Title	Current views of science educators in madrasahs about science
Author(s)	Muhammad Faizal bin OTHMAN and RAMANATHAN Subramaniam
Source	*ERAS Conference, Singapore, 24-26 November 2004*
Organised by	Educational Research Association of Singapore (ERAS)

Current Views Of Science Educators In Madrasahs About Science

Muhammad Faizal bin OTHMAN (faizal@muis.gov.sg)
Majlis Ugama Islam Singapura

RAMANATHAN Subramaniam (subrar@nie.edu.sg)
Natural Sciences and Science Education Academic Group
National Institute of Education

Abstract
In Singapore, science teachers in Madrasahs work in an environment where Islamic principles are pronounced. The curriculum offers both Islamic and secular studies. One aspect of its secular studies is science. The content of the science syllabus is primarily based on modern science. This research aims to document the current views of science educators in the Madrasahs about science, its connections with epistemology, religion, economy, environment, health, public policy, aesthetics and literacy. A total of 34 Madrasah science teachers, representing about 94% of the Madrasah science teachers population in Singapore, responded to a survey instrument for the purpose of this research. Results showed that science teachers in the Madrasahs are positive about science. In fact they feel that science is important, and that scientific research should be adequately funded by government. More than 90% of the respondents feel that a person can be both religious and scientific, that science has made contributions to public health, and that it has contributed to mankind's appreciation of beauty. However, most (91%) disagreed that science is more important than religion.

Introduction
Research on teacher's beliefs about science has received much attention in recent years from educators, as the educational paradigm has shifted from behaviourism to constructivism. Many educational researchers agree that teachers' beliefs may, in some way, affect teachers' instructional practice and eventually their students' ways of thinking. The knowledge, beliefs, and theories that a teacher holds about the nature of science as well as the teaching and learning of science determine to a great extent what science education will be for a given child (Ambimbola, 1983). Songer and Linn (1991) have shown that students' views about the nature of science do influence the outcomes of their learning in science – and this is, to a certain extent, shaped by the teachers' attitudes about science.

Hodson (1998) has suggested that there are two major reasons for the failure of modern education to achieve the objective of improving students' understanding of the nature of science – one is the teachers' own inadequate views about the nature of science, and another is the degree of confusion in the philosophical stance inherent in many of these curricula. In the Singapore context, Boo (1995) has investigated the views of pre-service and in-service teachers in Singapore about the nature of science, the aims of science education and science instruction. She found that the majority of

pre-service and in-service teachers in her study had a rather limited or superficial view of the nature of science.

The need for teachers to have positive attitudes in science is a given in today's society. Young (1998) has suggested that if changes are to be made in the uptake of science by pupils at all levels, then positive attitudes must be formed during the students' primary and secondary school days. This, in turn, relies on teachers themselves having a positive attitude towards this area of the curriculum. Young (1998) also found that it was crucial that positive attitudes towards science be developed and maintained in order that learning can take place.

Further research by Cobern and Loving (2002) and Levitt (2001) have also shown that positive attitudes about science were held by teachers in their respective studies. In particular, Levitt has suggested that teachers' beliefs about their role in elementary science do influence decisions about the teaching of science. In a study of 16 teachers from two school districts in Pennsylvania, USA, she found that teachers believed that the teaching of science should be student-centred. This belief was contrary to the ones held by teachers in the United Arab Emirates, who thought that science learning centred mainly upon the transmission of verified knowledge (Haidar, 2002), and by Taiwanese teachers (Tsai, 2002), who held traditional beliefs in teaching science, that is, science is thought to be best taught by transferring knowledge from teacher to students.

Levitt (2001) further found that teachers believed that students should be active participants in the learning of science, not just passive recipients of information. The teachers also felt that students should be engaged in hands-on activities when learning science, and that the learning of science should be meaningful to students. This was similar to the findings of Haidar (2002) who found that science learning is believed to be centred upon students making personal meaning out of scientific knowledge.

