Modeling the Activities of Scientists: Prospective Science Teachers' Poster Presentations in An STS Course*

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Abstract: In this study, prospective science teachers' (PSTs) views about their poster presentations were investigated. These posters were developed through PSTs' online and library research and scientific mini-symposiums in chemistry related topics in the framework of science, technology and society course (STS). During the first four weeks of STS course, PSTs (N=50) were taught about some important issues such as the goals for teaching science through STS, the topics to be taught, how the science and STS content be integrated, how to design STS instruction and how to prepare and present a poster. Fifty PSTs were grouped in small groups of four or five and freely selected their research projects in chemistry topics involving STS content. After their on-line and library research and scientific mini-symposiums, PSTs presented the poster presentations of their studies to all of students and educators in the faculty of education as a group of scientists in a manner of a scientific meeting and responded the questions of the visitors related to their posters toward the end of the STS course. Then, semi-structured interviews developed by the researchers were carried out with PSTs in small groups to

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identify PSTs' views about their poster presentations. The results of small-group interviews showed that PSTs described their poster presentations as a funny way of learning and they stated that they understood how the scientific developments are achieved by cooperative working which enabled them to feel as scientists. They also stated that this improved their self-confidence. They expressed that their poster presentations made the knowledge they gained in STS course more permanent and increased their curiosity and interest toward STS issues.

Introduction

Science, Technology, and Society (STS) as an educational reform movement became prominent in the 1970s in the United Kingdom. One of these was called Science in Society, and a second was called Science in a Social Context. The work of John Ziman, (1980) a British physicist and later a science educator, resulted in his writing about STS and popularization of the STS acronym there. There are no concepts and/or processes unique to STS; instead STS provides a setting and a reason for needing basic science and technology concepts and processes to deal with current problems and issues. STS means determining and experiencing ways that these basic ideas and skills of science and technology can be observed in society (Yager, 1990).

Basic to STS efforts is the production of an informed citizenry capable of making crucial decisions about current problems and issues and taking personal actions as a result of these decisions (Yager, 1984). From this perspective, STS means focusing upon current issues and attempts at their resolution as the best way of preparing students for current and future citizenship roles. This means identifying local, regional, national, and international problems with students, planning for individual and group activities which address them, and moving to actions designed to resolve the issues investigated. The emphasis is on responsible decision making in the real world of the student where science and technology are components (Yager, 1990).

In response to the growing impact of science and technology in contemporary societies during the last two decades, a new academic field called: "Science, Technology and Society--STS" was born and has grown into a new and active field (McGinn, 1991). STS received much of its early impetus as an educational initiative at the college and

university levels. Since the 1990s, perhaps the most visible of the new issue-based approaches in science education has been the so-called STS movement. This STS movement gained a substantial momentum in the last two decades. Subsequently, the STS theme has made significant strides into contemporary science education, primarily at the junior high and the high school levels (Aikenhead 1987; Bybee 1985, 1987; Yager, 1985; Zoller 1987). Unfortunately much of these developments were accomplished by instructional materials for use in a structured curriculum – with little attention to teaching style and strategies (Yager, 1996).

Instructional Strategies in STS Education

Science education, defined by Yager (1984), is a discipline concerned with the study of the interaction of science and society, including the study of the impact of science upon society as well as the impact of society upon science. In this connection, the ultimate goal of teaching science through STS is the production of scientifically and technologically literate persons after 11-13 years of involvement with science in schools (Fleming, 1989). There are two significantly different possibilities for initiating STS education into the school science curriculum. First is to infuse STS material, modules, or units such as those comprising the SATIS (Science and Technology in Society) project in Britain in 1986 and S-STS (Science through Science, Technology and Society) developed in the USA in 1985 into existing courses. Second is to develop separate, free-standing STS courses (such as Science in Society, developed in Canada in 1988; or SISCON, Science in Social Context, initiated in Britain in 1983) (Pedretti, 1996). Moreover, some schools involve students and teachers in selecting an annual STS issue. Some examples of STS topics, identified by the National Science Teachers Association, are: smoking, plastic wastes, ozone depletion, ground water contamination, exploring space, wildlife extinction, auto safety and dependence on fossil fuels (Yager, 1990).

