The effects of nationality on attitudes towards science among school students: a comparison of international studies

Riffat-un-Nisa Awan[1], Ghazala Noureen[2] and Anjum Naz[1]

[1]Department of Education, University of Sargodha, Pakistan.

[2]Department of Education, Lahore College for women University, Lahore, Pakistan.

ABSTRACT

This research examines the effects of nationality on attitudes of students to study science and mathematics. The main aim is to identify attitude variations of the students living in different geographical areas of the world with particular focus on students from developing and developed countries. It compares data from *'Trends in International Mathematics and Science Studies'* (TIMSS) 1996, 1999, 2003, 2007, *'Relevance of Science Education'* (ROSE) 2004, *'Programme for International Students Assessment'* (PISA) 2003, 2006, *'Science and Scientists'* (SAS) 2002. Findings make it clear that students are positive internationally but students in developing countries are more positive than the students in rich and developed countries in science, mathematics, biology and physics with chemistry as an exception. Overall East Asian students are lowest in their attitude scores in integrated science followed by Australia, North America and Western Europe while South East Asian and African Students are on other end followed by North Asia, and Middle East. It is also observed that the students' interest in science subjects is increasing with the years. For mathematics again the students of East Asia are lowest in their average scores in all international studies followed by West Europe, Australia and East Europe. On the other end are the nations like Africa, South East Asia, and Middle East. It was suggested that instead of only measuring level and dimension of attitudes, large-scale projects must look for the factors behind the tremendous variance that exists among countries, as well as how and when these attitudes change.

Introduction

The aim of this study is to explore how the attitudes of students to science and mathematics vary across different parts of the world. This study is timely and important because the number of students taking higher education courses in science and technology is rapidly decreasing in some countries. For example, Lyons (2006) reports that higher education enrolment in the natural sciences has been steadily declining in Australia, Canada, India, Japan, USA, and nearly every country in the European Union. According to a report of House of Commons (2002), the decline in the number of students taking science in UK is linked to a decline in students' interest in science and mathematics at secondary school level. If this is so, there is an urgent need to determine how and why student attitudes vary across different countries. This will enable the curricula in different countries to be developed to meet the needs and interests of secondary school students.

According to Osborne, Simon and Collins, (2003), 'The investigation of students' attitudes towards studying science has been a substantive feature of the work of the science education research community for the past 30–40 years.'(p1049). Unfortunately, different terminology has been used in studies covering similar ground. As Stefánsson (2006) describes, there are many terms and definitions in use, e.g. pupils' 'interest' in science, their 'views' of science, the 'images' they hold of science, and their 'motivation' to study science. Also, the different studies have used different methodologies and measuring instruments. Most studies have used quantitative methods, such as cross-sectional survey techniques. However, several studies have used qualitative methods, including interviews, observations and focus groups. It is not always clear that the term 'science' means the same from one piece of research to another. All that can be said is that the term implies some combination of physics, chemistry, biology and mathematics. Different researches have not always distinguished between different branches of science, and may therefore mask different attitudes to subjects within science. However, there are studies that distinguish between the branches of science.

In spite of these difficulties, the present research tries to uncover the holistic picture of attitude variations across the countries over the world. It focuses particularly on the variations in attitude between students of developed and developing nations. It also examines whether there are differences in attitude among different parts of the world.

Method

In this research only the cross-national comparative studies are discussed. The research projects included in this study are Relevance of Science Education (ROSE) in 2004, Science and Scientists (SAS) in 2002, Programme for International Students Assessment (PISA) in 2003, 2006, and Trends in International Mathematics and Science Studies (TIMSS) in 1996, 1999, 2003, 2007,. For the ROSE project, the data were kindly provided by Professor Svein Sjøberg, , as it was not publicly available. An average of mean scores of males and females, having positive

attitude, from ROSE and SAS was used in making various comparisons. For the PISA project, the mean scores of columns A, C and D were used for students' interest in biology, chemistry and physics, and a mean score was derived by adding up the scores of all items for integrated science in figure 3.8 entitled 'Index of general Interest in Science'. (OECD, 2006. Chap 3, p. 139). For the eighth graders in TIMSS, 15 year-olds in PISA and ROSE, and 13 year-olds in SAS, only the results of students giving 'Agree'or 'Strongly agree' responses are included. These responses are taken as indicating positive attitudes.

The results of the various projects are being discussed mainly under three headings i.e. (1) General Science, (2) Physics, Chemistry and Biology, and (3) Mathematics. As explained previous, the discussion will focus on comparisons between developing and developed countries and among different geographical parts of the world. The precise designation of countries as 'developed' or 'developing' is given in Table 1. The grouping of the countries in different parts of the world is specified in Table 2. In this grouping Asia and Europe are further divided into regions and the reason behind this division is the fact that some groups of countries are entirely different from the others in the same continent.

