

A Study of Iranian Students' Attitude towards Science and Technology, School Science and Environment, Based on the ROSE Project

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Abstract

This study has investigated attitudes towards science and technology, school science and environmental issues among middle school students. The population included all 3rd grade students in Isfahan and a total of 250 students (120 female and 130 male) were selected through stratified random sampling method. Research instrument was the Persian translation of the Relevance of Science Education (ROSE) Questionnaire. After pilot study, data were analyzed by SPSS. Cronbach's alpha coefficient for this scale was set to be .94. For data analysis, descriptive statistics and one sample t-test and independent t-test were used. Results indicated that there is a positive attitude towards science and technology, school science and environmental issues among students in three components of study. However, there was not a positive attitude towards some items of these components. The results also showed that in three components of the study, only there is a meaningful difference between males and females points of views in attitude towards environmental issues. According to this result, males have higher averages than the females. The results of this research provide important information about Iranian students' attitude towards science and could be used by science educators to development of science curricula and science text books.

Keywords: Science and Technology, School Sciences, Environment, Attitude, Science Education, Student, Middle School.

1. Introduction

Science education has been considered as a main area of education. This field is important because it could be improves science and technology education and increase the scientific development in higher education and other related fields. Therefore concerning the science education curriculum and the content of science books is so important. One of the fields to achieving the desired curriculum is concerning the favorites, needs and attitudes of students towards science and technology, science that is taught in schools and environmental issues. Knowing and awareness of these areas would enable science curriculum planners to develop better and appropriate curricula. Indeed, concerning element of learner in curriculum development is based on the theoretical background that considers learner, knowledge and society as the three main bases of curriculum (Eisner, 1984). Learner is the elements that many believe have most important position in structure of curriculum. Science is in the curriculum because it *is* relevant and, it should be added, relevant to *people*. Relevance is the very reason for its existence, and it should be the very backbone of science teaching (Newton 1988: 7).

Research on students' interest in science and technology increased from the 1960s (Osborne and others, 2003). Studies aimed at increasing the education of hearing the "student voice" in education. Such as work and study Flutter and Rudduck (2004), ESRC (2004), and Fielding (2004). Identifying and responding to the student voice may be seen as a means of reducing the alienation that some students feel from their schooling and thus of helping to overcome the associated problems. From this perspective, accommodating the student voice becomes a means of transforming schooling (Fletcher 2003) and of making the curriculum more relevant to students' needs and interests. 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 40 years. (Osborne et al, 2003). Students' increasing reluctance to choose science courses, and physical science courses in particular, in their final years of secondary education has important implications not only for the continuity of scientific endeavor but also for the scientific literacy of future generations. As a result, development of positive attitudes towards science, scientists, and learning science, which has always been a constituent of science education, is increasingly a subject of concern (Trumper, 2006). Students' learning interests and attitudes toward science have both been studied for decades. However, the connection between them with students' life experiences about science and technology has not been addressed much (Chang et al, 2009).

One of the new researches on student's interests and their needs and experiences on science and technology is - Relevance of Science Education (ROSE). Many researches like as TIMSS (Trends in Mathematics and Science study) and PISA (Program for international student Assessment) conducted to assess the students' abilities in science, however Rose questionnaire is not a test for assessing the conceptual understanding of students in science content, but it is a instrument for collecting data about emotional and attitude identity that students have in science and technology. Relevance of science argue that science and technology is one the important parts of life in all countries despite of their culture and level of development. It is argued that science and technology curriculum should be adjusted with needs of learners and between different groups of learners. It means that we can not accept the curriculum approaches with global and culture – neutral views when we are talking about kind of science and technology that is appropriate for all students and its goal is not only training the professionals in science and technology. For achieving to this goal we should hearing the "student voice" in science education (Schreiner and Sjoberg, 2004). This

instrument focuses on aspects that are important about of student involving in science and technology at school and life. It uses the word relevance to embrace a range of factors in terms that can be described as affective. Its broad aim is to generate perspectives and empirical findings that can inform discussions about how best to improve science curricula and enhance students' interest in science and technology in ways that:

- respect cultural diversity and gender equity
- promote personal and social relevance, and
- empower the learner for democratic participation and citizenship (Jenkins and Pell, 2006).

2. Background of research

ROSE study has been conducted in several countries by researchers of science education and its results have been published in recent years. In this section we point out some of this research and some of findings them.