In defining science, various interpretations exist in the beliefs of teachers worldwide. Young (1998) has found that teachers identified science in terms of disciplinary contexts used in the school curricula, for example, biology, physics and chemistry. Science was believed to be intellectually useful but was not seen as useful in everyday life. In addition, science was seen as something to be dealt with by specialists - it was not seen as having a day-to-day impact on an individual's approach to life. Also, teachers perceived science as finding out about the world. This was quite similar to the beliefs of Taiwanese teachers, who thought that science is a representation of truth and the provision of answers (Tsai, 2002). On the contrary, teachers in the United Arab Emirates thought that science is more about inventing or designing things (Haidar, 2002). In a Singapore study on 40 practising science teachers, Boo & Toh (1998) found that teachers subscribed to the view of science as largely a collection of facts.

Culture, as an overarching attribute of an individual's social environment, has attracted the attention of social constructivists in recent years as they sought to establish its nexus with science learning. Aikenhead (1997) has observed that students feel that school science is like a foreign culture to them. This feeling stems from the fundamental differences between the culture of modern science and the culture of indigenous societies. In the Arab culture, the work of Haidar (1997) on science

teachers' worldview presuppositions and the nature of science teaching and learning has also shown the influence of culture on the teaching and learning of science. It can therefore be argued that cultural studies in science education do play a major role in the teaching and learning of science in non-Western societies. Interestingly, this also applies to minority and religious groups in the Western world (Cobern 1993, Costa 1995, Aikenhead 1996). In this study, the definition of culture was taken as the "norms, values, beliefs, expectations, and conventional actions" of a group (Phelan et al, 1991).

Though the foregoing studies have made significant contributions towards our understanding of the nature of science, there is an absence of studies in the literature which examine the attitudes of science teachers in Islamic seminaries as well as of these teachers in multicultural settings. The Singapore setting offers a unique context to undertake this study as science education in the Madrasahs is offered in a religious environment. The majority of schools in Singapore do not have such an environment. Also, no research has so far been undertaken to study the views of Madrasah science teachers on science issues. This study therefore aims to document the current opinions and beliefs of science educators in the Madrasahs about science and its connections with epistemology, religion, economy, environment, health, public policy, aesthetics and literacy. As Singapore is a multi-cultural and multi-religious society that places great emphasis on science and technology driven socio-economic development as well as the peaceful co-existence of all religious groups, such an environment further affords a context to see how these settings have shaped the beliefs of science teachers in the Madrasahs as compared to more homogenous societies elsewhere, such as in the Middle-East.

Madrasahs In Singapore

A Madrasah, by definition, is an "institution for the training and formation of ulama" (Algar, 1987); the word 'ulama' means the learned and refers to scholars of Islam who are the guardians, transmitters and interpreters of its sciences, doctrines, and the laws and the chief guarantors of continuity in the spiritual and intellectual history of the Islamic community.

The first-full time Madrasah built in Singapore was the Madrasah Alsagoff Al-Arabiah, which was set up in 1912. In 1925, Madrasah Al-Arabiah was built and this was followed by Madrasah Aljunied Al-Islamiah in 1927. These three Madrasahs were built on lands bequeathed by Muslim philanthropists in the 1900's. The other three Madrasahs are Madrasah Al-Maarif Al-Islamiah, Madrasah Al-Irsyad Al-Islamiah, and Madrasah Wak Tanjong. They were built in 1936, 1947 and 1958 respectively.

All six Madrasahs offer both religious and secular education. Each Madrasah has its own curriculum, which is generally holistic. Students learn the Arabic language, Islamic history, and other Islamic subjects. In addition, students learn Mathematics, Science and the English language. Currently, students in the Madrasahs take the Singapore-Cambridge GCE'O' level examinations on top of their Secondary Four Religious Examination, which is administered by Majlis Ugama Islam Singapura (Muis), a statutory board under the Ministry of Community Development, Youth and Sports. Under the Compulsory Education Act, starting from the year 2008, it will be mandatory for Madrasah students in Primary 6 to take the national Primary School Leaving Examinations.