Analysis of Results
General Science
Developed vs Developing Countries
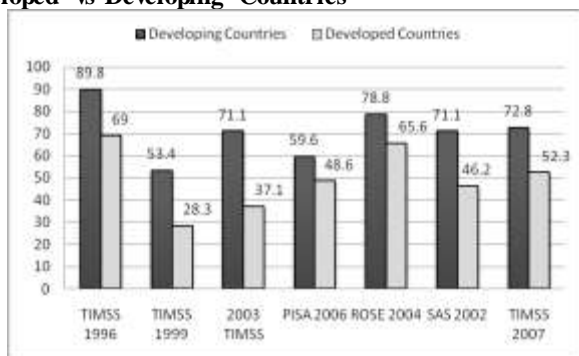
Figure 1. Mean Scores of Students' Science Positive Attitude for Developed and Developing Countries

Figure 1 summarises the data in Table 3 to facilitate comparisons between developed and developing countries. It shows that, for all the research projects, the mean scores of students in developed countries students are lower than those of students from developing countries. The data in Table 3 shows that countries like Norway, Sweden, England, Denmark, Iceland, Finland, Australia, Israel, Netherlands, Italy, Ireland, Canada, Hong Kong, Korea, Japan, and Taipei have the lowest percentages of students with a positive attitude. At the other extreme, are the countries like Nigeria, Philippines, India, New Guinea, Uganda, Ghana, Botswana, Malaysia, Tunisia, Jordon, Egypt, Iran, Kuwait, Singapore, Thailand, Columbia and Kyrgyzstan.

One important finding in the TIMSS projects is the increase in mean scores of developed countries from 28.2 in 1999 to 52.1 in 2007. On the other hand, the increase in mean score of developing countries is very small between 2003 and 2007. In TIMSS 2007, the difference in mean scores of developed and developing countries is not as great as it was in TIMSS 2003.

Different Geographical Parts of the World

Figure 2 shows that East Asian students have the lowest attitude scores. They are followed by Australia, North America, Western Europe and Eastern Europe, while South East Asia and

Africa, followed by North Asia and Middle East are at the other extreme. It is important to note that students from Japan, Korea, China and Hong Kong, did not particularly like science
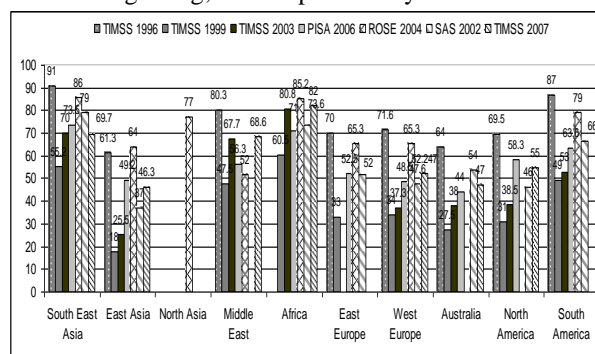
Figure 2. Mean Scores of Students Science Positive Attitude for Different Parts of the world

Physics, Chemistry and Biology

Attitudes towards the individual subject areas are not explored to the same extent as for general science, because, with the exception of a few countries, science is generally taught as an integrated subject to the younger students. PISA 2006 and TIMSS are the only studies that investigate attitudes towards the science subject areas separately. Table 4 gives the data for students' attitudes to Physics, Chemistry and Biology.

Developed vs Developing Countries
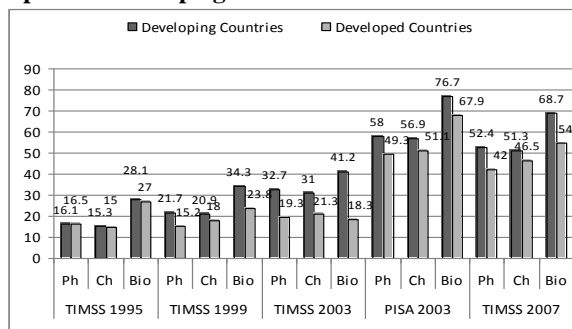
Figure 3. Mean Scores of Students Positive Attitude towards Physics, Chemistry and Biology in Developed and Developing Countries

Figure 3 shows that, in all subject areas, the attitudes of students in developing countries were more positive than those of the students in developed countries. In countries teaching the sciences as separate subjects at the eighth grade, attitudes were most positive towards biology and least positive towards chemistry and physics. The students in developing countries had slightly more positive towards physics than towards chemistry. In developed countries, it was the other way round.

