Pertanika J. Soc. Sci. & Hum. 25 (S): 239 - 250 (2017)

PERTANIKA JOURNALS

SOCIAL SCIENCES & HUMANITIES

Journal homepage: http://www.pertanika.upm.edu.my/

Science Attitude Indicators among Indigenous Pupils

Nur Bahiyah Abdul Wahab[1]*, Sharifah Nurulhuda Tuan Mohd Yasin[2], Azman Hassan[2], Jailani Md. Yunos[2] and Zulkifli Mohamed[2]

[1]Science Department, Institut Pendidikan Guru Kampus, Temenggong Ibrahim, Jalan Datin Halimah, 80350 Johor Bahru, Johor, Malaysia

[2]Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia

ABSTRACT

This research paper discusses the development of an instrument to measure the attitude to science displayed by indigenous pupils. The two main objectives of this research are to build a set of criteria for developing a correct attitude to science among indigenous pupils and to determine the reliability of each criterion to develop a correct attitude to science among indigenous pupils. A qualitative approach using document analysis and an expert interview protocol was undertaken to build the criteria for developing a correct attitude towards science among indigenous pupils. Data from the document analysis and expert interviews were analysed manually using the frequency matrix table. Cohen's Kappa reliability analysis was used to determine the agreement index items for each criterion identified. The reliability of the nine criteria and 28 dimensions that were established to measure attitude towards science among indigenous pupils was tested using the quantitative approach. To obtain the reliability score of these criteria, questionnaires were distributed to 31 indigenous pupils throughout Johor, Malaysia. The Kappa coefficient value was 0.84, which showed very good agreement. The responses were analysed using the Rasch Measurement Model as available in Winstep software. The Cronbach's Alpha value for the criteria was 0.98. The development of the instrument to measure the attitude of indigenous pupils towards science is one of the research efforts to enhance the learning competency of indigenous pupils, especially in the aspect of knowledge. The outcome of this research will be one of the key elements for future research in developing a science competency standard for indigenous pupils.

Keywords: Criteria, indicator, indigenous pupils and attitude towards science

ARTICLE INFO

Article history:
Received: 01 November 2016
Accepted: 15 April 2017

E-mail addresses:
nurbahiyahwahab@gmail.com (Nur Bahiyah Abdul Wahab),
shnurulhuda@gmail.com (Sharifah Nurulhuda Tuan Mohd Yasin),
azmanh@uthm.edu.my (Azman Hassan),
jailani@uthm.edu.my (Jailani Md. Yunos),
zulmohamed@uthm.edu.my (Zulkifli Mohamed)
* Corresponding author

ISSN: 0128-7702

INTRODUCTION

Curriculum transformation in Malaysia has taken into account the participation of minorities in Malaysia including indigenous pupils (Kementerian Pendidikan Malaysia (KPM), 2012). The Ministry of Education and Department of Orang Asli Development (JAKOA) have intensified efforts to improve the educational attainment of indigenous pupils. Various provisions and facilities have been channelled towards improving the performance of indigenous pupils, but a matter of concern is the twin issue of drop-outs and low-academic achievement among indigenous pupils that have still not changed significantly.

In this research, an instrument to measure attitude to science was built in an effort to improve the competency of indigenous pupils. This indicator can be used as a guide for teachers to shape a correct attitude among students towards science subjects. According to Martin, Seaton, Wagner and Gerlovich (2007), science can develop a positive attitude in terms of emotions and the intellect. Pupils who have a positive attitude towards science will accept the subject, its objectives, the activities and the overall learning environment positively.

Indigenous pupils seem to prefer non-formal education, particularly that which offers them freedom to do more challenging activities (Maarof & Sarjit, 2008). Therefore, indigenous pupils' interest need to be considered in addressing their learning problems. Thus, the implementation of a precise indicator to measure their attitude to science would be able to improve the motivation and inclination of indigenous pupils to learn and explore.