The total enrolment in the Madrasahs is about 4420 students. Each year, about 400 students enrol in Primary 1, the starting point for Madrasah education. Madrasahs are basically funded by donations from the public as well as by grants provided by Muis. The financial dispensation is in the form of student grants, teachers' top-up allowances, training and development budget for teachers, and so on. Under the Administration of the Muslim Law Act, all Madrasahs are under the jurisdiction of Muis, though each Madrasah has its own management committee to administer its operations.

Madrasah teachers are recruited by individual Madrasahs on the basis of their qualifications and experience. Currently, 49 out of the total 220 Madrasah teachers are undergoing a Diploma in Education programme.

Methodology

Subjects

34 science teachers from five full time Madrasahs in Singapore responded to a survey for the purpose of this study. They were either teaching science subjects or will be teaching science. A profile of the teachers who participated in this study is indicated below:

Gender
Male: 23% Female: 77 %

Academic Qualification
Degree: 48 % 'A' levels: 17 % Diploma: 26 % 'O' levels: 9 %

Age Group
20 – 29 : 40 %
30 – 39 : 49 %
40 & above : 11 %

Language stream in which educated
English 100 %

	Mean	Std Deviation
Teaching experience in full time Madrasahs	3.8 years	4.1 years
Teaching experience in national schools	1.3 years	2.2 years
Number of hours per week in teaching science	5.4 hours	5.2 hours

One Madrasah did not participate in this study as it did not offer formal science subjects in its curriculum. The authors conducted the survey on three different dates and venues as some teachers could not attend on the initial day of the survey. However, most of the teachers (27) completed the survey on the initial day. Three of the teachers completed the survey on the second day while another four completed it on the third day. Only one teacher was not able to participate.

Survey instrument

The instrument used for the survey was due to Cobern W.W (2000). A number of items in this instrument were fine-tuned, changed or deleted to suit the conditions of Islamic culture in Singapore as well as the school culture in the Madrasahs.

The revised instrument was validated by three doctorates from the National University of Singapore and the Nanyang Technological University in Singapore as well as by a prominent leader of an Islamic organisation in Singapore. Validation included the following:

i) use of language,
ii) structure / layout of survey form,
iii) scope / coverage of questions.
iv) clarity of statements

Based on their feedback, a few statements were slightly refined. This resulted in an instrument of 44 items, distributed into nine categories: epistemology, religion, economy, environment, health, public policy, aesthetics, gender and literacy. The instrument was later pilot- tested on three Muslim teachers who have taught science in a Madrasah or were teaching science in national schools. The results showed that the instrument was adequate for the purpose of this study.

The instrument was in English, as all Madrasah science teachers have been educated in the English medium and are comfortable with the use of English for communication. It was felt that it was not necessary to translate the statements in the instrument into Malay, a language which all of them are able to read, write and speak.

On the day of administration of the survey instrument, the teachers were briefed about the purpose of the research, assured that the survey was completely confidential, instructed that their names need not be written on the form, and that their frank opinions are sought about the various statements in the instrument. The teachers were requested to respond to each of the 44 items in the survey instrument according to how they felt about science and other issues, using a Likert scale of 1 to 5. The scores corresponding to the Likert responses were as follows:

1 – Strongly Disagree; 2 – Disagree; 3 - Not Sure; 4- Agree; 5 – Strongly Agree.

The survey instrument took about 30 minutes for completion.

Results

Data analysis

Descriptive statistics were used for data analysis in this study. Frequency counts and percentage points were calculated for each of the five responses corresponding to each of the 44 items. The means and standard deviation for each category as well as for each item, were also calculated.

The Cronbach Alpha parameter was used to test the internal consistency of the 44-item survey instrument. Its value of 0.70 is the same as the minimum norm of 0.70

recommended by Nunnaly (1978), and thus indicates good reliability of the survey instrument.

Survey results

The results of the study about Madrasah teachers' thinking about science are presented in Table 1, according to the nine categories explained earlier. Items with an asterix (*) denote that the scores are reversed.

