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Teacher candidates' perceptions regarding socio-scientific issues and their competencies in using socio-scientific issues in science and technology instruction

Şengul S. Anagün[a] *, Muhammet Özden[b]

[a] *Eskisehir Osmangazi University, Faculty of Education, Eskisehir, TURKEY, ssanagun@ogu.edu.tr*
[b] *Anadolu University, Faculty of Education, Eskisehir, TURKEY, muhammet_ozden@yahoo.com*

Abstract

This study it is aimed at investigating the views of science and classroom teacher candidates regarding socio-scientific issues and their competencies in using socio-scientific issues in science and technology teaching. Qualitative research approach was adopted in the study and criterion sampling technique was used in determining the participants. The data of the present study were gathered through a questionnaire that included five open-ended questions. The data of the research were gathered in Summer School at the 2009-2010 academic years and were analyzed through descriptive analyses. It was found out that teacher candidates conceptualize socio-scientific issue phenomenon in different ways. When the definitions are generally examined, it is seen that the features of socio-scientific issues are current events, having a scientific basis and an effect on individual and societal life. Teacher candidates state that they are incompetent in making use of socio-scientific issues in science and technology teaching.

Keywords: Socio-Scientific Issues; Science and Technology Instruction; Teacher Education;

1. Introduction

Socio-scientific issues (SSI) are representations of significant social issues related to science in social aspects. There have been societal concerns, particularly moral, political, social and economic although much scientific knowledge and inquiry practices take place. Thus, inquiry and negotiation of SSI necessitates the integration of science concepts and processes within social constructs and practices (Nuangchalerm, 2010). Socio-scientific tasks ensure individuals to think about the consequences of science on societal life and improve their decision making and inquiry skills (Pike, 2007). Therefore, it is necessary that school-age children should be informed about the aforementioned developments by means of science and technology lessons, should be encouraged to think about such issues and should engage in discussions in the classroom.

Through socio-scientific issues, students learn to be active and informed participants of the society (Reis and Galvão, 2009). Students need to learn strategies to be prepared for this rapidly changing world. The role of the science educators is to show students how to think like scientists with social concerns. An effective science instruction helps building strong societies composed of individuals who are aware of their present and future (Nuangchalerm, 2010). Socio-scientific issues can be used in science classrooms for the following purposes: 1) to

* Muhammet Özden Tel.: +90-222-335-05-80; fax:+90-222-335-05-79.
E-mail address: muhammet_ozden@yahoo.com.

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provide rich contexts supporting the exploration of important science contents, 2) to help students understand the association of science with their lives, and 3) to create interest and motivation towards science among students (Zeidler et al., 2005; cited: Klosterman & Sadler, 2008). Today, many researchers believe that modern design of scientific literacy can be achieved through socio-scientific issues and advocate that socio-scientific issues are essential elements for today's science and technology classrooms (i.e.; Driver, Newton and Osborne, 2000; Hughes, 2000; Zeidler, Walker, Ackett and Simmons, 2002). Therefore, it is necessary that school-age children be informed, channeled towards learning and it should be assured that they discuss on the socio-scientific issues. It will make students unaware of the influence of science and technology on social life unless students are taught about this issue. It is the teachers' responsibility to remove this limitation, help students get ready for life in this aspect and guide them. At this point, acquiring the desired outcomes by using socio-scientific issues in science and technology lessons, generating an effective teaching-learning process, knowing what to consider in practice and understanding how to reflect the things learnt into the teaching-learning process can only be possible by determining the teacher candidates' perceptions of their competencies in using the social scientific issues. Within this scope, in this study it is aimed at investigating the views of science and classroom teacher candidates regarding socio-scientific issues and their competencies in using socio-scientific issues in science and technology teaching.

2. Methodology

Qualitative research approach was adopted in the study and criterion sampling technique (Yıldırım and Simsek, 2006) was used in determining the participants. For this purpose, the following criteria were adopted in the study: 1. Teacher candidates are studying either in classroom teaching or science education teaching programs, 2. Teacher candidates attended lessons with regards to science and technology teaching, 3. Teacher candidates participated in the study voluntarily. Data of the study were gathered from teacher candidates studying in classroom teaching and science and technology teaching programs of a university in Turkey. 83 teacher candidates, who fulfill the aforesaid measures, participated in the study and these participants were asked to fill in a survey. In the examination and assessment phase of the surveys, 14 of the survey forms weren't analyzed for some reasons. As a result, the study was conducted with 69 participants. 29 % of the teacher candidates in the study were female while 71% were male. Similarly, 29 % of the participants were studying in science education teaching program and 79% were students in classroom teaching program. The data of the present study were gathered through a questionnaire that included five open-ended questions. Using a questionnaire with open-ended questions enable the researcher to figure out the whole picture since it allows participants to express their exact opinions or beliefs (Ekiz, 2003). The data of the research were gathered in Summer School at the 2009-2010 academic years. In order to obtain teacher candidates' views on socio-scientific issues, all questionnaires were implemented to teacher candidates by the first researcher in the informal meetings. The data obtained were analyzed through descriptive analyses (Yildirim and Simsek, 2006; Miles & Huberman, 1994).

