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An Exploratory Factor Analysis on Generating of Quality of Science Teacher Attributes From Malaysian Science Teacher Perspectives

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Abstract

This study is to develop and establish the reliability attributes of quality science teacher from Malaysian science teacher perspectives. This paper discusses the validity and reliability of quality science teacher attributes obtained through the Exploratory Factor Analysis (EFA) process using IBM SPSS Version 21. The design of quantitative survey method used in this study to collect data through attributes of quality science teacher instrument (AQSTI) which has been generated from the previous studies. AQSTI consist of 68 item under three constructs namely value, skill and knowledge were put together to form a questionnaire using a 5-point Likert-scaled. Participants consisted of 230 science teacher in secondary school. The instrument was representing indicators for quality science teacher attributes. The internal consistency using Cronbach's coefficient alpha for every construct is greater than 0.800. For the overall instrument using the 68 items that comprised the three constructs, internal consistency reliability revealed a Cronbach's coefficient alpha of 0.900. From the analysis, 42 items of quality science teachers generate where 19 items retained under values attributes, six item for skills attribute and, 17 item for knowledge attributes. However, there were 26 items absent from the original questionnaire, thus the items were discarded because they were found inappropriate for representing constructs proposed. Consequently, a total of 42 items representing indicators for these attributes of a quality science teacher. Furthermore, all the attributes used to collecting data to develop attributes of quality science teacher for the real study to improve the quality of student teachers, in terms of values, skills and knowledge.

Keywords: Exploratory Factor Analysis, Attributes, Quality Science Teacher, Values, Skills And, Knowledge.

Introduction

The education system in Malaysia often has transformed in line with the global world development in order to produce human capital that meets the need. Updating and improvement of the basic causes of transformed in education to achieve the goals and vision

of the State (Ministry of Education, 2013). To ensure this goal is achieved, the teacher is an individual who played the important role in implementing policies to produce quality human capital in education content (Brotby, 2016). Indirectly, all these efforts to be the responsibility of the educators (Ahmad, 2008). The quality of human capital can be produced if the educators have the quality to meet this objective. Teacher quality could be improved if they practice in the quality of the practice of their profession (Halim & Meerah, 2006). Professional skills teacher quality refers to the ability to convey their knowledge, skills and show a good attitude when implementing responsibilities (Abdullah & Jasmi, 2014). Teachers need to have a great personality, skills, knowledge and innovation high for a positive impact on students (Aderi, Noh, Razak, & Kasim, 2015) Basic education in Malaysia is also experiencing a transformed as found in the Malaysian Education Development Plan 2013-2025 emphasizes the education of science, technology, engineering and mathematic (STEM) Kementerian Pendidikan Malaysia, (2013). The quality of science teachers is needed to ensure that all wishes will be fulfilled.

Review of literature

National Education Philosophy, emphasis on balance outcome on development human capital, while Malaysian Teacher Standard provides an overview of the standards for teacher to achieve it, (Bahagian Pendidikan Guru, 2009). Generally, the standard was divided into three constructs which are values, knowledge and skills. Another related study of quality teacher attributes by Sylvia Chong and Horn Mun Cheah, (2009) was articulated in values, skills and knowledge (VSK) is a framework for initial teacher preparation programmes. The VSK framework articulated, in broad terms, the desired skills and knowledge components for beginning teachers, with the underlying core values permeating the programmes.

Background of the Research

Through the process of exploratory factor analysis was conducted aims to improve the validity of the newly-built item (Reinhard, 2006). In addition, the implementation of the exploratory factor analysis is to reduce too many items into the same dimensions as the dimensions of the same item means (Toni Rietveld, 1993).

The Purpose of the Study

The focuses of this study to see the instrument of quality science teacher attributes is valid and reliable through factor analysis. The instrument was developed from the previous study using document analysis.

Methodology

A quantitative method using exploratory factor analysis (EFA) was applied in this study as a process to the developed instrument (Steven Lovett; Antonette M.Zeiss & Gloria D. Heinemann, 2002).

Sample

This study involves 270 science teacher in secondary school using convenience sampling methods (Hertzog, 2008) in peninsular Malaysia. The sample size for an EFA should be at least 100 (Gorsuch, 1983). Andrew L. Comrey, (1992) suggest that sample size for EFA , N=100 is poor, N=200 is fair , N=300 is good, N=500 is very good and N=1000 or more is excellent. If the EFA is for a pilot study the sample selected should not involve in the actual study. The respondent had at least five years of experience in teaching of science and the priority is for an expert science teacher.

Instrument

The instrument was developed from the previous study in document analysis using thematically method (Nor'ain, Nuruhuda, Azwani, & Noraini, 2014) with the deductive approach (Soiferman, 2010). These sources of data to developed the instrument were policy, philosophy, online information, and research literature on Malaysia education, especially in the science field. From the document analysis, 68 items were generated.