PROBLEM STATEMENT

Education as a right of indigenous communities is not a new issue for the Ministry of Education and the Department of Orang Asli Development (JAKOA). Both organisations have collaborated to provide education for indigenous communities and have allocated a large amount of funds to assist indigenous communities in receiving education and achieve success in life. To realise Malaysia's vision of achieving developed nation status by the year 2020, the social and economic progress of indigenous communities need to aligned with those of the rest of the country notwithstanding the often-heard cliché that these communities are undeveloped and laid-back (Ma'rof & Sarjit, 2008).

Ahmad and Mohd. Jelas (2009) stated that education is considered a trivial matter by indigenous communities. According to them, the majority of parents in indigenous communities are not concerned about their children's school attendance and they do not monitor their children's education performance. In addition, reviews of indigenous pupils' competency level and attitude towards learning give an alarming report (Ahmad & Mohd Jelas, 2009; Ma'rof & Sarjit, 2008; Shaari, Yusoff, Nuraini, Ghazali, & Dali, 2011).

They have been found to be sensitive, humble and prone to sulking, leading to difficulty in interacting with the outside

world (Ma'rof & Sarjit, 2008). They seem to find interaction with others difficult because they are rather timid. According to Ahmad and Mohd. Jelas (2009), the timidity of indigenous pupils causes them to learn only when there is external reinforcement. They also feel ashamed when they have difficulty understanding a topic and are embarrassed to ask questions. Ma'rof and Sarjit's finding (2008) that indigenous pupils are sensitive is supported by Ahmad and Mohd. Jelas (2009), who found that the reason for their sensitivity was low self-esteem. They are embarrassed and demotivated from going to school because they feel they are looked down upon by society.

A positive attitude towards science subjects was used as the main subject in this research. Identifying the attitude of indigenous pupils to science allows teachers to identify suitable opportunities, space and time that can develop indigenous pupils' interest in learning in order to motivate these children to be engaged in lessons, for instance by asking questions to satisfy their curiosity. Hence, the objectives of this research were:

i. to build a set of criteria for an instrument that measures attitude towards science among indigenous pupils
ii. to determine the reliability of each criterion of the instrument

METHODOLOGY

This research used the qualitative approach based on document analysis and expert protocol interview to determine a set of criteria for an instrument to measure the attitude of indigenous pupils towards science. The document analysis was done to identify the key criteria. According to Hassan (2009), a document review is the most suitable method to collect information in a qualitative study.

Data obtained from the document analysis were analysed to identify the criteria for an instrument to measure pupils' attitude to science. Subsequently, data obtained from interviews with experts were analysed manually using the frequency matrix table. Cohen's Kappa reliability analysis was conducted to determine the overall agreement index from the obtained criteria. The coefficient agreement value was calculated using Cohen's (1960) formula. The formula is as follows:

$$K = (fa-fc) / (n-fc)$$

where, K is the coefficient

fa is the unit of agreement

fc is the possibility that the unit is set at the level of 50%

N is the number of transcription units or construct-tested agreement

The reliability of the criteria was tested using the quantitative approach. Sets of a questionnaire that measured the criteria, consisting of 80 items, were distributed to 31 indigenous pupils throughout Johor. The responses were analysed using the Rasch Measurement Model as available in Winstep software.

RESULTS AND DISCUSSION

Document Analysis and Expert Interviews for Criteria to Measure Attitude to Science

Data obtained from the document analysis were summarised (see Table 1). Some of the studies consulted were Noll (1935), Kozlow and Nay (1976), Martin and Harlen (1996) and Kementerian Pendidikan Malaysia (2011). Noll (1935) found that attitude to science is closely related to application of science skills such as intellectual honesty, accuracy in action, open-mindedness (rational), suspended judgement, findings based on the evidence of cause and effect and critical thinking. Noll's (1935) definition of attitude to science has some similarities with the measurement of attitude to science by Kozlow and Nay (1976), which encompasses criteria such as critical thinking, suspended judgement, dependence on evidence, honesty, objectivity and willingness to change opinion. According to Harlen (1996), the inquiry learning approach can build individual criterion such as honesty, respect for evidence, curiosity and critical reflection.