Table 1 Madrasah teachers' views about science

Item	SA	A	NS	D	SD	Mean	Std Deviation
1. Aesthetics (mean = 4.00, sd = 0.17)							
Science can contribute to our appreciation and experience of beauty.	23.5	70.6	5.9	0	0	4.12	0.66
*Scientific explanations tend to spoil the beauty of nature.	17.6	61.8	11.8	8.8	0	3.88	0.81
2. Economy (mean = 3.58, sd = 0.97)							
Developing new scientific knowledge is very important for keeping our country economically competitive in today's world.	35.3	58.8	5.9	0	0	4.29	0.58
*Knowledge in science is useful for only a few people.	38.2	50	2.9	5.9	2.9	4.15	0.96
*Scientific research is economically determined.	0	8.8	14.7	61.8	14.7	2.18	0.8
*The strength of our national economy does not depend on scientific knowledge.	20.6	44.1	20.6	14.7	0	3.71	0.97
3. Epistemology (mean = 2.94, sd = 0.47)							
*No form of knowledge can be completely certain – not even scientific knowledge.	5.9	8.8	8.8	58.8	17.6	2.26	1.05
*No source of knowledge provides absolute truth – not even science.	9.7	19.4	16.1	35.5	19.4	2.65	1.28
Science is the best source of reliable knowledge.	15.2	27.3	18.2	36.4	3	3.15	1.18
Scientific knowledge is the truest form of knowledge.	2.9	23.5	20.6	41.2	11.8	2.65	1.07
The methods of science are objective.	5.9	55.9	17.6	20.6	0	3.47	0.9
The methods of science are the most reliable source of true, factual knowledge	8.8	32.4	20.6	38.2	0	3.12	1.04

We can be certain that scientific knowledge is reliable.	11.8	47.1	17.6	23.5	0	3.47	0.99
4. Health (mean = 3.84, sd = 0.42)							
*Scientific knowledge contributes little to good health.	20.6	52.9	5.9	11.8	8.8	3.65	1.2
Scientific knowledge is the single most important factor in the improvement of medicine and public health.	23.5	35.3	14.7	26.5	0	3.56	1.13
Scientific research makes important contributions to medicine and the improvement of public health.	38.2	58.8	0	2.9	0	4.29	0.58
5. Literacy (mean = 3.84, sd = 0.64)							
All students should study science during the secondary school levels	47.1	41.2	5.9	2.9	2.9	4.26	0.93
Even at the university level all students should study at least some science.	23.5	35.3	11.8	26.5	2.9	3.5	1.21
*Most people do not really need to know very much science.	17.6	52.9	11.8	17.6	0	3.71	0.97
Science should be taught at all school grade levels.	35.3	52.9	11.8	0	0	4.24	0.65
*Science should not be made an important subject for the primary school level.	47.1	41.2	0	8.9	2.9	4.21	1.04
*Students should not be forced to take science courses at the university	2.9	20.6	14.7	55.9	5.9	2.59	0.99
Understanding science is a good thing for everyone.	50	47.1	2.9	0	0	4.41	0.78
6. Public Policy (mean = 3.11, sd = 0.97)							
*Government should not be in the business of using tax dollars to fund scientific research.	0	29.4	44.1	11.8	14.7	2.88	1.01
Research in science is generally very important.	50	50	0	0	0	4.5	0.51
*Scientific knowledge influences government decision making too much.	0	17.6	29.4	44.1	8.8	2.56	0.89
*Scientific research is often potentially dangerous to the public.	29.4	47.1	20.6	2.9	0	4.03	0.8
*Scientific research is politically determined.	2.9	14.7	29.4	35.3	17.6	2.5	1.05
Scientific research should be adequately funded by government.	50	50	0	0	0	4.5	0.51