Limitation of the Study

Limitations inherent in the EFA technique is in the naming constructs that may exist in every factor proposed. There are also items that are difficult to interpret because of the classified into more specific factors, therefore the interpretation of researchers based on literature review is required to help overcome these problems (Tabachnick & Fidell, 2007). This study also focusing on the perspective of quality of science teacher from science teacher selected through their expertise and experience that have been generated from document analysis.

Data Analysis

IBM SPSS Version 21 was used for data analyse and the generation of statistics. The data also analysed by EFA using principle components analysis (PCA) followed by a varimax rotation. 68 items used to be analyse using factor analysis. The factor analysis has been used to restructure data specifically whether there have the data reduction or dimension reduction in essential form (Matsunaga, 2010).

Results

The overall mean score for the instrument is this study is 4.32 with a standard deviation of 0.529. The internal consistencies (alpha coefficients) are 0.909 for value, 0.821 for skill, and 0.941 for knowledge. The overall value of Cronbach's alpha for attributes quality of science teacher instrument (AQSTI) is 0.890. Table 1 shows the mean, standard deviation, and Cronbach's alpha for each construct. Gable and Wolf (1993) alpha reliability for the entire construct must be has a value of at least 0.80 to 0.70 but the top is better. Pallant (2001) also believes the alpha index of 0.7 or above is good for scale
instruments that have ten or more items and an alpha value of 0.5 is considered either to scale instruments that have fewer than ten items. Since in this study, the reliability value is greater than 0.8 for each construct so it was considered good items and reliable.

Table 1
Set of attribute quality science teacher construct.

constructs	Number of items	Mean	Standard Deviation	Reliability
Value	19	4.48	0.518	0.909
Skill	6	4.34	0.509	0.821
Knowledge	17	4.14	0.560	0.941
Total	**42**	**4.32**	**0.529**	**0.890**

In this study, the construct validity of each instrument is conducted through exploratory factor analysis using principal component analysis (PCA). This analysis was conducted to prepare and identify the legality of a large number of items are grouped into

each constructor below certain variables of the study sample (Tabachnick & Fidell, 2007). The methodology proposed by Hair, Black, Babin, & Anderson, (2010)used in this study in which: 1) all items which have anti-image correlation ≥ 0.5 will be received, 2) test Bartlett's Test of Sphericity achieve significant values ($p < 0.05$) to measure the correlation between items or variables, 3) test sample efficiency Kaiser-Meyer-Olkin high of ≥ 0.5 were used to determine adequate item 4) items that have the load factor (factor loading) ≥ 0.5 is maintained. From the results of exploratory factor analysis to test Bartlett's Test of Sphericity demonstrated the value of $p < 0.000$ according to Hair et al., (2010) the significant value of $p < 0.05$ indicate that the correlation between items sufficient for factor analysis was conducted. KMO test displays multi-collinearity 0.916, namely greater than 0.50 indicates that the item is not the same aspect. Table 2 show the result of KMO and Bartlett's Test.

Table 2
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.916
Bartlett's Test of Sphericity	Approx. Chi-Square	6858.112
	df	861
	Sig.	0.000

The results of exploratory factor analysis also showed the value of communality between 0.0 and 1.00 to reflect the proportion of the variance of each factor. All 42 items give the communality 1.000 shows that the contribution factor is 100% to the overall variance. Table 3 shows the final items generate fo AQSTI with there factor loading.

Table 3
AQSTI with factor loading

	Component		
Item	1	2	3
P14	.793		
P15	.752		
P3	.741		
P13	.740		
P18	.732		
P17	.707		
P8	.700		
P16	.692		
P19	.672		
P20	.657		
P12	.655		
P2	.651		
P10	.619		
P4	.557		
P11	.550		
P9	.542		
P1	.515		
V17		.673	

V16		.661	
V19		.660	
V22		.657	
V4		.651	
V15		.648	
V10		.645	
V7		.627	
V5		.612	
V8		.612	
V14		.610	
V13		.602	
V11		.597	
V18		.596	
V12		.593	
V20		.579	
V9		.572	
V6		.507	
V21		.500	
K1			.672
K11			.625
K8			.621
K23			.603
K15			.595
K2			.589

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Conclusion

The factor analysis result has demonstrated that there is three factor in quality science teacher attributes. The three constructs are valued (19 items), skill (six items), and knowledge (17 items). Consequently, a total of 42 items representing indicators for these attributes of a quality science teacher.