Science and Technology in Society (SATIS) units were intended to involve students as actively as possible. SATIS units were designed to get students involved through strategies such as discussions, simulations, role-play, decision-making, problem-solving, and surveys, instead of passively reading or listening (Hunt, 1988). According to Scharmann et al., (2001), instructional techniques for STS education include developing

simulations, cooperative and collaborative approaches, inquiry based learning, independent projects, small group discussions, case studies, oral presentations, and written reports. For example, Streitberger (1988) devised a method he called project-based learning in a general chemistry class for teaching STS topics. Students were provided with a list of suggested issues from which they could select one as a project. Their task was to work on resolutions of the issue by means of a debate that is presented on paper. In another study, STS topics were taught to students in large group sessions, while the discussions, analyses, quizzes, and assignments were handled in small breakout sessions (Kowal, 1991). In this study, an expert in the field also provided information from enrollees in each of the sessions concerning various STS topics (Kowal, 1991).

One approach to contemporary science education is to introduce students to the activities of scientists. This approach has been advocated as a means of enhancing student ability and interest in science. Since teaching science does not only mean just teaching a particular knowledge base and it should strive to teach the process of science. So, in this study, we expected students to do research and to present their findings like scientists through poster presentations.

Purpose

The aim of this study was to investigate prospective science teachers' (PSTs) views about their poster presentations that they developed through PSTs' online and library research and scientific mini-symposiums in the chemistry related topics in the framework of science, technology and society course (STS). We chose this poster presentation to introduce students to the increasingly common communication form of scientists at scientific meetings.

The following primary research question formed the basis of this study: what are the views of PSTs about their poster presentations in a university STS course?

Methods

Participants

A total of 50 final year of university students (24 males and 26 females), ages 22-23, enrolled in a science, technology and society course participated in this study during the second semester of 2003-2004 academic year in the Faculty of Education, Gazi University, Ankara, Turkey. The group of participating students was randomly selected from five classes enrolled to the STS course.

Procedures

This study is a qualitative research. STS course was 12 weeks long (3-hours per week). During the first four weeks of STS course, PSTs were taught about some important issues such as the goals for teaching science through STS, the topics to be taught, how the science and STS content be integrated, how to design STS instruction and how to prepare and present a poster. Then, fifty PSTs were grouped in small groups of four or five and they freely selected their research projects in chemistry topics involving STS content. As the subjects were related to Turkey (local) and World (global) it was expected students to show their interest and involve all the studies.

Some of these STS topics are:

- Resources, mining and recycling of silver in Turkey
- The situation of synthetic fiber industry in Turkey,
- Resources , mining and recycling of gold in Turkey
- Olive and olive products in Turkey
- Nuclear Energy Plants
- Recycling of plastics

Since each group determined their own STS topics, the PSTs focused upon the approaches they would use to deal with the topic. This three-staged approach included: 1) Library-online searching, 2) Mini-scientific symposia and 3) Poster presentations. This new approach for the STS course was based on modeling the activities used by scientists.

Poster Presentations

Each group started to prepare its poster presentations for the final week after the completion of online and library search and their mini-scientific symposium. They first worked with group members to summarize their respective topics into 10-12 page reprints. They were asked to prepare their posters with tables, graphs, and pictures which would summarize their topics in the most appropriate and appealing manner. The posters were prepared in the general format stated in literature (e.g., Huddle, 2000; Sisak, 1997). All the posters started with the title, the names and the universities of the presenters, and an abstract – just as commonly used in a scientific poster. The PSTs were told to keep the text as short as possible and to present the texts and the schemes readable from a distance of 3 meters. They were also advised to use different colors and symbols in order to illustrate the important points.

The time and the place of the poster presentations were advertised to the whole faculty with emails and written advertisements. Each presentation was held in an exhibition hall of the faculty with the presence of the dean, assistant deans, faculty, staff, and other teacher candidates at the final week of the course. The PSTs answered the questions of the visitors in the spirit of a true scientist. Utmost care was shown to make the poster presentation the same as a real life scientific conference. Also, each group examined the poster presentations of others and asked questions. Some photographs of PSTs' posters and poster presentations are included as Appendix A.

