Problems with Science and Technology Education in Turkey

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National and international indicators show that there is a big inadequacy in science and technology education in Turkey as compared to other countries. This important problem affects the young students' structure of thinking perspective and perceptions of nature in a wrong way. The problems in science and technology education will block creative and critical thinking, curiosity and positive attitudes towards nature. In order to determine attitudes towards science and technology education program and the reasons of low achievement in science education, a questionnaire with 20 items about science and technology lesson, has been prepared and applied to 84 science and technology lesson teacher in elementary schools in two different cities (Adıyaman and Malatya) of Turkey. According to the result of this research, the main problems with science and technology education are insufficient number of science and technology teachers' taking active role in the preparation of the programs, the insufficient in-service training of the science teacher in the transition state of a new program, the huge numbers of the students in the class, the informational education orienting students towards only exam achievement, the broken link with other lessons (e.g. mathematics program) and insufficient physical conditions of schools (less laboratory opportunities).

Keywords: Turkish Science and Technology Education, History and Philosophy of Science, Epistemological Role of Science.

INTRODUCTION

The Recent Problem

Turkey, with a population of 63 million, is a bridge between Europe and Asia. The country was established in 1923, after the Ottoman Empire collapsed at the end of the First World War. The schooling consists of three main components: basic education (primary and middle schools, age 6–14; 8 years), which is compulsory; secondary education (high lycees or senior high schools, age 14–17, 3 years); and higher education (colleges and universities). The Turkish Educational System was centralized by the Act of "Law of Unification of Instruction" in 1924. All schools throughout the country must use the same curricula, which are developed and implemented by the National Ministry of Education (Ayas, *et al*, 1993). Teachers, students, parents and all participants of education have groused about the science education in Turkey since 1924. A lot of science education program was developed and applied by Turkish National Education Ministry. All programs are tried to apply with a great excitement, but, unfortunately, science education problem was not solved completely.

There was no "separate" science course in elementary school programs from 1924 up to 1974. The science subjects were included to some degree in "Knowledge of Life" lesson in a heterogeneous form. Only after 1974 science courses became separate and given some importance.

The Indicators in Turkish Science and Technology Education

The concrete indicator of science achievement is national and international central exam results. The

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average of science lesson questions answered correctly by the students was 4.79 questions from 25 science questions in "The Secondary Education Entrance Exam" called OKS in 2005. Out of 786,284 students in 2005 65,076 students scored zero in this exam. This means almost 8% of students have no idea about questions. Also in the same year there were 57,163 students scoring zero in "The University Entrance Exam" called ÖSS. The average of correctly answered science questions was 3.9 out of 45 questions.

International Association for the Evaluation of Educational Achievement (IEA) is an institute making international evaluation and assessment for countries. Thirty eight countries joined the Third International Mathematics and Science Study (TIMSS-R, 1999) in 1999. Turkey had lower scores in the science section and ranked 33rd among the 38 participating countries (Kılıç, 2002). All of the parameters above verify low achievement of Turkish science education program. Almost 70% students cannot solve any science questions in Turkey. This is very thought-provoking in terms of Turkish science education (Arslan, 2005). One of the important aims of science education in the USA is to teach "science for every one and to create scientifically literate citizens", according to the National Science Education Standards in the USA (1996), but escaping from science classes is still the norm world wide. For example, Baykul (1990) found that Turkish students' attitudes toward science and mathematics courses substantially decreased from grade 5 through grade 11.

The Relevance of Science Education (ROSE) is an international project that aims determining important factors with science education and technology as an universe. The main property of this project is to determine factors affecting students' motivation during science and technology instructions and analyze them. Some of these factors are variety of students' experiences about science and technology out of schools, attitudes towards different science and technology subjects, attitudes towards scientists and expectations in future. (Sjoberg, 2004)

According to the findings of this project about Turkish Science and technology lesson program, (Çavaş, 2004)

- Male students like science and technology lesson more than female students.

- Female students don't want to take science and technology lesson in schools; male students are undecided about this subject.

- Male students want to become scientist in future more than females.