Different Geographical Parts of the World
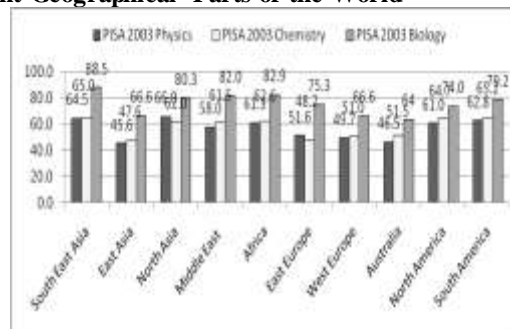
Figure 4. PISA Mean Scores of Students Positive Attitude towards Physics, Chemistry and Biology in different Parts of the World
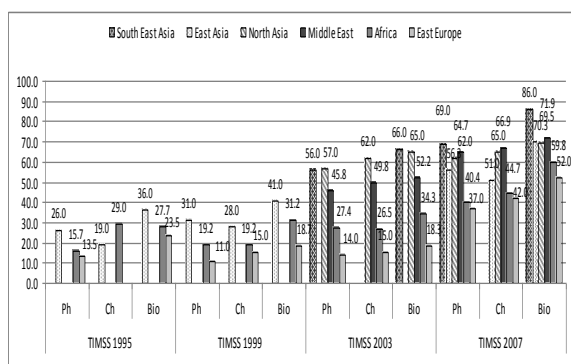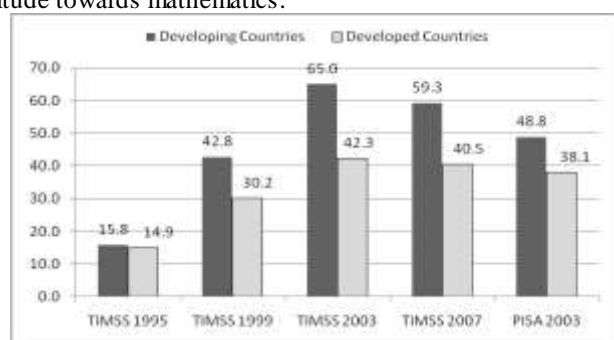
Figure 5. Mean Scores of Students Positive Attitude towards Physics, Chemistry and Biology in different Parts of the World

Figure 4 and 5 show that the students' interest in physics, chemistry and biology is increasing with the years. This trend can be observed clearly by comparing the means in the TIMSS projects from 1995 to 2007. Overall, the mean scores were lowest for students in Western Europe, followed by those East Europe, North and East Asia. The students in South East Asia had highest mean scores, and were followed by North and South America, the Middle East and Africa. Once again, the students were more positive towards biology than chemistry and physics. Counteis like Macedonia Bulgaria, Moldova, and the Russian Federation in TIMSS 1999 and Armenia, Macedonia, Moldova, and Indonesia and Lebanon in TIMSS 2003 and Indonesia, Algeria and Syrian Arab Republic in TIMSS 2007 have relatively large percentages of students at the high level in almost all subject areas. Serbia has the highest percentages in the high category for biology, while the Slovak Republic has the highest in chemistry and the Russian Federation in physics. Romania was amongst the most positive in biology, but was less positive in physics and chemistry.

Mathematics

Only the five research reports of TIMSS and one report of PISA consider attitudes to mathematics. The results in the following table suggest that there was a generally positive attitude towards mathematics.
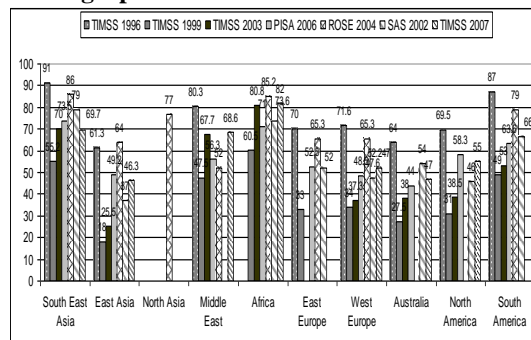

Figure 6. Mean Scores of Students Mathematics Positive Attitude in Developed and Developing Countries

The countries with the largest percentages of students with positive attitudes included Iran, Kuwait, Columbia, Cyprus, Denmark, Greece, Malaysia, Morocco, South Africa, Philippines, Tunisia, Jordan, Indonesia, Morocco, Botswana, Ghana, Egypt, Thailand, Mexico, Brazil and Turkey. At the other extreme were Japan, Austria, Luxembourg, Finland, Hungary and Netherlands and Korea. Thus, with a few exceptions, the general trend is that students in developing countries have more positive attitudes than those developed countries. This difference is small in TIMSS 1995, but it

increases over the years until 2003, while the scores decrease to 2007. PISA also tells the same story with students in developing countries having a more positive attitude (Mean =59.3) than those in developed countries (Mean =40.5).