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Appendix

Arahan:

Kajian ini bertujuan untuk mengumpul maklumat dan mengenal pasti atribut NILAI, KEMAHIRAN dan PENGETAHUAN guru sains yang berkualiti yang harus diterapkan ke

dalam model latihan perguruan di universiti dan IPGM khususnya untuk guru sains. Soal selidik ini mengandungi 68 soalan berkaitan atribut guru sains berkualiti. Tuan/puan telah dipilih untuk memberikan maklum balas kepada soal selidik berikut bagi menyempurnakan kajian ini berdasarkan amalan tuan/puan segabai guru berpengalaman/ guru cemerlang sains di sekolah.

BAHAGIAN A : Atribut NILAI guru sains berkualiti.
Bahagian ini mengandungi 25 item

Bagi setiap penyataan di bawah, tuan/puan dipohon untuk membulatkan skala yang terbaik mewakili pandangan tuan/puan tentang **atribut guru sains berkualiti dari aspek nilai dalam amalan PdP** berdasarkan skala seperti berikut:

Sangat Tidak Setuju → **Sangat Setuju**
STS → **SS**

Guru sains berkualiti perlu mempunyai nilai…		**Tahap Persetujuan Tuan/Puan** STS → SS				
1.	... percaya bahawa semua pelajar boleh belajar.	1	2	3	4	5
2.	... memupuk semangat inovasi dan kreativiti.	1	2	3	4	5
3.	... komitmen tinggi terhadap profesion perguruan terutamanya dalam bidang sains.	1	2	3	4	5
4.	... bekerjasama dengan komuniti.	1	2	3	4	5
5.	... menghargai perbezaan budaya.	1	2	3	4	5
6.	... menyampaikan pengajaran dengan ikhlas.	1	2	3	4	5
7.	... komitmen yang tinggi kepada sistem pendidikan semasa.	1	2	3	4	5
8.	... berusaha meningkatkan pengetahuan secara berterusan.	1	2	3	4	5
9.	... berusaha meningkatkan kemahiran saintifik secara berterusan.	1	2	3	4	5
10.	... sedia memberi khidmat kepada masyarakat.	1	2	3	4	5
11.	…mementingkan amalan hidup yang sihat.	1	2	3	4	5
12.	… mengutamakan keselamatan dalam melaksanakan tugas.	1	2	3	4	5
13.	… sikap terbuka untuk menerima idea baharu berkaitan PdP sains.	1	2	3	4	5
14.	… bersedia untuk melaksanakan idea baharu berkaitan PdP sains.	1	2	3	4	5
15.	….mudah didekati kerana mempunyai sifat penyayang.	1	2	3	4	5
16.	….menggalakkan pelajar belajar secara berkumpulan yang melibatkan kepelbagaian budaya.	1	2	3	4	5

17.	....melibatkan diri dalam aktiviti komuniti sekolah untuk menggalakkan pembelajaran sains.	1	2	3	4	5
18.	....menunjukkan sikap saintifik.	1	2	3	4	5
19.	....menggalakkan sikap saintifik dalam kalangan pelajar.	1	2	3	4	5
20.	....mematuhi kod etika professional perguruan dengan memodelkan tabiat kerja yang baik.	1	2	3	4	5
21.	....menggunakan bahasa positif untuk menggalakkan pelajar supaya bertambah baik.	1	2	3	4	5
22.	....sedia berkhidmat kepada masyarakat	1	2	3	4	5
23.	....menghambakan diri kepada Tuhan.	1	2	3	4	5
24.	....mengamalkan sikap cinta kepada alam sekitar.	1	2	3	4	5
25.	....menggalakkan sikap cinta kepada alam sekitar kepada pelajar.	1	2	3	4	5

BAHAGIAN B : Atribut KEMAHIRAN Guru Sains yang Berkualiti.
Bahagian ini mengandungi 23 item

Bagi setiap penyataan di bawah, tuan/puan dipohon untuk membulatkan skala yang terbaik mewakili pandangan tuan/puan tentang **atribut guru sains berkualiti dari aspek kemahiran** berdasarkan skala seperti berikut:

Sangat Tidak Setuju → **Sangat Setuju**
STS → **SS**

Guru sains berkualiti perlu mempunyai kemahiran		**Tahap Persetujuan Tuan/Puan** **STS** → **SS**				
26.	....menyampaikan pengajaran dengan berkesan.	1	2	3	4	5
27.	....berupaya motivasikan pelajar.	1	2	3	4	5
28.	....menggunakan pelbagai teknik pengajaran yang berkesan untuk memudahkan pemahaman pelajar.	1	2	3	4	5
29.	....menguruskan disiplin bilik darjah dengan baik dengan mengendalikan kelas secara teratur untuk pembelajaran yang selesa.	1	2	3	4	5
30.	....menilai prestasi pelajar untuk memperbaiki amalan PdP.	1	2	3	4	5
31.	....menggunakan data prestasi pelajar untuk memperbaiki amalan pembelajaran pelajar.	1	2	3	4	5
32.	....berkomunikasi untuk bekerjasama dengan ibu bapa dengan baik.	1	2	3	4	5
33.	....menguruskan keselamatan rutin kelas / makmal dengan berkesan.	1	2	3	4	5
34.	....mengaplikasi teori bagi memperbaiki pengajaran.	1	2	3	4	5