- Both male and female students want to work in a technology related works.

METHOD

A survey method was used in this study. Details are of the employed method are given below.

Research Design and Procedure

This study intends to determine science and technology teachers' attitudes towards science and technology education program and the reasons of low achievement in science education.

According to Kobella (1988), the affective domain related to science education is mainly concerned with attitudes related to science. In order to determine attitudes towards science and technology education program and the reasons of low achievement in science education, It has been prepared a questionnaire with 20 items about science and technology lesson and applied to 84 science and technology lesson teachers in elementary schools in two different cities (Adıyaman and Malatya) of Turkey.

Participants

The participants of the present study were 84 elementary school science and technology teachers in two different cities (Adıyaman and Malatya) of Turkey.

Data Collection Instrument

Data were collected through "The Attitude Scale towards Science and Technology Education Program". The researcher has developed this scale by reviewing the literature and soliciting expert views in the area. The internal reliability of the survey was calculated by using Cronbach's Alpha Formula and found be high (α=0.87).

Data Analysis

Descriptive statistics were used to analyze data. Percentage was used to determine the science and technology teachers' attitudes towards science and technology education program and the reasons of low achievement in science education.

RESULTS

According to the result of this research (Table 1), the main problems with science and technology education are insufficient number of science and technology teachers' taking active role in the preparation of the programs, the insufficient in-service training of the science teacher in the transition state of a new program, the huge numbers of the students in the class, the informational education orienting students towards only exam achievement, the broken link with other lessons

Table 1. Percentages of agreement or disagreement to the presented problem statements in science and technology education in Turkey

Insufficient number of science and technology teachers' taking active role in the preparation of the programs.	Agree	% 74.6
	Disagree	% 25.4
The insufficient in-service training of the science teacher in the transition state of a new program.	Agree	% 82.7
	Disagree	% 17.3
The huge numbers of the students in the class.	Agree	% 78.9
	Disagree	% 21.1
The informational education orienting students towards only exam achievement.	Agree	% 93
	Disagree	% 7
The broken link with other lessons (e.g. mathematics program).	Agree	% 58.7
	Disagree	% 41.3
Insufficient physical conditions of schools (less laboratory opportunities).	Agree	% 55.6
	Disagree	% 44.4

(e.g. mathematics program) and insufficient physical conditions of schools (less laboratory opportunities).

Schwirian (1967) stated that attitude toward science is the basis of acceptance and support of science or the basis of rejection of science and scientific activities in a society. Therefore, the decline in attitude toward science may result in the decrease of scientific research support, for today's students will be tomorrow's scientists and decision making persons in their society. In other words, students who have a positive attitude toward science are more likely promote science and scientific research in a country (Gieger, 1973). Consequently, countries like Turkey, need scientifically literate citizens. To achieve this goal we must examine the attitudes of our science teachers (Türkmen, et. al, 1999). In his paper Machamer (1998) gives an overview of issues related to the nature of science. He defines science, epistemologically, as a method of inquiry about the things and structures in the world, and describes the concerns of the philosophy of science:

- Epistemological: Philosophy of science asks what the nature and essential characteristics of scientific knowledge, how this knowledge is obtained, how it is codified and presented, how it is subjected to scrutiny, and how it is warranted and validated.

- Metaphysically: Philosophy of science examines the kinds and natures of things in the world, in so far as science deals with them.

- Ethically: Philosophy of science directs questions towards the value system that scientists have and asks how these values affect the practices and conclusions of science.

According to him, for educational purposes the epistemological point of view bears the highest significance. He asserts that "science, as it is taught and practiced in an educational setting, should be concerned with questions about the nature and adequacy of knowledge." Further, he identifies epistemological key concepts to be addressed: aims and goals of science; limits of science; nature of scientific discovery; nature of scientific explanation; theory, law, model and hypothesis, paradigms and research traditions in science; evidence, test, confirmation, falsification, and prediction; experiments as types of empirical tests; and finally social, cultural, political and ethical implications of science (Taşar, 2003).