Lavonen et al. (2008) studied the interests and experiences of students in physics and chemistry based on the ROSE study in Finland. Their research conducted on 3626 secondary students with average of 15 years old. Based on their results, students have many experiences in outside the school and were related to science and technology. However, they had little experience in using technology tools such as mechanical. These results showed diversity of science and technology experiences between students.

Manninen et al. (2005) examined conceptions of students about technology and environmental issues and school science. Their results showed that girls show more concern towards environmental issues. Their results also showed that both boys and girls believe in science and technology capacities and capabilities.

Stefánsson (2006) examined the Icelandic students' views about science and technology and also school science. He suggested that students consider school sciences interesting, easy to learn and believe that everyone should learn science in school. They also believed that the science that they learn in school is useful in everyday life.

Ogava and Shimode (2008), in their study on 560 Japanese students (268 female and 292 male) with average of 15 years old, examined their views about the various components of ROSE project. Result showed that there was not meaningful difference between girls and boys in attitude toward science. They consider school science important and easy to learn but were opposite to increasing the science content in science curriculum.

Trumper (2006) investigated students' interests in physics based on the ROSE study. He studied the factors in students' ideas about science in school, out-of-school experiences in science and their attitudes towards science and technology. Results showed that in general, students' interests in physics are neutral (neither positive nor negative), however, boys were more interested in physics than girls.

Chang et al. (2009) in their study on 942 Taiwanese students examined their attitudes about science and technology, learning interests and life experiences. The results indicated that boys showed higher learning interests in sustainability issues and scientific topics than girls. However, girls recalled more life experiences about science and technology in life than boys.

Anderson (2006) investigated views of 1027 students from central region of Ghana about ROSE components. His results showed that the majority of students believed that science and

technology are useful for society and can help to reduce poverty and famine in the world. The results also showed that boys are more interested in become scientists than girls.

Cavas et al. (2009) examined Turkish students' attitudes toward the environment and their interest in learning about environmental protection with respect to gender with the help of data from the ROSE study. Their study was conducted on 1,260 students in 9th grade in Turkey. The findings of this study revealed that Turkish students have favorable attitudes toward environmental issues, students are eager to find solutions to environmental problems and show optimistic trends about the future, students' interests in learning about environmental protection issues are moderate level, and statistically significant differences were found in environmental attitudes and interests in learning about environmental protection mean scores of students regarding gender.

Jenkins and Pell (2006) studied English students views on science and technology, school science and environmental issues. The sample of schools was drawn to reflect as far as possible the geographical distribution and type of secondary schools within the English education system. A total of 1,284 questionnaires were eventually received from 34 schools. The results showed that most students agree that science and technology are important for society and are optimistic about the contribution that these disciplines can make to curing diseases such as HIV/AIDS and cancer.

There was a lower level of agreement that the benefits of science are greater than its possible harmful effects, although a majority of both boys and girls hold this view. Only a minority of boys and girls agreed that science and technology will help to eradicate poverty and famine in the world. Students' positive views about science, technology and society are not reflected in their opinions about their school science education. While this is regarded as 'relevant' and 'important' by most students, most boys (and rather more girls) don't like it as much as other subjects.

Most students did not agree that school science is a difficult subject. Most boys and girls disagreed that school science has made them more critical and skeptical, opened their eyes to new and exciting jobs or increased their appreciation of nature.

Both boys and girls disagreed strongly that threats to the environment are not their business. However, such disagreement is not reflected in a corresponding general willingness to sacrifice many goods to solve or alleviate environmental problems. There was also, at best, only a moderate level of interest in learning about a range of environmental issues, save for the possible radiation dangers associated with mobile telephones and the protection of endangered species of animals.

Jenkins and Pell (2006) finally classified the English students in terms of school science preference in four categories: pro-science, latent pro-science, anti-science and apparent pro-science.

3. Research Questions

The research investigates attitudes of students in science education from three aspects. Each of these aspects or components and examining students' attitudes toward them can play important role in preparing information for curriculum planners to identify demands and needs of students in science education. These components are:

3.1 Science and technolog

Attitude towards science and technology provides important information on different aspects of students' understandings of the role and performance of science and technology in society. Trust of learners to science and technology and also their interest in topics of science and technology assess within the items of this factor;

3.2 School sciences

Whether the attitude of students towards science and technology is important, but Learners' attitude towards science that is presented directly to students in schools has also many implications for curriculum planners, textbooks designers and teachers. This component of school science, , providing the important information about the motivation of students toward science, their confidence in their ability to Science, their conception of the necessity of science education in schools, etc.;

3.3 Environment

On the assumption that successful environmental actions require environmental empowerment, empowering young people to deal responsibly with environmental issues should be a principal concern of education. Empowerment may be described as encouragement for action and belief in one's possibility and ability to influence one's surroundings. It is important to understand the attitudes, beliefs and prejudices that might prevent individuals from recognizing and using their possibilities to act (Schreiner and Sjøberg, 2002).