A proper attitude to science as outlined by the Ministry of Education, which is in line with Martin et al. (1994), emphasises criteria such as diligence, a caring nature, independence, honesty, rationality, critical thinking, accuracy, objectivity and truth. The summary of criteria based on the document analysis is shown in Table 1.

Table 1
Criteria to measure indigenous pupils' attitude to science obtained from document analysis

Researcher/Criteria	KPM (2011)	Harlen (1996)	Martin et al. (1994)	Kozlow & Nay (1976)	Noll (1935)	f
Diligence	√	X	√	X	X	4/7
Caring nature	√	X	X	X	X	4/7
Independence	√	X	√	√	X	5/7
Rationality	√	√	√	√	√	7/7
Critical thinking	√	√	√	√	√	7/7
Dependence on evidence	X	√	√	√	√	4/7
Objectivity	√	√	√	√	√	5/7
Willingness to change opinion	√	√	√	√	√	5/7
Rationality	√	√	√	√	√	5/7

Table 1 shows that the main criteria in measuring indigenous pupils' attitude to science as obtained from the document analysis are: i) diligence; ii) caring nature; iii) independence; iv) honesty; v) rationality; vi) critical thinking; vii) dependence on evidence; viii) objectivity; and ix) willingness to change opinion.

Table 2
Review by experts of criteria to measure attitude to science

No	Pupils' Science Attitude Criteria	Expert 1	Expert 2	Expert 3
1.	Diligence	√	√	√
2.	Caring nature	√	√	√
3.	Independence	√	√	√
4.	Honesty	√	√	√
5.	Rationality	√	√	√
6.	Critical thinking	√	√	√
7.	Dependence on evidence	√	√	√
8.	Objectivity	√	√	√
9.	Willingness to change opinion	√	√	X

Based on the document analysis and protocol of interviews shown in Table 2, the main attributes frequently cited by researchers in measuring attitude to science are: i) diligence; ii) caring nature; iii) independence; iv) honesty; v) rationality; vi) critical thinking; vii) dependence on evidence; viii) objectivity; and ix) willingness to change opinion.

Comparison of Criteria Selected by Researchers Based on Document Analysis

Table 3
Comparison of attributes selected by researchers for dimension of diligence

No	Diligence Dimension	Hussin (1984)	Md Aroff & Hoon (1994)	Martin et al. (1994)	KPM (2011)
1.	Dedication	√	√	√	√
2.	Determination	√	√	√	√
3.	Diligence	√	√	√	√

Table 3 compares the criteria selected by different researchers for the dimension of diligence. The frequently mentioned attributes are dedication, determination and diligence.

Table 4
Comparison of attributes selected by researchers for dimension of caring nature

No	Caring Nature Dimension	Hussin (1984)	Md Aroff & Hoon (1994)	Martin et al. (1994)	KPM (2011)
1.	Compassion	√	√	√	√
2.	Understanding	√	√	√	√
3.	Appreciation	√	√	√	√

Table 4 compares the criteria selected by different researchers for the dimension of caring nature. The frequently mentioned attributes are compassion, understanding and appreciation.

Table 5
Comparison of attributes selected by researchers for dimension of independence

No	Independence Dimension	Hussin (1984)	Md Aroff & Hoon (1994)	Martin et al. (1994)	KPM (2011)
1.	Responsibility	√	√	√	√
2.	Initiative	√	√	√	√
3.	Confidence	√	√	√	√

Table 5 compares the criteria selected by different researchers for the dimension of independence. The frequently mentioned attributes are responsibility, initiative and confidence.

Table 6
Comparison of attributes delected by tesearchers for dimension of honesty

No	Honesty Dimension	Noll (1935)	Kozlow & Nay (1976)	Hussin (1984)	Md Aroff & Hoon (1994)	Martin et al. (1994)	Harlen (1996)	KPM (2011)
1.	Truth	√	√	√	√	√	√	√
2.	Trustworthiness	√	√	√	√	√	√	√
3	Readiness to acknowledge the work of others	√	√	X	X	√	√	√
4	Readiness to assess findings	√	√	X	X	√	√	√

Table 6 compares the criteria selected by different researchers for the dimension of honesty. The frequently mentioned attributes are truth, trustworthiness, readiness to acknowledge the work of others and readiness to assess recording findings.