Different Geographical Parts of the World

Figure 7. Mean Scores of Students Mathematics Positive Attitude in Different Parts of the World

Students of East Asia are lowest in their average scores in all studies. These students are followed by those in Western Europe, Australia and Eastern Europe. At the other end, are Africa, South East Asia, Middle East and South America where students are very positive about mathematics. East Asian pupils come up again with low interest in the subject. Once again, the two countries with the least positive attitudes were high-performing Japan and Korea.

Discussion

The results of all the studies may be summarised as follows.

1. Overall a high proportion of students in every country are positive or very positive about science and mathematics.

2. The students in the modernised and rich countries show little or moderate interest in science, mathematics, physics, chemistry and biology. On the other hand, children in developing and poor countries appear to be more interested in the subjects.

3. East Asian students particularly from Japan and Korea are lowest in their attitude scores in Science and mathematics, whereas all other Asian nations and African students are highest in their attitude scores.

4. Attitudes were most positive towards biology as compared to chemistry and physics. In developing countries, students were in favour of physics, whereas students in developed countries favoured chemistry

5. The number of students with positive attitudes to all science subject areas is increasing through the years.

6. There is a clear demarcation in Asian students as East Asian with lowest scores and South East Asians and Middle East students among the high scorers.

Developing vs Developed Countries

The results indicate that the interest in learning science is much higher in developing countries than in the rich and technologically developed countries. Sjøberg (2002) gives a very logical explanation for this phenomenon and concludes 'education in developing countries is largely seen as a privilege that everybody strives for, while many pupils in the rich countries see school as a tedious duty that is imposed on them. The same perspective may explain the strong interest in science expressed by girls in developing countries' (p 95).

The other conclusion that can be drawn is that the students in these countries are not challenged enough, have low academic expectations and standards, and find the curriculum easy. They are therefore more positive about the subject. Papanastasiou (2000) makes the point that teachers in these societies have low

expectations that students can easily satisfy, and consequently develop positive attitudes. The results also indicate that in poorer countries, young people have a rather heroic image of scientists, while this is not the case in highly developed Western societies (Sjøberg, 2002). In African countries, students' high interest in science may indicate that young people in these countries find it meaningful to meet challenges they are facing like poverty and ill health. They therefore want to strive for the betterment of material conditions. Authorities in Africa could utilize this positivity to alleviate poverty and hunger from the continent.

Different Geographical Parts of the World

The findings of this research cannot be explained easily as determinants of attitude have very different effects on the students in different countries or cultures. Children's academic achievement is given a more central role in some cultures than in others.

This is the biggest question, which needs to be answered for knowing why the countries with the highest achieving students showed the lowest on attitude scales and vice versa. This result is especially interesting in the case of Japanese and Korean students who are in the top 10% as regards achievement (Smith, Martin, Mullis, & Kelly, 2000). These effects have been dubbed by Sjøberg (2002) as the "Japanese paradox."

In East Asian countries, Confucian culture plays a significant part. Tsao, (2004) explains that some cultures emphasise children's personality development, and value experiences that stimulate children to think, and be confident or creative. They also stress the importance of children developing a sense of self-worth, and being independent and responsible for accomplishments. In other cultures, members of the family, teachers, and peers have great influence on the children. The varying degree of these cultural characteristics plays its role in the development of the attitudes of the students in different parts of the world.

In the case of East Asian students, it seems that a pressure is being put on the students to achieve high levels of performance in science and mathematics. There is also a strong emphasis on learning content. It may therefore be that the students follow a demanding curriculum leading to high achievement but have little enthusiasm for the subject (Mullis, Martin, Gonzalez, Gregory, Garden, O'Connor, Chrostowski, and Smith, 2000). Le Tendre, (1999) asserts that 'stories that laud the educational achievements of Japan are followed by stories that excoriate the pressures and traumas inflicted on students by the relentless regimen of study' (p 39). He further states that the studies from Japan suggest that concepts of intelligence, motivation, and persistence are culturally constructed in ways that are discernibly different from those of the U.S. or other Western nations. This pressure could be the possible explanation of the negative attitudes of the students.

Leung (2002) could not identify any particular reason for their high achievement and negative attitude of East Asian students. However, we may get some insight in this regard, from the results of the investigation by Ye, Wells, Talkmitt, & Ren, (1998), which shows that Chinese students are more influenced by their families, peers and school than the more independent American students. The latter consider scientific knowledge to be very useful for a future job, higher education, and daily lives. American students also have a more immediate concern for science, and less concern for the future than the students in China and other East Asian countries sharing the Confucian culture.