According to these three components, the research questions include:

- 1- What is the attitude of students towards science and technology?
- 2- What is the attitude of students towards school science?
- 3- What is the attitude of students towards environmental issues?
- 4- Is there any meaningful difference between male and female opinions on each Component?

4. Research Methodology

This study seeks to examine attitudes towards science and technology among high school students. For this purpose, a descriptive - survey was used. The population of study was all 8th grade students of Isfahan. A total of 250 students (120 girls and 130 boys) were selected as sample of study. The instrument of study was Persian version of ROSE questionnaire. Three part of this questionnaire are on attitudes to science and technology, science school and environmental includes 49 items with a Likert scale of four degrees. Among of questionnaire items, 16 items are relating to attitudes towards science and technology, 15 items are relating to school science and 18 items are relating to environmental issues. Cronbach's alpha coefficient was calculated for 49 items set to be .94. In this study, the descriptive statistics like as mean and standard deviation and one sample t-test for testing hypothesis were used.

5. Results

Findings are based on an analysis of research questions. In each section table of analysis and the statistical analysis of the data is presented.

5.1 The first research question: What is the attitude of students towards science and technology?

According to the results in Table 1, all items related to attitude towards science and technology are above average ($M=2.5$) and all items are meaningful at the level of $P \leq 0.05$. In general the results show that students have a positive attitude towards science and technology. From all items, item No. 3 (Science and technology will find cures to diseases such as HIV/AIDS, cancer, etc.), has the highest average ($M=3.31$) and item No. 15 (We should always trust what scientists have to say), has the lowest average ($M=2.67$).

5.2 The second research question: What is the attitude of students towards school science?

Results of Table 2 show that all items of students' attitudes towards school science except four items are meaningful at the level of $P \leq 0.05$. Items No. 17 (School science is a difficult subject), ($M=2.49$), No. 29 (School science has taught me how to take better care of my health), ($M=2.58$) No. 30 (I would like to become a scientist), ($M=2.64$) and No. 31 (I would like to have as much science as possible at school), are not meaningful at the level of $P \leq 0.05$. Among items of this component, item No. 26 (School science has increased my curiosity about things we cannot yet explain) has the highest average ($M=3.26$) and item No. 17 (School science is a difficult subject), has the lowest average ($M=2.49$).

5.3 The third research question: What is the attitude of students towards environmental issues?

Table 3 shows the Result of attitude towards the environment. According to these results, 11 items with average upper of $M=2.5$ are significant at the level of $P \leq 0.05$. These items are: Items No. 32 (Threats to the environment are not my business), ($M=2.40$), No. 33 (Environmental problems make the future of the world look bleak and hopeless), ($M=2.44$), No. 35 (Science and technology can solve all environmental problems), ($M=2.60$), No. 39 (People worry too much about environmental problems), ($M=2.64$), No. 42 (It is the responsibility of the rich countries to solve the environmental problems of the world), ($M=2.62$), No. 46 (Animals should have the same right to life as people), ($M=2.63$), No. 48 (Nearly all human activity is damaging for the environment), ($M=2.55$). Among items of this component, item No. 48 (Nearly all human activity is damaging for the environment) with ($M=3.06$) has highest average and item No. 38 (We can still find solutions to our environmental problems) with ($M=2.27$) have lowest average.

5.4 Fourth research question: Is there any meaningful difference between male and female opinions on each Component?

To examine differences in male and female students' opinions about each of the components of attitude towards school science, science and technology and environment, Independent t-test was conducted and the results are showed in Table 4. Based on these results, only in the third component of the attitude towards environmental issues, there are significant differences between boys and girls ($t=2.06$, $P=0.04$). Accordingly, the boys with a mean total ($M=49.07$), have the higher average in this component.