Table 7
Comparison of attributes selected by researchers for dimension of rationality

No	Rationality Dimension	Noll (1935)	Kozlow & Nay (1976)	Hussin (1984)	Md Aroff & Hoon (1994)	Martin et al. (1994)	Harlen (1996)	KPM (2011)
1.	Open-mindedness	√	√	√	√	√	√	√
2.	Logic	√	√	√	√	√	√	√

Table 7 compares the criteria selected by different researchers for the dimension of rationality. The frequently mentioned attributes are open-mindedness and evaluation based on logic.

Table 8
Comparison of attributes selected by researchers for dimension of critical thinking

No	Critical Thinking Dimension	Noll (1935)	Kozlow & Nay (1976)	Hussin (1984)	Md Aroff & Hoon (1994)	Martin et al. (1994)	Harlen (1996)	KPM (2011)
1.	Critical Thinking	√	√	√	√	√	√	√
2.	Dependence on empirical evidence	√	√	X	X	√	√	√
3.	Readiness to challenge validity of statements	√	√	X	X	√	√	√

Table 8 compares the criteria selected by different researchers for the dimension of critical thinking. The frequently mentioned attributes are critical thinking, dependence on empirical evidence and readiness to challenge validity of statements.

Table 9
Comparison of attributes selected by researchers for dimension of dependence on evidence

No	Dependence on Evidence Dimension	Noll (1935)	Kozlow & Nay (1976)	Martin et al. (1994)	Harlen (1996)	KPM (2011)
1.	Readiness to ensure facts are supported by explanation	√	√	√	√	√
2.	Readiness to provide evidence for supporting facts	√	√	√	√	√

Table 9 compares the criteria selected by different researchers for the dimension of dependence on evidence. The frequently mentioned attributes are readiness to ensure facts are supported by explanation and readiness to provide evidence for supporting facts.

Table 10
Comparison of attributes selected by researchers for dimension of objectivity

No	Objectivity Dimension	Noll (1935)	Kozlow & Nay (1976)	Martin et al. (1994)	Harlen (1996)	KPM (2011)
1.	Readiness to consider all data before making decisions	√	√	√	√	√
2.	Readiness to report findings based on observation	√	√	√	√	√

Table 10 compares the criteria selected by different researchers for the dimension of objectivity. The frequently mentioned attributes are readiness to consider all data before making decisions and readiness to report findings based on observation.

Table 11
Comparison of attributes selected by researchers for dimension of willingness to change opinion

No	Willingness to Change Opinion Dimension	Noll (1935)	Kozlow & Nay (1976)	Martin et al. (1994)	Harlen (1996)	KPM (2011)
1.	Readiness to accept facts	√	√	√	√	√
2.	Readiness to admit knowledge is dynamic	√	√	√	√	√
3.	Readiness to modify a hypothesis based on evidence	√	√	√	√	√

Table 11 compares the criteria selected by different researchers for the dimension of willingness to change opinion. The frequently mentioned attributes are readiness to accept facts, readiness to admit knowledge is dynamic and readiness to modify a hypothesis based on evidence.

Findings from Interviews with Experts

Table 12
Findings from interviews with experts on dimension of diligence

No	Diligence Dimension	Expert 1	Expert 2
1.	Dedication	√	√
2.	Determination	√	√
3.	Diligence	√	√

Table 12 compares the criteria selected by the different experts during the interviews for the dimension of diligence. Both experts agreed that these attributes should be present: dedication, determination and diligence.

Table 13
Findings from interviews with experts on dimension of caring nature

No	Caring Nature Dimension	Expert 1	Expert 2
1.	Compassion	√	√
2.	Understanding	√	√
3.	Appreciation	√	√

Table 13 compares the criteria selected by the different experts during the interviews for the dimension of caring nature. Both experts agreed that these attributes should be present: compassion, understanding and appreciation.