*Scientific research should be carefully regulated by law.	0	5.9	5.9	58.8	29.4	1.88	0.77
*Scientists should not be allowed to research anything they wish.	8.8	20.6	17.6	47.1	5.9	2.79	1.12
There is little need for the legal regulation of scientific research	5.9	5.9	23.5	50	14.7	2.38	1.02
7. Religion (mean = 2.07, sd = 0.51)							
*A person can be both religious and scientific.	0	0	0	38.2	61.8	1.38	0.49
Religion and science are almost always at odds with each other.	5.9	5.9	5.9	55.9	26.5	2.09	1.05
Religion tends to impede scientific progress.	0	11.8	5.9	47.1	35.3	1.94	0.95
*Religious knowledge contributes more to the well being of a person's life than does science.	2.9	14.7	14.7	41.2	26.5	2.26	1.11
Science is a more important source of knowledge than religion.	0	5.9	2.9	55.9	35.3	1.79	0.77
Scientific knowledge tends to erode spiritual values.	0	8.8	11.8	47.1	32.4	4.32	0.64
Scientific research is morally neutral.	2.9	32.4	35.3	26.5	2.9	3.06	0.92
8. Environment (mean = 3.67, sd = 0.94)							
*Knowledge of science has often contributed to the destruction of our environment and natural resources.	8.8	52.9	17.6	17.6	2.9	3.47	0.99
*Our natural environment would actually be helped by the absence of scientific knowledge.	2.9	64.7	11.8	14.7	5.9	3.44	0.99
Science can help us preserve our natural environment and natural resources.	23.5	64.7	8.8	2.9	0	4.09	0.69
Without science, we will not be able to preserve our natural environment and natural resources.	20.6	41.2	23.5	14.7	0	3.68	0.98
9. Gender (mean = 4.24, sd = 0.82)							
Women are welcome in science just as much as men are.	41.2	47.1	5.9	5.9	0	4.24	0.82

** denotes score is reversed*

Six of the nine categories had means of over 3.5, which can be interpreted to reflect a view towards positiveness of science in relation to each of these categories. These categories are science and aesthetics, economy, health, literacy, environment and gender. The category with the highest mean was science and gender, which has a mean of 4.24. This result indicates that the teachers affirm (88.3%) the relationship of science to gender, where science is non- discriminatory when it comes to opportunities given to men and women. The perception that women should not be alienated from the mainstream of science is a welcome development. However, as there was only one question posed in this category, the result cannot be assumed to be conclusive when compared to the other categories, which had more questions in each category. The category with the second highest mean (4.00) was science and aesthetics. The teachers agreed (94.2%) that science can contribute to the appreciation and experience of beauty and believed (79.4%) that scientific knowledge did not spoil the beauty of nature. Two categories: science and health, and science and literacy categories, have the same mean score of 3.84. The teachers affirm the relationship of science to good health, and perceived scientific knowledge as an important factor in improvement of public health. In addition, the teachers also believed that science was an important subject that should be taught at all levels.

The fifth and sixth ranked categories were science and environment, and science and economy, each scoring 3.67 and 3.58 respectively. The Madrasah science teachers affirm (88.2%) that science has a positive relationship with the development and preservation of the natural resources and environment. They also affirm (94.1%) that science has a positive role in keeping the national economy competitive and believed (64.7%) that the strength of the economy depends on the development of scientific findings. These findings are especially of relevance in the Singapore context, where there is a pronounced emphasis on science and technology driven socio-economic development.

Two categories, science and public policy, and science and epistemology, fall into a zone of uncertainty, with a mean of 3.11 and 2.94 respectively. The teachers appear to be uncertain about the positive relationship between science and public policy. However they unanimously agreed (100%) that scientific research should be adequately funded by government. As for the epistemological basis of science, none strongly agreed that the methods of science are the most reliable source of factual accuracy and that scientific knowledge is reliable Also, for the other statements in this category, few strongly agreed. It is not clear as to the basis upon which these attributes are premised by the teachers but it is worthy of further study.

The only category which garnered a mean of less than 2.5 was the relationship between science and religion. The teachers disagreed (91.2%) that science was more important than religion. An interesting finding is that all of them unanimously agreed (100%) that a person can be both religious and scientific. In addition, most of them disagreed (82.4%) that religion tends to impede scientific progress.

Discussion

The present study sheds some useful light on the views held by science educators in the Madrasahs in Singapore on a range of issues pertaining to the religion, economy, aesthetics, public policy, environment, epistemology, gender, health and literature. It is clear that the Madrasah science teachers possess a mature worldview of science, and this is a welcome development in the context of Singapore, where the influence of science and technology in all sectors of the economy is well pronounced.