6. Conclusions

The results of this study showed that in general, students show positive attitudes towards all three components of science and technology, science and the environmental issues. Student are interested in a job related to the technology, they consider science and technology important to society and believe that Science and technology will find cures to diseases such

as HIV/AIDS, cancer, etc. (congruent with the results of Trumper (2006)). They believe that Thanks to science and technology, there will be greater opportunities for future generations and Science and technology make our lives healthier, easier and more comfortable (corresponds with the results of Stefánsson (2006)). Results also showed that in opinion of the students, The benefits of science are greater than the harmful effects it could have and with lower average than to other items, the believe that Science and technology will help to eradicate poverty and famine in the world and science and technology are helping the poor. Despite these benefits, students believe that science and technology are the cause of the environmental problems and Science and technology benefit mainly the developed countries. Also the students show a positive attitude towards the activities of scientists in science and technology. They believe that scientists are neutral and act without bias and always had to trust their words and follow the scientific method that always leads them to correct answers. These results mostly are in line with the results of Schreiner and Sjoberg (2005) that showed students in all studied countries, have a high degree of agreement on six items. These items are:

- Science and technology will find cures to diseases such as HIV/AIDS, cancer, etc;
- Science and technology are important for society;
- Thanks to science and technology, there will be greater opportunities for future generations;
- New technologies will make work more interesting;
- The benefits of science are greater than the harmful effects it could have;

These results also are in line with Jenkins (2006).

Results of the second component of school science, or the content of the science that are presented in schools, show that in this component has a positive attitude. However, there are some items suggest students' dissatisfaction with school science in some cases. They consider science as an interesting lesson and easy to learn (congruent with the results of Jenkins and Pell (2006) and Stefánsson (2006)) and with a high average they argue that like school science better than most other subjects. In view of students, science they learn at school will improve their career chances and will be helpful in my everyday life and Science has shown them the importance of science for their way of living.

The results also showed that according items of this component, school science plays an important role in increasing curiosity of students and made them more critical and skeptical and increases their appreciation of nature. However in three items, the results were below average and there was not positive attitudes towards school science. In this regards, students don't interesting in increasing science lessons at school (corresponds with the results of Ogawa and Shimode (2008)), while they believe that school science has not taught them how to take better care of their health appropriately. Also with lower averages than the previous two items, they would't like to become a scientist (congruent with the results of Jenkins and Pell (2006)).

In third component, attitude towards the environment, the results strongly suggest that students are strongly opposed with this idea that "Threats to the environment are not my business" (corresponds with the results of Jenkins and Pell (2006)). They also do not believe that environmental problems make the future of the world look bleak and hopeless. However, they do not believe that science and technology could solve all environmental problems. They

argue that we can still find solutions to our environmental problems and believe that they can personally influence what happens with the environment. They are optimistic about the future of the environment and also confirmed their role in helping the environment and consider responsibility of the rich countries and experts to solve the environmental problems of the world. In general, with a high average, they consider the natural world as scared that should be left in peace.

The results of independent t-test about the difference between male and female students in each components showed that there is a significant differences between these two groups only in component of attitude towards the environment. Accordingly, the boys generally show a better attitude towards the environment. In comparison with the findings of Schreiner and Sjoberg (2003), this finding is not congruent with their study. Also these findings are not corresponds with the results of Manninen et al. (2005). The results of Jenkins (2006) also show that in component of attitude towards science and technology, generally the girls have the lower average than boys, although Although the differences are not large.

In conclusion, it should be noted that the ROSE questionnaire despite having a high ability to measure students' ideas on discussed components, have some limitations. The questionnaire did not define the science and technology, therefore students may have different withdraw from these two words in mind, when completing the questionnaire. Therefore, identifying and defining the word of science and technology in terms of assessing students' attitudes to science and technology would be important (Osborne and Collins, 2000).

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Table 1. Results of one sample t- test about students' attitudes towards science and technology

Test Value = 2.5						Items
Sig.	df	t	SD	Mean	N	
0.00	249	9.03	1.12	3.14	250	1. I would like to take a job in technology
0.00	249	9.03	1.10	3.22	250	2. Science and technology are important for society
0.00	249	10.32	1.00	3.31	250	3. Science and technology will find cures to diseases such as HIV/AIDS, cancer, etc.
0.00	249	12.71	1.07	3.23	250	4. Thanks to science and technology, there will be greater opportunities for future generations
0.00	249	10.66	1.06	3.12	250	5. Science and technology make our lives healthier, easier and more comfortable
0.00	249	9.20	1.09	3.03	250	6. New technologies will make work more interesting
0.00	249	7.69	0.98	3.08	250	7. The benefits of science are greater than the harmful effects it could have
0.00	249	9.38	1.13	2.89	250	8. Science and technology will help to eradicate poverty and famine in the world
0.00	249	5.42	1.18	2.73	250	9. Science and technology can solve nearly all problems
0.00	249	3.03	1.14	2.74	250	10. science and technology are helping the poor
0.00	249	3.38	1.10	3.09	250	11. Science and technology are the cause of the environmental problems
0.00	249	8.45	1.08	3.08	250	12. A country needs science and technology to become developed
0.00	249	8.41	1.14	3.01	250	13. Science and technology benefit mainly the developed countries
0.00	249	7.04	1.13	2.75	250	14. Scientists follow the scientific method that always leads them to correct answers
0.02	249	3.50	1.13	2.67	250	15. We should always trust what scientists have to say
0.00	249	2.23	1.18	3.12	250	16. Scientists are neutral and objective