Table 14
Findings from interviews with experts on dimension of independence

No	Independence Dimension	Expert 1	Expert 2
1.	Responsible	√	√
2.	Initiative	√	√
3.	Confidence	√	√

Table 14 compares the criteria selected by the different experts during the interviews for the dimension of independence. Both experts agreed that these attributes should be present: responsibility, initiative and confidence.

Table 15
Findings from interviews with experts on dimension of honesty

No	Honesty Dimension	Expert 1	Expert 2
1.	Truth	√	√
2.	Trustworthiness	√	√
3	Readiness to acknowledge the work of others	√	√
4	Readiness to assess findings	√	√

Table 15 compares the criteria selected by the different experts during the interviews for the dimension of honesty. Both experts agreed that these attributes should be present: truth, trustworthiness, readiness to acknowledge the work of others and readiness to assess findings.

Table 16
Findings from interviews with experts on dimension of rationality

No	Rationality Dimension	Expert 1	Expert 2
1.	Open-mindedness	√	√
2.	Logic	√	√

Table 16 compares the criteria selected by the different experts during the interviews for the dimension of rationality. Both experts agreed that these attributes should be present: open-mindedness and evaluation based on logic.

Table 17
Findings from interviews with experts on dimension of critical thinking

No	Critical Thinking Dimension	Expert 1	Expert 2
1.	Critical thinking	√	√
2.	Dependence on empirical evidence	√	--
3.	Readiness to challenge validity of statements	√	√

Table 17 compares the criteria selected by the different experts during the interviews for the dimension of critical thinking. Both experts agreed that these attributes should be present: critical thinking and readiness to challenge validity of statements. However, for the attribute of dependence on empirical evidence, the experts had different opinions. Expert 1 believed it was necessary but Expert 2 did not. According to Expert 2, in order to obtain empirical evidence, integration science skills need to be used, but these skills are less appropriate for use by lower primary pupils.

Table 18
Findings from interviews with experts on dimension of dependence on evidence

No	Dependence on Evidence Dimension	Expert 1	Expert 2
1.	Readiness to ensure facts are supported by explanation	√	√
2.	Readiness to provide evidence for supporting facts	√	√

Table 18 compares the criteria selected by the different experts during the interviews for the dimension of dependence on evidence. Both experts agreed that these attributes should be present: readiness to ensure facts are supported by explanation and readiness to provide evidence for supporting facts.

Table 19
Findings from interviews with experts on dimension of objectivity

No	Objectivity Dimension	Expert 1	Expert 2
1.	Readiness to consider all data before making decisions	√	√
2.	Readiness to report findings based on observation	√	√

Table 19 compares the criteria selected by the different experts during the interviews for the dimension of objectivity. Both experts agreed that these attributes should be present: readiness to consider all data before making decisions and readiness to report findings based on observation.

Table 20
Findings from interviews with experts on dimension of willingness to change opinion

No	Willingness to Change Opinion Dimension	Expert 1	Expert 2
1.	Readiness to accept facts	√	√
2.	Readiness to admit knowledge is dynamic	√	√
3.	Readiness to modify a hypothesis based on evidence	√	X

Table 20 compares the criteria selected by the different experts during the interviews for the dimension of willingness to change opinion. Both experts agreed that these attributes should be present: readiness to accept facts and readiness to admit knowledge is dynamic. However, the experts disagreed on the attribute readiness to modify a hypothesis based on evidence. Expert 1 agreed that this attribute was necessary but Expert 2 did not. According to Expert 2, evaluating a hypothesis might be confusing for pupils, especially if there are discrepancies in observed data.

Agreement Value for Criteria

Based on the analyses, the researchers identified nine criteria and 25 dimensions to be used to build an instrument to measure the attitude of indigenous pupils to science. The instrument was reviewed by two experts and received the agreement of both that it was useable. The Kappa coefficient value for agreement was 0.84, which indicated very good agreement.