All the Madrasah science teachers who participated in this study believe that a person can be both religious and scientific. This is in line with the findings of Othman and Subramaniam (2003), which showed that Madrasah science teachers believed that science can be integrated with Islam. Such a belief contradicts a popular notion that some religions are in conflict with science (Seng, 2001). The latter author also mentions that despite this conflict, there has been a mutually enriching relationship between science and religion over the ages despite a number of unfortunate incidents. This is a significant finding as such beliefs could lead to a new curriculum, with a hybrid of religion and science in the Madrasah classroom. A curriculum that integrates science and Islam will bring about collateral learning in the classroom, where students construct scientific concepts side by side, and with minimal interference and interaction with their indigenous beliefs (Jegede, 1997). Conflicts of schemata that come about when relating a physical event may arise in the Madrasah classroom when science and Islamic knowledge are integrated and taught in the classroom. What is important is not the existence of conflict of ideas, but the ways in which students and teachers manage the conflicts in their minds. Aikenhead & Jegede (1999) opine that when cultural clashes between the world of modern science and indigenous culture occur, students who do not manage the conflicts successfully may approach the clash in two ways: invent ways to avoid constructing scientific knowledge or, conveniently, store the constructed scientific knowledge in their minds out of harm's way from interfering with their life-world experiences. Such approaches may bring about what researchers call the *Fatima's rule*, whereby students study a subject to pursue what is being tested and do not lead to pursuing deep knowledge.

The teachers disagreed (79.5%) that scientific knowledge tends to erode spiritual values. Most also disagreed (82.4%) that religion tends to impede scientific progress. Aikenhead and Jegede (1999) have suggested that success in science courses depends on three main factors: the degree of cultural difference that students perceive between their life-world and their classroom: how effectively students move between their life-world culture and the culture of science or school science: and the assistance students receive in making those transitions occur easily..

The positive attitudes toward science possessed by Madrasah science teachers is further underscored by their views (100%) that research in science is generally very important. These findings are similar to those found by Cobern & Loving (2002) in their study of teachers in the Midwest, USA, and by Young (1998) in her study of primary science teachers in Sheffield, UK. Attitudes do affect behaviour, and positive attitudes among teachers will lead to good teaching and, subsequently, good learning.

On the relationship between science and public policy, Madrasah science teachers agreed (100%) that scientific research should be adequately funded by government. Furthermore they also agreed that developing new scientific knowledge is

very important for keeping our country economically competitive in today's world. Such a stand suggests that the teachers view science as a domain that is very important for the nation. This perception by the teachers is very encouraging for a society such as Singapore where science and technology play an important role in socio-economic development. In fact, Jenkins (1999) has suggested that in today's society, it is imperative for citizens to be 'scientifically literate' in order to be able to contribute towards decision-making about issues that have a scientific dimension, whether these issues be personal (e.g. relating to medication or diet) or more broadly political (e.g. relating to nuclear power, ozone depletion or DNA technologies).

Some of the important reasons for these beliefs could be that science and technology are deeply embedded in various aspects of societal endeavours in Singapore and that science and technology have been key factors that have helped to pivot Singapore up the ranks in the economic league. And this has translated into all round development for the various community groups in Singapore.

Conclusion

In summary, this study has shown that science teachers in the Madrasahs in Singapore have positive attitudes towards science. Moreover, they find that science and religion can be integrated and need not be in conflict. This is a significant finding in the context of the multicultural setting of Singapore society.

Acknowledgement

We thank Majlis Ugama Islam Singapura (Muis) for their support of this study. We would further like to thank the participating Madrasahs, namely Madrasah Aljunied Al-Islamiah, Madrasah Al-Maarif Al-Islamiah, Madrasah Al-Irsyad Al-Islamiah, Madrasah Wak Tanjong Al-Islamiah and Madrasah Al-Arabiah Al-Islamiah, as well as their teachers for their assistance in this study. All views expressed in this article are those of the authors, based on their interpretations of this study, and does not necessarily represent those of their organizations.