Another explanation of such response pattern comes from Iben (1991) who notes that Japanese students are more conservative in their response to attitude questions, and this expression is part of the Japanese child's training. Moreover, Japan's teachers and families have very high expectations, which students struggle to fulfil. As a result, they develop negative attitudes toward the subject (Papanastasiou, 2000).

The results also show that students of Western countries have critical attitudes to science and technology. Such views are very surprising as science knowledge is the basis of advancement in these societies. Sjøberg (2005) evaluates the situation in a historical perspective, suggesting that, when today's modern societies are in the era of early industrialisation, the focus is directed towards progress and growth for the benefit of the society. Now, that era has passed in which the work of physicists, technicians and engineers is seen as crucial for people's life and well-being. According to Sjøberg (2005), late modern societies can be characterised as post-materialistic societies, emphasising values like environment, democracy, care for others, self-actualisation, etc. They further states that the recruitment of Western students to medicine, biology and environment studies is not falling, and in these subjects the girls often outnumber the boys. Nowadays, young people feel that scientists are endangering the earth especially with developments in genetics, like cloning and bio-engineering. As Sjøberg, (2002) explains 'It may be seen as an indication that many young people have a rather well informed sceptical attitude towards certain aspects of modern society. Maybe their doubts are based on real fears about an unknown future that scientists may lead them into?' (p 96). Thus, Western societies need to remove the problems associated with the public image of scientists as being heroic.

Conclusions

Despite all these plausible explanations, it is quite evident that many factors may influence students' self-perception, and how they respond to different subjects in schools. These factors include teaching methods, the curriculum, design of textbooks, students' academic goals and aspirations. Education authorities everywhere must consider that, as long as science is not the most interesting subject, they will not choose to pursue it further. This study observes the absence of recent data on key factors and determinants of attitude in a cross-cultural context. Researchers have, for the most part, been fairly thorough in investigating whether students are positive or not, and it merely gives data about the level of attitude, positive or negative. However, they are missing the factors that determine these attitudes. They do not answer the questions of why students in different countries behave the way they do. The current knowledge base highlights critically important and fertile areas of research that require consideration from researchers. Instead of measuring only the level and dimension of attitudes, international research studies must look for the factors behind the tremendous variance that exists among countries, as well as how and when these attitudes change. They must look for the factors behind this difference that exists among the countries of the world.

More complete, comparable, and up-to-date information for monitoring trends and changes in attitude across the world is needed There is still a great need for further investigation into the differences between the cultures and the strengths of the cultures which can be used to improve and develop the attitudes

of students towards school and school science. Detailed studies of practices, values, and cultural parameters that affect education must be explored.

Many complex and subtle processes related to different cultural patterns affect pupils' attitudes so qualitative research is stronger than quantitative methods in exploring such cultural patterns. Comparative qualitative studies involving careful first-hand assessments of the peculiarities of culture and circumstance would seem to be the best option to attain such knowledge. Moreover, qualitative approaches will help the researchers to explore or understand more fully the 'why' question of attitude.

It is also quite possible that some cultures are more realistic in their self-understanding and self-measurement than others. There must be some researches to explore the response pattern of different cultures. This is what PISA studies advise while making the comparisons across countries, as students might not be answering the questions in the same way in different countries.

Acknowledgements:

References

1. Beaton, A. E., Martin, M.O., Mullis, I.V.S., Gonzales, E.J., Smith, T.A., & Kelly, D.L. (1996). Science Achievement in the Middle School Years: IEA's TIMSS. Chestnut Hill, MA: Boston College.

2. Beaton, A. E., Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Kelly, D.L., and Smith, T.A. (1996a). Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study. Chestnut Hill, MA: Boston College.

3. Brandell, G. and Staberg, E. (2008). Mathematics: a female, male or gender-neutral domain? A study of attitudes among students at secondary level. Gender and Education, 20 (5), 495-509.

4. House of Commons, (2002). Science Education from 14-19: third report of session 2001-02. Volume 1: Report and Proceedings of the Committee. London: The Stationery Office. http://www.parliament.uk/commons/selcom/s&tpnt37.htm

5. Iben, M. F. (1991). Attitudes and Mathematics. Comparative Education, 27(2), 135-151.

6. LeTendre, G.K. (1999). The Problem of Japan: Qualitative Studies and International Educational Comparisons. Educational Researcher, 28 (2), 38-45.

7. Leung, F. S. (2002). Behind the High Achievement of East Asian Students. Educational Research and Evaluation, 8(1), 87-108.

8. Lyons, T. (2006). Different Countries, Same Science Classes: Students' experiences of school science in their own words. International Journal of Science Education, 28, (6), 591–613.

9. Martin, M. O., Mullis, I., Gonzalez, EJ., Gregory, KD., Smith, TA., Chrostowski, SJ., et al (2000). TIMSS 1999 International Science Report Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade. Chestnut Hill, MA: Boston College.

