

PRE-SERVICE SCIENCE TEACHERS PERCEPTIONS AND PRACTICES RELATED TO HISTORY OF SCIENCE INSTRUCTIONS

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ABSTRACT

The purposes of this study were to describe pre-service science teachers' (PTs) perceptions and practices about using history of science (HOS) in their instructions and their experiences as in-service teachers (ITs) and to determine the relationship between PTs perceptions and practices about using HOS in their classrooms. The HOS Instructional Survey was administered to 68 PTs in two different universities in Turkey. After these students had graduated, some questions were asked about their views about practicing integrating the HOS in their instruction to the 19 ITs who started to work in schools. Findings revealed that PTs had favorable level of perceptions and practices about using HOS in their classrooms. Furthermore, PTs' perceptions are highly correlated with their practices about using HOS in their classrooms. Interview results revealed that after PTs become ITs, in their teaching practices of history of science they emphasized mostly conceptual understanding and the least emphasis given to contextual understanding.

Key Words: History of Science, Pre-service Teachers, In-service Teachers .

INTRODUCTION

There are some main goals of science education explained by the researchers. One of these aims is developing informed nature of science understanding. In order to achieve these aims science education should have instructional materials a wide range of methodologies, and inquiry procedures (Hurd, 1970). In the National Science Education Standards it was emphasized that history of science has an important role while achieving science education goals (NCR 1996). Teaching science integrating with history of science has been investigated by many researchers over a century (Lin, 1998; Matthews, 1994; Solomon, Duveen, & Scot, 1992). Solomon, et al. (1992) explain the advantage of incorporating history of science in science teaching in these main areas "a) better learning of concepts of science, b) increased interest and motivation, c) an introduction of the philosophy of science, d) a better attitude of the public towards science, and understanding of social relevance of science" (Solomon, 1992 p.410). Whang and Schmidt (2001) conducted a study to examine students'

learning in History of science through the world and the way of teaching history, philosophy and sociology of science (HPSS). They also investigated the relationship between HPSS and students' science achievement. These data were obtained from (1) educational officials' reports of HPSS coverage, (2) curriculum guides' HPSS coverage, (3) science textbooks' HPSS coverage, and (4) teachers' report of HPSS practices. The way of teaching HPSS environment were investigated with respect to different dimension namely; Influence of Science, Technology on Society; Influence of Society on Science, Technology; History of Science & Technology; Nature of Scientific Knowledge; The Scientific Enterprise. Results of the study revealed that HOS was the most favorite area of History philosophy, and sociology of science in at least one grade level. Second most popular topic was Influence of Science, Technology on Society in the worldwide science classrooms. History of Science and Technology and Influence of Science, Technology on Society was the most coherent topic covered by both guides and textbooks respectively. USA was the first country in terms of the percentage of teachers who reported that they taught HPSS and percentage of instructional time they dedicated to HPSS areas in their science classrooms.

Teaching with the history of science improves the understanding of the nature of science (Solomon, et al., 1992; Seker & Welsh, 2006; Irwin, 2000); however effect of history of science on students' learning of scientific concepts is still controversial (Seker & Welsh, 2006). Teachers use the history of science in their instructions for different purposes namely; to promote conceptual understanding, procedural understanding, and contextual understanding (Wang & Marsh, 2002). In one such study, researchers (Wang & Marsh, 2002) intended to investigate teachers' perceptions of the instructional role of the history of science, and their practices of teaching science from a historical point of view. In this study history of science instructional survey was implemented to twelve teachers, and then among these teachers five of them were selected for the interview. History of science instructional survey includes three domains of understanding as history of science conceptual framework, namely; conceptual understanding, procedural understanding, and contextual understanding. According to Wang and Marsh (2002, p.180) the conceptual, procedural and contextual framework of using history of science in instructions was described in Figure 1.

<i>Conceptual understanding</i>	<i>The description, presentation, comparison or contradiction of scientific</i>
	<i>a) thoughts, ideas, concepts, notions, plans, schemes,</i>
	<i>b) definition, explanations, models, illustrations, graphics, instrumentation</i>
	<i>c) findings, standards, laws, theories to</i>
	<i>enriching the presentation of scientific knowledge</i>
	<i>emphasizing the tentative nature of scientific knowledge</i>
<i>Procedural understanding</i>	<i>process of thinking or experiment,</i>
	<i>process of investigation</i>
	<i>process of concluding, inferring, elaboration, reporting, and application.</i>
<i>Contextual understanding</i>	<i>Psychological factors involved in the science making (e.g., motivation, incentives, purposes)</i>
	<i>Social factors (e.g., peer influences, public attitudes, social needs, or political factors that effect on the scientists action)</i>
	<i>Cultural factors associated to the science research (e.g., personalities, culture of family, organization, social, or ethics, etc.)</i>

Figure 1: History of science conceptual framework

The findings of this study revealed that teachers were more likely to incorporate historical elements regarding contextual understanding than the other categories. Especially teachers did not integrate procedural understanding with their curriculum. Teachers believed their curriculum was overloaded with topics; therefore they could not emphasize the importance of the history of science in their curriculum.

Another study (Wang, & Cox-Petersen, 2002) which aims to compare elementary, secondary and student teachers' perceptions and practices related to history of science instruction was the extended version of previous study (Wang & Marsh, 2002). Sample consisted of 43 elementary teachers, 8 middle school science teachers, and 21 high school science teachers. History of science instructional survey was applied to these teachers. The findings of the study showed that teachers had different views with respect to their grade levels which they teach. Most high school teachers use history of science to promote students' understanding of the content and nature of scientific knowledge. Also they used history of science to develop their scientific process skills. Most elementary teachers support that the history of science can help students' understanding the role of science in the society, and to increase students' positive attitude toward science.