35.	....menyuarakan pendapat tentang PdP.	1	2	3	4	5
36.	....menguruskan kerja dan masa dengan baik.	1	2	3	4	5
37.	....mengurus aktiviti kokurikulum dengan baik.	1	2	3	4	5
38.	....menggunakan teknologi pendidikan yang sesuai untuk keberkesanan PdP.	1	2	3	4	5
39.	....menggunakan alat bantu pengajaran yang sesuai untuk keberkesanan proses PdP.	1	2	3	4	5
40.	....menggunakan bahasa saintifik yang sesuai dalam PdP.	1	2	3	4	5
41.	....menguruskan bahan sains mengikut prosedur dengan baik.	1	2	3	4	5
42.	....menyediakan aktiviti pengayaan untuk meningkatkan keberkesanan pengalaman pembelajaran sains .	1	2	3	4	5
43.	....berkomunikasi secara berkesan untuk menyampaikan objektif pengajaran .	1	2	3	4	5
44.	....menggalakkan pelajar menjalankan penyelidikan saintifik .	1	2	3	4	5
45.	....mengatasi masalah berkaitan isu-isu bencana alam.	1	2	3	4	5
46.	....mengendalikan peralatan makmal sains dengan baik .	1	2	3	4	5
47.	....menggunakan teknik penyoalan yang melibatkan pemikiran aras tinggi (KBAT) bagi mencabar pemikiran pelajar.	1	2	3	4	5
48.	....mengesan pengetahuan sedia ada pelajar terhadap PdP sains.	1	2	3	4	5

BAHAGIAN C : Atribut PENGETAHUAN Guru Sains yang Berkualiti.
Bahagian ini mengandungi 20 item
Bagi setiap penyataan di bawah, tuan/puan dipohon untuk membulatkan skala yang terbaik mewakili pandangan tuan/puan tentang **atribut guru sains berkualiti dari aspek pengetahuan** berdasarkan skala seperti berikut:

Sangat Tidak Setuju → **Sangat Setuju**
STS → **SS**

Guru sains berkualiti perlu mempunyai pengetahuan….		**Tahap Persetujuan Tuan/Puan** **STS** → **SS**				
49.	....tinggi terhadap kandungan subjek sains yang diajar (seperti fakta, konsep, prinsip, teori, falsafah, idea, dan lain-lain).	1	2	3	4	5
50.	....memilih bahan pengajaran yang sesuai dengan subjek diajar.	1	2	3	4	5
51.	....menjawab soalan pelajar dengan baik.	1	2	3	4	5

52.	....pelbagai jenis strategi PdP sains yang berkesan.	1	2	3	4	5
53.	....penggunaan teknologi dalam PdP.	1	2	3	4	5
54.	....pentaksiran untuk menilai pencapaian pelajar.	1	2	3	4	5
55.	.... menggunakan maklum balas dari pada pelajar untuk keberkesanan PdP.	1	2	3	4	5
56.	....tentang tabii sains (*Nature of Science*).	1	2	3	4	5
57.	....kemahiran saintifik (kemahiran proses sains dan kemahiran manipulatif sains).	1	2	3	4	5
58.	....sains dalam konteks pelbagai budaya (seperti agama, budaya dan kaum).	1	2	3	4	5
59.	....tentang nilai murni dalam bidang sains.	1	2	3	4	5
60.	....tentang idea global dalam bidang sains (seperti tenaga, iklim, hubungan sains dengan bidang lain).	1	2	3	4	5
61.	....tentang implikasi terhadap aplikasi sains (seperti Pembangunan Mampan, pemuliharaan dan pengurusan sisa)	1	2	3	4	5
62.	....pelbagai model yang berkaitan dalam amalan PdP sains.	1	2	3	4	5
63.	....penyelidikan semasa dalam PdP sains (seperti pendekatan baru untuk mewujudkan persekitaran PdP positif).	1	2	3	4	5
64.	....tentang masalah pembelajaran konsep sains.	1	2	3	4	5
65.	....tentang teori pedagogi dalam PdP sains.	1	2	3	4	5
66.	....tentang strategi untuk meningkatkan kreativiti / inovasi dalam PdP sains.	1	2	3	4	5
67.	....kemahiran berfikir dalam bidang sains.	1	2	3	4	5
68.	....cara mengurus untuk mengatasi isu berkaitan bencana alam.	1	2	3	4	5