Instruments

Semi-structured interviews developed by the researchers were carried out with PSTs in small groups to identify PSTs' views about their poster presentations. Each focus-group interview lasted about 20 minutes. All interviews were audio-recorded, transcribed verbatim, and analyzed. Some interview questions are below.

- Did you know anything about poster presentations before?
- How did you feel during the assignment?
- How did you feel when the visitors came to see your presentation?

- Can you compare this method to other assignments? What was the difference of this study?
- How did you feel when you saw your poster on the board?
- How did your poster presentations affect your understanding STS topics?
- What did you gain from all poster tasks?
- What do you think about whether or not these poster presentations helped you to make your knowledge more permanent?
- Are you going to use poster presentations when you become a science teacher in middle school science classrooms?

Results

First, the results of small-group interviews showed that none of the PSTs knew the poster presentations used for sharing information among scientists at the scientific meetings before. The following interview excerpt is illustrative of this finding:

> *Instructor: Did you know anything about poster presentations before?*
> *Student: "When I first heard that we would prepare a poster I thought we would do something like an advertisement. Now I know that it is a scientific study."*

PSTs (N=34) described their poster presentations as a funny way of learning and they stated that they understood how the scientific research is achieved by cooperative groups of scientists which enabled them to feel as real scientists. Note the following interview excerpts:

> Instructor: *How did you feel when the visitors came to see your presentation?*
> *Student: " We were very excited during our faculty teachers' visit because always they were teaching to us but then we taught something that they didn't know, we were the instructors then, it was really amazing*."

> *Instructor: How did you feel when you saw your poster on the board?*
> *Student: "Seeing our studies on our poster and seeing visitors interested in our posters made me very happy"*

Instructor: How did you feel when you saw your poster on the board?
Student: We could summarize all the information on our poster so we managed to present the most important points of the subject in a limited time. Therefore, we made an activity of scientists and it made me happy.

PSTs (N=32) stated that poster task provided them to study with their peers in a different way. The following interview excerpts are illustrative of this finding:

Instructor: Can you compare this method to other assignments?
Student: "Poster presentation was the first and very different study. Assignments we used to make were always the same, we used to prepare our homework assignments depending on the same pattern, but we had to think about what we were doing and we had to collaborate during poster presentation".

Instructor: Can you compare this method to other assignments? What was the difference of this study?
Student: "The difference of this study was that all the members of the group took responsibility. We knew that if one of us would succeed we would succeed, if one of us would fail we would fail and all the people studied for whole subject."

Instructor: Can you compare this method to other assignments? What was the difference of this study?
Student: When preparing the posters we distribute the work on equality basis. We were perfectly cognizant that the failure of one of us would affect the rest.

PSTs (N=41) also stated that their poster presentations improved their self-confidence toward carrying out scientific research, and also changed students' views about process of science. Consider the following interview excerpts pertaining to this finding:

Instructor: What did you feel during the assignment?
Student: "I felt myself like a scientists. Because we reviewed all the resources about our topic and we had first hand experience during the research. Also we presented our poster like scientists. So I felt myself as if I knew the most about our topic in the faculty that was great. And we concluded differently from the same data, like scientists, when we discussed in our group. This changed my view about the process of science."

Instructor: How did you feel during the assignment?
Student: "When we were making research about re-use of plastics and during our field studies and poster presentation I felt that we were making something really important, now I have more self-confidence and I feel that what we made was really serious."

PSTs (N=28) expressed that their poster presentations made the knowledge they gained in STS course more permanent. Consider the following interview excerpt pertaining to this finding:

Instructors: What did you gain from all poster tasks?
Student: "In these studies I did not only gain important and current information about STS, I also learned how to make and present a scientific study"

PSTs (N=39) thought that their understanding of STS issues was more meaningful and permanent as a result of their poster presentations. The following interview excerpts are illustrative of this finding:

Instructor: How did your poster presentations affect your understanding STS topics?
Student: "I can say that we understood better and more permanent because we didn't just memorize the knowledge, unlike this, we carried out discussions with our group members about which part of the results of our study should be in our

poster. Additionally, we were aware of that we had to respond our visitors' questions related to our study presented in our poster and this increased our responsibility. Moreover, I think that the knowledge presented in our poster is more permanent for the visitors"