With these respects, the purposes of present study had two aspects: (1) to describe pre-service science teachers' perceptions and practices about using history of science in their instructions and their experiences as in-service teachers. (2) to determine the relationship between PTs perception and practices about using history of science in their classrooms.

METHOD

Sample and Data Collection

This study included both qualitative and quantitative parts as a longitudinal research. History of Science Instructional Survey was administered to 68 pre-service science teachers in two different universities in the capital city of the country. Approximately 83.4% of the pre-service science teachers completed all of the survey questions for the quantitative part of the study. After graduation, some of these pre-service science teachers pursued their careers as teachers in elementary schools. As a longitudinal study these teachers were followed and their views on integrating history of science into their science instruction and their experiences were also explored qualitatively. In our country because of a national exam some of the pre-service science teachers could not start their career after their graduation. Therefore, 19 in-service teachers could respond to our survey questions in the following year.

History of Science Instructional Survey developed by Wang and Marsh (2002) was translated and adapted by researchers. This instrument is 5-Likert type scale and consists of 26 items. Of the 13 items, 4 related to conceptual domain of understanding, 3 related to procedural domain of understanding, and 6 items related to contextual domain of understanding for both their perceptions and practices. Two open ended questions were added to the end of the survey in order to examine pre-service teachers' views about the history of science more deeply. Following year the teachers who become in-service teachers were asked to describe how and why they integrated history of science in their class and to give an example about their instructions.

Data Analysis and Results

For quantitative part of this study descriptive statistic results showed that pre-service science teachers had favorable level of perceptions and practices about using history of science in their classrooms. Descriptive statistic results of pre-service science teachers perceptions and practices about using history of science were presented in Table 1.

Table 1: Descriptive statistic results of pre-service science teachers' perceptions and practices about using history of science

	Dimension	M	S.D
Perceptions	Conceptual understanding	4.25	.50
	Procedural understanding	4.16	.60
	Contextual understanding	4.27	.48
Practices	Conceptual understanding	4.25	.50
	Procedural understanding	4.14	.62
	Contextual understanding	4.26	.48

Correlation results showed that pre-service science teachers' perception is highly correlated with their practices about using history of science in their classrooms. Correlation results between pre-service science teachers' perceptions and practices about using history of science were shown in Table 2.

Table 2 : Correlation Results

	Conceptual Perceptions	Procedural Perceptions	Context Perceptions
Conceptual Practices	.769*	.631*	.699*
Procedural Practices	.517*	.875*	.611*
Contextual Practices	.596*	.753*	.908*

* Correlation is significant at the .01 level

For qualitative parts of this study interview results revealed that after pre-service science teachers become in-service teachers, in their teaching practices of history of science they emphasized mostly conceptual understanding and the least emphasis given to contextual understanding. Teachers reported that they most emphasized tentative nature of scientific knowledge through the history of science in science courses.

One of the teachers gave an example about his/her application in the course as;

"I used history of science especially while I was teaching the structure of the atoms. Students have understood that the structure of atom has changed over the years. I gave them project about examination and presentation of scientists' life and their scientific projects. In this way, students both entertained and learned"

Another teacher pointed out different aspect of integration of history of science in science courses.

"I integrated history of science and life of the scientists in my science course. In my class students realized that scientists were not different people from the other people."

Some of the teachers mentioned that even if they want to integrate history of science in science courses, they could not achieve their aims because of the overloading curriculum and classroom climate such as physical conditions and inadequate materials.

DISCUSSION AND CONCLUSION

Pre-service science teachers had remarkable perceptions and practices about using history of science in their classrooms. Their perceptions about integrating history of science in science lesson affect their practice directly. However they reported that they had insufficient knowledge about the history of science. Therefore most of the pre-service science teachers (93.8%) suggested that history of science course should be offered in the education faculty undergraduate programs. Some of the pre-service science teachers reported that "Although history of science was integrated with in Science-Technology-Society course in a limited time; history of science changed our attitude toward science". They reported that "history of science course can supply the process that how scientists attain scientific knowledge, increase student motivation, increase student awareness about changing scientific knowledge, and development process of changing knowledge. Moreover, the students may learn concepts of scientific models and their explanations permanently and meaningfully. History of science course helps students to understand that scientists are not different people from other people. They are not apart from the society and everybody can be scientist. Most of the pre-service science teachers thought that "History of science course is much related with nature of science, and history of science is reflection of the nature of science". Therefore, history of science course may have potential to improve students' nature of science understanding.

Another issue is integrating history of science and nature of science. Most of the students supported that history of science and nature of science should be incorporated with each other in such a course mentioned above. This idea has been supported in the literature, since history of science is used to improve students or pre-service teachers nature of science views (Seker & Welsh, 2006; Solomon, et al., 1992). On the other hand small number of student (6.3%) agreed that history of science course should not be open as a separate course. History of science should be integrated to another course in the undergraduate programs.

It was understood from the interviews that pre-service science teachers purpose of using history of science in their instructions changed after they become in-service teachers. Most of our in-service teachers integrated history of science in their instructions for conceptual understanding including the tentative nature of scientific knowledge. Some of the in-service teachers also integrated history of science in their instructions for Procedural understanding including process of investigation, but they realized that they gave the least importance to the contextual understanding such as cultural factors associated to the scientific research. Most of them explained the reason of this perception as indicating "In our new elementary science and technology curriculum more emphasis was given to tentative nature of scientific knowledge, therefore they used history of science in our instructions to promote this issue, also they gave importance scientific investigations if the number of the students in the class is appropriate for implementing these activities". They also reported that they did not realize that they had not mentioned about cultural factors in their instructions and they thought as a reason of this explaining there was no much more emphasis on this issue in our new elementary curriculum.

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