Aspect	Science Attitude
Kappa Agreement Value	K = (46-25) /(50-25) = 0.84
Interpretation	Excellent

Summary of Reliability of the Items and Respondents

Questionnaires were distributed to 31 indigenous pupils in order to obtain the reliability of the proposed instrument. The completed questionnaires were collected and analysed using the Rasch Measurement Model available in Winstep software. The results of the analysis are given below.

Cronbach's Alpha	Item reliability	Person reliability	Item separation	Person separation
0.98	0.82	0.95	2.15	4.48

The value for Cronbach's Alpha was 0.98. According to Pallant (2001), for an instrument in the preliminary stages of a study, the acceptable Alpha value is 0.6. The reliability of the items and the respondents for the criteria in the proposed instrument to measure the attitude of indigenous pupils to science was more than 0.80. Bond and Fox (2013) stated that when the reliability value was above 0.80, strong reliability is indicated. The separation indices for the items and respondents obtained were 2.15 and 4.48, respectively. This shows that there was separation for difficulty levels for two categories of item difficulty and four levels of achievement of pupil attitudes. This finding indicated that the instrument that was built to measure the attitude of indigenous pupils towards science was highly reliable and therefore, highly acceptable.

CONCLUSION

In conclusion, the findings yielded nine criteria for measuring the attitude of indigenous pupils towards science namely, diligence, caring nature, independence,

honesty, rationality, critical thinking, and dependence on evidence, objectivity and willingness to change view. The instrument developed was found to have high reliability and was strongly accepted.

With this instrument, teachers will be able to understand the attitude to science that should be formed during science lessons. Attitude is important because it affects what is learnt as well as the effort put into carrying out activities during a lesson.

REFERENCES

Ahmad, A. R., & Mohd Jelas, Z. (2009). *Masyarakat Orang Asli. Perspektif pendidikan dan sosiobudaya*. Bangi: UKM.

Bond, T., & Fox, C. M. (2015). *Applying the Rasch model: Fundamental measurement in the human sciences.* Routledge.

Cohen, J. (1960). A coefficient for agreement for nominal scales. *Education and Psychological Measurement, 20*, 37–46.

Harlen, W. (1996). *The teaching of science in primary school.* London: David Fulton.

Hassan, A. (2009). *Instrumen penilaian pembimbing dalam perlaksanaan PBK pelajar di industri.* Johor: Universiti Teknologi Malaysia.

Hussin, S. (1984). Pengajaran nilai dalam kurikulum. Selangor: Penerbit Fajar Bakti.

Kementerian Pelajaran Malaysia (KPM). (2011). *Dokumen standard kurikulum dan prestasi. Sains Tahun 3.* Putrajaya, Malaysia: Bahagian Perkembangan Kurikulum.

Kementerian Pelajaran Malaysia (KPM). (2012). *Laporan awal pelan pembangunan pendidikan Malaysia 2013 hingga 2025.* Putrajaya: Kementerian Pelajaran Malaysia.

Kozlow, M. J., & Nay, M. A. (1976). An approach to measuring scientific attitudes. *Science Education, 60*(2), 147–172.

Ma'rof, R., & Sarjit S. G. (2008). *Orang Asli: Isu, transformasi dan cabaran.* Selangor: Penerbit Universiti Putra Malaysia.

Martin, R. E., Seaton, J. C., Wagner, K., & Gerlovich, J. (2007). *Teaching science for all.* Allyn and Bacon: USA.

Md. Aroff, A. R. & Hoon, C. L. (1994). *Pendidikan moral*. Selangor: Longman Malaysia.

Noll, V. H. (1935). Measuring in scientific attitudes. *The Journal of Abnormal Psychology, 30*, 145–154.

Pallant, J. (2001). *SPSS survival manual.* NSW, Australia: Allen & Unwin.

Shaari, A. S, Yusoff, N., Ghazali, M. I., & Dali, M. H. (2011). Kanak-kanak minoriti Orang Asli di Malaysia: Menggapai literasi Bahasa Melayu. *Jurnal Pendidikan Bahasa Melayu, 1*(2), 59–70.