10. Martin, M. O., Mullis, I.V.S., & Foy, P. (2008). TIMSS 2007 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

11. Martin, M. O., Mullis, I.V.S., & Foy, P. (2008a). TIMSS 2007 International Science Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

12. Martin, M. O., Mullis, I.V.S., Gonzalez, E.J., & Chrostowski, S.J. (2004). Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

13. Mullis, I. S., Martin, M.O., Gonzalez, E.J., Gregory, K.D., Garden, R.A., O'Connor, K.M., Chrostowski, S.J., and Smith, T.A. (2000). TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade. Chestnut Hill, MA: Boston College.

14. Mullis, I.S., M.O. Martin, E.J. Gonzalez, S.J. Chrostowski, (2004). TIMMS 2003 International Mathematics Report Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades. TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College.

15. OECD (2004). Learning for Tomorrow's World First Results from PISA 2003. Paris: OECD.

16. OECD (2006). PISA 2006 Science Competencies for Tomorrow's World. Paris: OECD.

17. Osborne, J., Simon, S. & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. International Journal of Science Education, 25, 1049–1079.

18. Papanastasiou, C. (2000). Effects of attitudes and beliefs on mathematics achievement. Studies in Educational Evaluation, 26(1), 27–42.

19. Schreiner, C. & Sjøberg, S. (2007). Science education and youth's identity construction - two incompatible projects? In D. Corrigan, Dillon, J. & Gunstone, R. (Eds.), The Re-emergence of Values in the Science Curriculum. Rotterdam: Sense Publishers.

20. Sjøberg, S. (2002). Science for the children? Report from the Science and Scientist-project. Department of Teacher Education and School Development, University of Oslo. Retrieved 30th April 2008 from http://folk.uio.no/sveinsj/sas_report_new%20.pdf

21. Sjøberg, S. (2005). How do learners in different cultures relate to science and technology? Asia-Pacific Forum on Science Learning and Teaching, Vol.6 (2) Forward, 1-17

22. Smith, T. A., Martin, M.O., Mullis, I.V.S., & Kelly, D.L. (2000). Profiles of Student achievement in Science at the TIMSS International Benchmarks. TIMSS International Study Centre Lynch School of Education BOSTON COLLEGE Chestnut Hill, Massachusetts.

23. Stefánsson, K. K. (2006). 'I just don't think it's me' A study on the willingness of Icelandic learners to engage in science related issues Unpublished dissertation, University of Oslo Department of Teacher Education and School Development

24. Tsao, Y.L. (2004). A Comparison of American and Taiwanese Students: Their Math Perception. Journal of Instructional Psychology, 31(3), 206-213.

25. Ye, R., Wells, R., Talkmitt, S., & Ren, H. (1998). Student Attitudes toward Science Learning: A cross-National study of

American and Chinese Secondary School Students. Paper presented at the Annual Meeting of the National Science Teachers Association (Las Vegas, NV, April 16-19, 1998

Table1. List of Developed and Developing Countries

Developing Countries		Developed Countries
Algeria	Liechtenstein	Australia
Argentina	Lithuania	Austria
Armenia	Macao-China	Belgium
Azerbaijan	Macedonia	Canada
Bahrain	Malaysia	Cyprus
Bangladesh	Malta	Denmark
Bosnia and Herzegovina	Mexico	England
Botswana	Moldova	Finland
Brazil	Montenegro	France
Bulgaria	Morocco	Germany
Chile	Mozambique	Greece
Chinese Taipei	Nigeria	Hong Kong
Columbia	Palestinian Nat'l Auth	Iceland
Croatia	Papua New Guinea	Ireland
Czech Republic	Philippines	Israel
Dubai UEA	Poland	Italy
Egypt	Qatar	Japan
El Salvador	Romania	Korea
Estonia	Saudi Arabia	Luxembourg
Georgia	Serbia	Netherlands
Ghana	Slovak Republic	New Zealand
Hungry	South Africa	Norway
India	Sudan	Portugal
Indonesia	Swaziland	Russian Federation
Iran	Syria	Scotland
Jordon	Thailand	Singapore
Kuwait	Trinidad	Slovenia
Kyrgyzstan	Tunisia	Spain
Latvia	Turkey	Sweden
Lebanon	Uganda	Switzerland
Lesotho	Ukraine	US