CONCLUSION AND DISCUSSION

The main problem with Turkish science and technology education is lack of research on epistemological knowledge and attitudes. The epistemological role of science and technology can not be comprehended well by the society. The use of history and philosophy of sciences could not defined and organized by all contributors in science and technology teaching. Program changes, curriculum and textbook about this lesson; ignore the epistemological role of science and the significance of history and philosophy of science. In 2006, Mettas et. al's research indicated that students' self-beliefs and attitudes are significantly related to science achievement and should be given consideration by instructional designers, when developing science materials and curriculum. These factors should be in mind of any science teacher in order to enable him promote the discussed positive attitudes and beliefs through teaching. Recently, a new program was developed and started to apply in

elementary schools. The name and content of the lesson are changed. It is called "Science and technology" instead of science lesson. The present problems of Turkish science and technology education can be designated as follows in the view of many investigations (Eşme, 2004) up to date:

- The intensive curriculum (95% of all science education program) but insufficient time allocation for science education (87 hours per year).

- The instruction of lesson in an information level and students in passive position (only listening and writing), teachers in active position (writing on the board and teaching in a classical way).

- Evaluation of the lesson in information level by using multiple choice items.

- Insufficient usage of science laboratories.

R. Medupe (1999) has investigated problems of science education in South Africa and concluded the problems similar to the Turkish science and technology education problems. These problems were reported as lack of equipment and laboratory for science education, overcrowding in schools, improperly trained or under-qualified teachers and epistemological knowledge about science and technology.

In the other study, the main problems of science (especially physics) teaching in Germany are summarized as students' lack of interest and motivation in the subject, their poor understanding of scientific concepts, ideas, methods, and results, and their lack of comprehension of the social, political, and epistemological role of science by Riess (2000) similarly.

Besides these, there is a different study about the problems with Turkish science and technology education. Çavaş and Kesercioğlu (2004), reported that Turkish students have more positive attitudes toward science and technology than developed countries' students.

As a result, the literature based on epistemological knowledge and attitudes is insufficient and in a less amount. Scientific literacy for public understanding science and technology should be tested by the contribution of a high number of participants. According to the results, curriculum and textbook should be re-organized and the teachers should be educated effectively with a long term and detailed in-service instructions. Education faculties should be reorganized and teacher candidates should be provided with educational perspective of science and technology education. In addition to these, according to Akgül (2006), course instructors need to be well informed and equipped about the nature of science.

The assessment and evaluation items should be defined and used in a productive way. The system of assessment and evaluation should be reflected to the central exams (University and high school entrance exams).

In this paper, the problems of Turkish science and technology educations are presented. The lack of epistemological role of science is emphasized and the productive use of history and philosophy of science is proposed in science and technology education. Most of the science and technology education programs neglect the scientific literacy of the population, interest and the motivation of all participants. The programs should be prepared with the contribution of all participant and educators can find their perspective in the program.

Educational Implications

This study has some implications to help solving problems with Turkish Science and Technology Education.

First of all, the majority of science and technology teachers and others related to science and technology education should join all of the processes and take active role during the preparation of science and technology education instruction program. Besides this, the in-service training programs should be well organized satisfactorily in the transition state of a new science and technology education programs.

The crowded classrooms have been caused serious problems in science and technology education because, laboratory activities could not be performed efficiently with crowded classrooms. So, the number of students should be decreased for science and technology lessons. The crowded classrooms can be divided in to smaller groups for laboratory activities in different time intervals.

The achievement criterions should not be depended on only exam achievement. The achievement criterions should contain all of the activities in the school. For example, achievement scores for each semester should be considered.

The link with other lessons should be established and planned periodic group gatherings for collaboration. Especially, Mathematics and Turkish Language teachers should collaborate with science and technology teachers.

The laboratory conditions are very important for science and technology education. For this reason, laboratory conditions and materials should be provided. If there is no enough materials, the experiments or activities should be performed with alternative materials and equipments. Finally, the problems with Turkish Science and Technology Education can be solved by the contribution of all participants related to science and technology education.

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