Instructor: How did your poster presentations affect your understanding STS topics?
Student: Before we started our poster, we made research through online, library, scientific articles and newspapers, and also went to Beypazarı for our project and interviewing with authorized people in our research topic. Then we discussed with each other about what we would select for our poster from all the data collected. So, this provided us to be experts on the topic and I feel that the knowledge we had is more permanent"

PSTs (N=46) stated that they would use the poster presentations when they become a science teacher in the middle school science classrooms. Note the following interview excerpt:

Instructor: Are you going to use poster presentations when you become a science teacher?
Student: "*Yes. I think preparing and presenting a poster will be a very funny way of learning science for my middle school students and especially I believe that it will improve the relationships between my students and me and among the students , so I am going to teach it to my students*"

Summary and Conclusions

The results of small-group interviews showed that many PSTs described their poster presentations as a funny way of learning and they stated that they understood how the scientific developments are achieved by cooperative working which enabled them to feel as scientists. They also stated that this improved their self-confidence in understanding, doing and presenting a research project. Also, they expressed that their poster presentations made the knowledge they gained in STS course more meaningful

and increased their curiosity and interest toward STS issues. This also enabled knowledge of STS gained that is a common knowledge among PSTs in classroom as a result of the poster presentations in the STS course. Moreover, our classroom observations indicated that the poster presentations in general had positive effects on PSTs' attitudes toward learning, science, and scientists.

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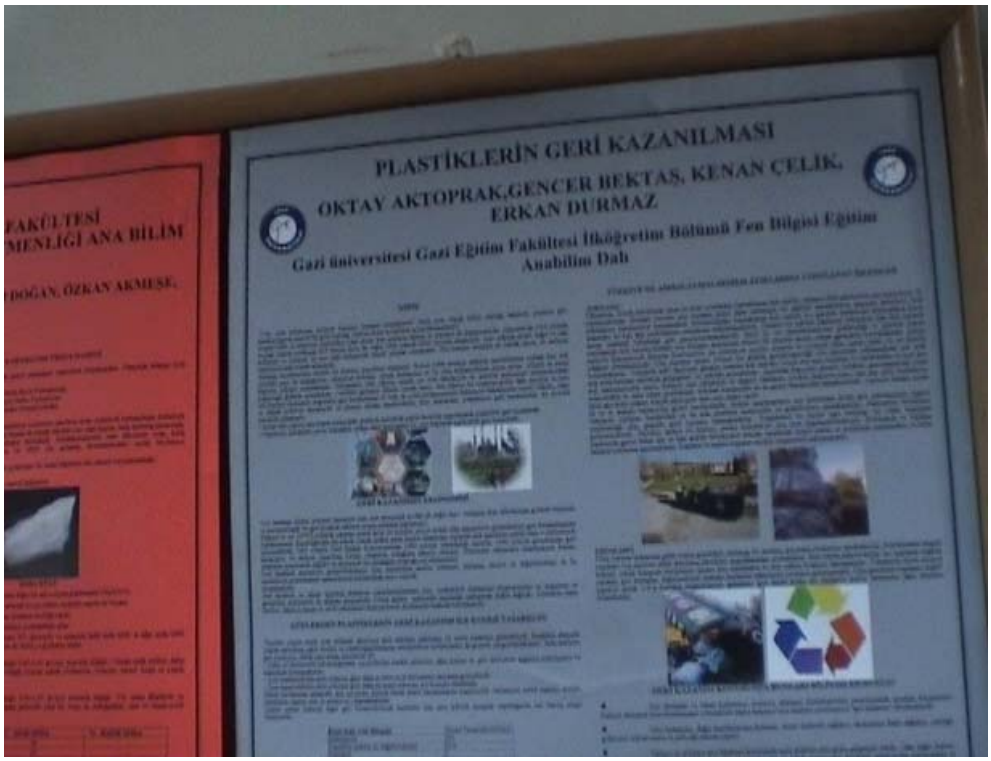
Appendix A. Some photographs of PSTs' posters and poster presentations.


PLASTİKLERİN GERİ KAZANILMASI
OKTAY AKTOPRAK,GENCER BEKTAŞ, KENAN ÇELİK, ERKAN DURMAZ
Gazi üniversitesi Gazi Eğitim Fakültesi İlköğretim Bölümü Fen Bilgisi Eğitim Anabilim Dalı