Table2. The Grouping of the Countries in Different Parts of the World

South east Asia	East Asia	North Asia	Middle east	Africa	Eastren Europe	Wesern Europe	Australia	North America	South America
Bangladesh	Chinese Taipei	Azerbaijan	Bahrain	Algeria	Armenia	Austria	Australia	Canada	Argentina
India	Hong Kong	Georgia	Dubai UEA	Botswana	Bosnia and Herzegovina	Belgium	New Zealand	Mexico	Brazil
Indonesia	Japan	Kyrgyzstan	Iran	Egypt	Bulgaria	Denmark		USA	Chile
	Korea	Russian Federation	Israel	Ghana	Croatia	England			Columbia
Malta	Macao-China	Ukraine	Jordon	Lesotho	Cyprus	Finland			El Salvador
Philippines			Kuwait	Malta	Czech Republic	France			Trinidad
Singapore			Lebanon	Morocco	Estonia	Germany			Uruguay
Thailand			Oman	Mozambique	Hungry	Greece			
			Palestinian Nat'l Auth	Nigeria	Latvia	Iceland			
			Qatar	Papua New Guinea	Lithuania	Ireland			
			Saudi Arabia	South Africa	Macedonia	Italy			
			Turkey	Sudan	Moldova	Liechtenstein			
				Swaziland	Montenegro	Luxembourg			
				Syria	Poland	Netherlands			
				Tunisia	Romania	Norway			
				Uganda	Serbia	Portugal			
				Zimbabwe	Slovak Republic	Scotland			
					Slovenia	Spain			
						Sweden			
						Switzerland			

Table 3. Percentage of Students with Positive Attitude towards General Science

Projects Countries	Timss 1996	Timss 1999	Timss 2003	Pisa 2006	Rose 2004	Sas 2002	Timss 2007
Argentina				56			
Australia	60	27	36	42		54	47
Austria				51	72		
Azerbaijan				66			
Bahrain			70				68
Bangladesh					84		
Belgium	71			51			
Botswana			85		85		84
Brazil				63			
Bulgaria				56			
Canada	68	30	30	52			56
Chile		49	53	60		65	
Chinese Taipei		27	26	53			40
Columbia	87			81			83
Croatia				55			
Cyprus	70	33					
Czech Republic				47			
Denmark				43	52		
Dubai UEA							68
Egypt							82
El Salvador							77
England	78	39		49	61	49	55
Estonia				54	60		
Finland				39	57		
France				56			
Germany				56	71		
Ghana			83		88		80
Greece				54	70		
Hong Kong	69	25	40	56			
Hungry				47		52	
Iceland				46	63	50	
India					86	76	
Indonesia		52		69			
Iran	93	56	60				73
Ireland	67			46	67		
Israel	59	30	42	44			57
Italy		29	29	54			47
Japan	56	10	17	45	64	30	47
Jordon		59	83	70			77
Korea	59	10	19	41		44	38
Kuwait	89						60
Kyrgyzstan				76			
Latvia				54	64		
Lesotho					86	71	
Liechtenstein				47			
Lithuania				60			

Country							
Luxembourg				54			
Macao-China				51			
Malaysia		72	73		80		73
Mexico				73			
Montenegro				61			
Morocco			80				
Mozambique					70		
Netherlands				38			
New Zealand	68	28	40	46			
Nigeria					77		
Norway	67		35	49	68	43	59
Palestinian Nat'l Auth			80				70
Papua New Guinea					72		
Philippines		63	75		94	82	
Poland				50	71		
Portugal				54	68		
Qatar				57			61
Romania				59			
Russian Federation				58	77		
Saudi Arabia			71				68
Scotland	78		49		67		56
Serbia				56			
Singapore	92	46	62				68
Slovak Republic				47			
Slovenia				51	66		
South Africa		58	76				
Spain	73		36	40	68	56	44
Sudan					74		
Swaziland				80			
Sweden				45	59	44	
Switzerland	67			50			
Thailand	90	43		78			68
Trinidad					79	68	
Tunisia		63	80	71			84
Turkey		45		54	52		77
Uganda					90	75	
Uruguay				58			
US	71	32	47	50		46	54
Zimbabwe				83			

The table above presents the data about the percentage of students in high category of attitude index for general science.

Table 4. Percentage of Students with Positive Attitude towards Physics, Chemistry and Biology