References

Aikenhead, G.S. (1996) Science education: Border crossing into the subculture of science. *Studies in Science Education,* 27. 1-52.

Aikenhead, G.S. (1997). Toward a First Nations cross-cultural science and technology curriculum. *Science Education, 27, 1-52.*

Aikenhead, G.S & Jegede, O.J (1999) Cross Cultural Science Educatoin: A Cognitive explanation of a cultural phenomenon, *Journal of Research in Science Teaching,* 36, 269-287.

Algar H. (1987) 'Ulama' The Encyclopedia of Religion, 15:115-117, *London: Collier Macmillan Publisher.*

Ambimbola, I. (1983). The relevance of the "new" philosophy of science for the science curriculum. *School Science and Mathematics, 83(3), 181-193.*

Boo, H.K (1995). Teachers' and students understandings of the nature of science and implications on learning processes and outcomes. *Paper presented at the 9th Annual Conference of the Educational Research Association, Singapore, November 1995.*

Boo, H.K. & Toh, K.A. (1998). Practising Teacher's Views of Science. *Journal of Science and Mathematics Education in Southeast Asia, Malaysia, XXI: 29-36.*

Cobern, W.W. (1993). Contextual constructivism: the impact of culture on the learning and teaching of science. In K. Tobin (ed.) *The Practise of Constructivism in Science Education (Hillside, NJ: Lawrence Erlbaum Associates), 51-70.*

Cobern, W.W. (2000) The Thinking about science Survey Instrument (TSSI) – SLCSP 151. Kalamazoo, MI: Scientific Literacy and Cultural Studies Project *(http://www.wmich.edu/slcsp/slcsp151/tssi-v2.pdf).*

Cobern, W.W. & Loving, C.C (2002) Investigation of Preservice Elementary Teachers' Thinking about Science, *Journal of Research in Science Teaching,39(10), pp 1016-1031.*

Costa, V.B. (1995). When science is "another world": Relationships between worlds of family, friends, school and science, *Science Education,*79, 313-333.

Haidar A. H (1997) Arab prospective science teachers' world view: Presuppositions towards nature. *International Journal of Science Education, 19, 1093-1109.*

Haidar A.H (2002) Emirates secondary school science teachers' perspectives on the nexus between modern science and Arab culture, *International Journal of Science Education, 24(6), pp 611-626.*

Hodson, D. (1998). Towards a philosophically move valid science curriculum. *Science Education, 72, 19-40.*

Jegede, O. (1997). School science and the development of scientific culture: A review of contemporary science education in Africa. *International Journal of Science Education,*19, 1-20

Jenkins, E.W (1999) School science, citizenship and the public understanding of science. *International Journal of Science Education, 21, NO. 7, 703– 710*

Levitt K.E (2001) An Analysis of Elementary Teachers' Beliefs Regarding the Teaching and Learning of Science, *Science Education, 86, pp 11-22.*

Nunnaly, J. (1978) *Psychometric Theory*, New York: McGraw Hill.

Othman, M.F. and Subramaniam, R. (2003). Madrasah science teachers' perspectives on the nature of science, teaching, and learning of science. *Paper presented at the Educational Research Association of Singapore Conference, November 2003.*

Phelan, P., Davidson, A., & Cao, H. (1991). Student's multiple worlds: Negotiating the boundaries of family, peer, and school cultures. *Anthropology and Education Quarterly, 22, 224-250.*

Seng, P.L. (2001). Islam, Science and Science Education: Conflict or Concord? *Studies in Science Education, 36, 45-78.*

Songer, N.B., & Linn, M.C. (1991). How do students' views of science influence knowledge integration? *Journal of Research in Science Teaching, 28(9), 733-760.*

Tsai C.C, (2002) Nested epistemologies: science teachers' beliefs of teaching, learning and science, *International Journal of Science Education, V24, no. 8, pp 771-783*

Young T (1998) Student Teachers' Attitudes Towards Science (STATS), *Evaluation and Research in Education, V 12, No 2*