Table 2. Results of one sample t- test about students' attitudes towards school science

Test Value = 2.5						Items
Sig.	df	t	SD	Mean	N	
0.87	249	-0.15	1.21	2.49	250	17. School science is a difficult subject
0.00	249	6.59	1.13	2.79	250	18. School science is interesting
0.00	249	9.27	1.00	3.09	250	19. School science is rather easy for me to learn
0.00	249	7.48	1.09	3.02	250	20. School science has opened my eyes to new and exiting jobs
0.00	249	4.31	1.11	2.80	250	21. I like school science better than most other subjects
0.00	249	8.99	1.01	3.08	250	22. I think everybody should learn science at school
0.00	249	7.86	1.03	3.02	250	23. The things that I learn in science at school will be helpful in my everyday life
0.00	249	9.86	1.02	3.14	250	24. I think that the science I learn at school will improve my career chances
0.00	249	5.15	1.17	2.88	250	25. School science has made me more critical and skeptical
0.00	249	12.03	0.99	3.26	250	26. School science has increased my curiosity about things we cannot yet explain
0.00	249	8.49	1.09	3.09	250	27. School science has increased my appreciation of nature
0.00	249	4.44	1.10	2.81	250	28. School science has shown me the importance of science for our way of living
0.34	249	0.95	1.25	2.58	250	29. School science has taught me how to take better care of my health
0.07	249	1.82	1.21	2.64	250	30. I would like to become a scientist
0.48	249	0.70	1.26	2.56	250	31. I would like to have as much science as possible at school

Table 3. Results of one sample t- test about students' attitudes towards environment

Test Value = 2.5						Items
Sig.	df	t	SD	Mean	N	
0.16	249	-1.38	1.19	2.40	250	32. Threats to the environment are not my business
0.44	249	-0.76	1.24	2.44	250	33. Environmental problems make the future of the world look bleak and hopeless
0.02	249	2.19	1.24	2.67	250	34. Environmental problems are exaggerated
0.17	249	1.35	1.21	2.60	250	35. Science and technology can solve all environmental problems
0.00	249	3.22	1.21	2.75	250	36. I am willing to have environmental problems solved even if this means sacrificing many goods
0.01	249	2.42	1.19	2.68	250	37. I can personally influence what happens with the environment
0.00	249	-2.84	1.29	2.27	250	38. We can still find solutions to our environmental problems
0.07	249	1.81	1.25	2.64	250	39. People worry to much about environmental problems
0.04	249	2.06	1.19	2.66	250	40. Environmental problems can be solved without big changes in our way of living
0.00	249	2.98	1.22	2.73	250	41. People should care more about protection of environment
0.12	249	1.53	1.23	2.62	250	42. It is the responsibility of the rich countries to solve the environmental problems of the world
0.00	249	3.83	1.26	2.81	250	43. I think each of us can make a significant contribution to environmental protection
0.00	249	3.02	1.25	2.74	250	44. Environmental problems should be left to experts
0.01	249	2.49	1.26	2.70	250	45. I am Optimistic about the future
0.10	249	1/64	1.26	2.63	250	46. Animals should have the same right to life as people
0.00	249	5.23	1.23	2.90	250	47. It is right to use animals in medical experiments if this can save human lives
0.50	249	0.67	1.13	2.55	250	48. Nearly all human activity is damaging for the environment
0.00	249	7.63	1.16	3.06	250	49. The natural world is scared and should be left in peace

Table 4. Results of independent t- test about three factors based on gender

Sig.	df	t	SD	Mean	N	Gender	Factors
0.08	248	-1.74	10.01	46.99	120	female	Attitude toward science and technology
			9.54	49.16	130	male	
0.15	248	-1.44	8.34	42.58	120	female	Attitude toward school science
			9.12	44.18	130	male	
0.04	248	-2.06	7.40	47.01	120	female	Attitude toward environment
			8.24	49.07	130	male	