Projects countries	Timss 1995			Timss 1999			Timss 2003			Pisa 2003			Timss 2007		
	Ph	Ch	Bi	Ph	Ch	Bi	Ph	Ch	Bi	Ph	Ch	Bi	Ph	Ch	Bi
Algeria													83	78	84
Argentina										55	53	73			
Armenia							48	38	51				61	47	71
Australia										44	48	62			
Austria										49	47	76			
Azerbaijan										70	64	68			
Belgium	13		24	11		17			18	52	52	73			
Bosnia Herzegovina													44	47	68
Brazil										58	61	78			
Bulgaria				35	26	52	35	29	45	53	52	73	55	52	73
Canada										56	54	70			
Chile										62	65	76			
Chinese- Taipei										52	46	68			
Columbia										80	83	92			
Croatia										80	83	78			
Cyprus							33	27					49	48	
Czech Republic	11	9	16	15	14	27				47	40	69	31	44	55
Denmark										52	53	59			
Estonia							18	17	21	53	49	69			
Finland				11	15	18				41	45	66			
France										65	50	75			
Georgia													58	48	73
Germany										56	59	77			
Greece										53	53	78			
Hong Kong										56	55	75			
Hungry	10	10	22	11	9	23	19	15	26	41	36	72	31	29	53
Iceland										50	47	72			
Indonesia									66	59	55	90	69		86
Ireland										40	44	77			
Italy										44	46	74			
Japan										40	48	65			
Jordon										69	73	86			
Korea										31	42	62			
Kyrgyzstan										77	75	94			
Latvia	23	25	41	18	21	26	31	29	25	58	48	47			
Lebanon							57	62	65				57	62	61
Liechtenstein										43	53	47			
Lithuania	15	15	32	17	12	27	25	27	33	54	48	79	37	42	55
Luxembourg										55	58	75			
Macao-China										49	47	73			
Macedonia				45	42	65	50	48	61						
Malta													45		
Mexico										75	74				
Moldova				24	24	35	40	39	49	54	51	81			
Morocco													79	76	84
Netherlands	14		23	11		21	12		18	40	38	63			
New Zealand										49	55	66			
Norway										56	58	47			
Poland										36	42	77			
Portugal										58	56	61			
Romania	25	25	40	17	20	37	27	26	36	57	48	80	42	43	61
Russian Federation	26	19	36	31	28	41				51	47	79	59	54	66
Serbia							21	21	33	42	44	82	28	31	56
Slovak Republic	13	8	18	14	20	19	21	21	25	46	41	69			
Slovenia	13	11	25	12	11	22	16	22					23	42	46
Spain										35	36	59			
Sweden							16	15	19	48	50	61	37	42	52
Switzerland										55	59	51			
Syrian Arab Republic													67	68	78
Thailand										70	75	87			
Tunisia										79	67	86			
Turkey										47	50	78			
Ukraine													52	51	72
United Kingdom										51	55	75			
Uruguay										59	64	77			
US										52	56	68			

Table 5. Percentage of Students with Positive Attitude towards Mathematics

Projects countries	Timss 1995	Timss 1999	Timss 2003	Pisa 2003	Timss 2007
Algeria					83
Armenia			59		55
Australia	9	30	51	38	34
Austria	12			30	
Bahrain			70		59
Belgium	15	25	29	33	
Bosnia and Herzegovina					41
Botswana			84		78
Bulgaria		36	48		46
Canada	16	35	55	38	48
Chile		45	66	60	
Chinese Taipei		23	25		37
Columbia	26				69
Cyprus	26	50	53		44
Czech Republic	6	19		28	31
Denmark	26			55	
Dubai UEA					54
Egypt			82		78
El Salvador					68
England	18	41	39	37	40
Estonia			38		
Finland		21		27	
France	16			42	
Georgia					58
Germany	13			40	
Ghana			82		70
Greece	20			42	
Hong Kong	9	28	35	46	47
Hungry	7	19		27	30
Iceland	14			36	
Indonesia		51	71	72	72
Iran	30	54	70		64
Ireland	13			36	
Israel	17	44	57		49
Italy	40	35	32	42	38
Japan	3	9	17	24	30
Jordon		54	81		72
Korea	5	9	18	31	33
Kuwait	34				57
Latvia	8	26	50	36	
Lebanon			71		63
Liechtenstein				42	
Lithuania	7	30	53		38
Luxembourg				32	
Macao-China				39	
Macedonia		46	55		
Malaysia		74	78		73
Malta					42
Mexico				62	
Moldova		27	61		
Morocco		73	85		84
Netherlands	6	17	16	30	
New Zealand	15	34	56	43	
Norway	12		45	35	37
Oman					78
Palestinian Nat'l Auth			77		56
Philippines		59	73		
Poland				41	
Portugal	16			45	
Qatar					57
Romania	15	34			47
Russian Federation	12	36	55	45	53
Saudi Arabia			63		54
Scotland	17		54		33
Serbia			43	33	35
Singapore	20	45	63		60
Slovak Republic	9	31	47	38	
Slovenia	8	19			25
South Africa		62	79		
Spain	13			38	37
Sweden	10		29	42	39
Switzerland	16			44	
Syria					70
Thailand	16	37		72	57
Tunisia		57	79	72	73
Turkey		41		58	71
Ukraine					54
Uruguay				52	
US	15	35	58	39	41