socio-cultural environment across time.

7. Conclusion and Implication

The findings of this study have both theoretical and practical implications that could benefit various stakeholders in the field of science education in general and particularly facilitators, agencies/institutions, and researchers involved in non-formal science education. Human interactions play a significant role in influencing individuals daily. Therefore, in ensuring that this non-formal learning of science is effective, competent facilitators wisely adapt and apply their competencies to personal, physical, and sociocultural contexts. The level of competence of facilitators should be constantly improved by focusing on training and professional development courses to maintain the existing competencies and improve some aspects. Agencies/institutions can increase the conditions for hiring facilitators based on Bachelor's/Master's academic qualifications. Non-formal science learning complements formal learning. However, collaborative relationships between agencies/institutions and relevant parties are essential where the agencies or institutions can enrich and further diversify programs involving facilitators by involving school teachers to share their experiences and best practices.

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