3. Findings

3.1. Teacher candidates' views on the concepts of socio-scientific issues

Teacher candidates define the concept of socio-scientific issue in different ways. To illustrate, one of the participant teacher candidates defined socio-scientific issue as: *"both social- daily events and scientific issues that interest people"* (33). According to some other definitions, socio-scientific issue is *"citizens' awareness about scientific information and developments"* (59), *"scientific issues affecting daily life"* (11), *"social issues such as global warming, cloning"* (29). When the definitions obtained were examined as a whole, it was found out that teacher candidates consider socio-scientific issue mostly as "scientific issue that interests the society". As well as this, the majority of the teacher candidates were found to experience problems in perceiving, explaining and conceptualizing the socio-scientific issue concept. What causes this situation is the fact that socio-scientific issue is not emphasized enough in science and technology lessons and also teacher candidates are unaware that they can use socio-scientific issues in science and technology lessons in the same way as they use many materials to enrich the learning- teaching process. On the other hand, there are some other factors affecting this issue as teacher education

programs in Turkey are prepared by the Higher Education Council and no flexibility is given to education faculties. As a result of all these specific cases, it can be thought that teacher candidates are experiencing problems in conceptualizing and explaining socio-scientific issues.

3.2. Teacher candidates' views on socio-scientific issues that can be used in science and technology lessons

According to teacher candidates, the following issues can be used as socio-scientific issues: *"basic issues related with genetically modified products, global warming, nuclear plants, energy sources and their utilization, nuclear energy, energy production, water consumption, environmental pollution, scientific inventions, scientific development and technological products, healthy nutrition, balanced diet, eating habits, obesity, health and epidemic and contagious diseases, Crimean Congo hemorrhagic fever, swine flu, bird flu, stem cell therapy, cloning, organ transplantation, evolution theory and history of science"*. The issues stated by the teacher candidates as the ones that can be used are composed of the issues affecting the society either positively or negatively. On the other hand, social-scientific issues that the teacher candidates stated that they can be used in science and technology lessons are the problems often discussed in published and visual media in Turkey and they are on the agenda of public opinion. Starting from this point, social-scientific issues are said to be the issues on which the society has discussions and which have a daily nature. It was seen that teacher candidates were experiencing problems in conceptualizing socio-scientific issues, however; regarding the socio-scientific issues that can be used in science and technology lesson, suggestions compatible with literature were provided.

3.3. Teacher candidates' views regarding the contribution of utilizing socio-scientific issues in science and technology education to students

Teacher candidates stated that socio-scientific issues have the following functions in science and technology education: *"developing awareness and providing general culture", "understanding science-technology-society-environment relationships", "enriching learning environments and gaining interest in science and technology", "developing scientific process skills", "gaining, thinking, discussing and problem solving skills"* and *"gaining attitudes and values"*.

A teacher candidate expresses that socio-scientific issues should be present in Science and Technology lessons for the purpose of developing awareness and providing general culture and stated his opinion as follows:

"... young people and students are not sensitive in any of the social or scientific issues. We, as educators should lead the way on this issue. It should be known that the people who have base stations in their neighborhood or on their building will experience harmful conclusions and the permanent damage that base stations leave can never be compared with the rental value of any base station..." (1)

As understood, the basic reason in covering socio-scientific issues in science and technology education is to inform the individuals in the society through education and creating an awareness regarding the effect of scientific and technological developments on human life or health.

It was suggested that covering socio-scientific issues in Science and Technology lessons will help students learn science, technology, society and environment relations. A teacher candidate participating in the study expresses this relationship with the following statement: *"students will understand the social events scientifically and they will see that science is not a separate branch but always present in social setting."* (42) Undoubtedly, scientific and technological developments affect the life of individuals or societies in a positive or negative way. The individuals' or societies' science perceptions, cultural, ethical and moral values evolve depending on this interaction. Additionally, developments in the field of science of technology affect natural environment adversely. Therefore, for the purpose of making the students understand science-technology-society-environment pattern, it is important to include socio-scientific issues.

It is thought that using socio-scientific issues in science and technology lessons enrich the learning environment. Moreover, teacher candidates believe that socio-scientific issues make the learning enjoyable and increase interest in science and technology lessons. In line with this, teacher candidates present their view as *"students' interest towards science and technology increases"* (22), *"It gives an insight to the students. Students' interest in lessons increases."* (32). A more elaborative view on the issue is as follows:

"*Since we will bring life to school by making the students see that the problems they have in their lives are also in their lessons, the lessons will be more fun. Moreover, the students will understand that they are a part of the society by trying to create solutions to the problems."* (77).

One of the benefits of utilizing socio-scientific issues is that it develops scientific process skills. Regarding the development of these skills teacher candidates stated their views as follows: *"making students like research. Having a scientific way of thinking"* (8), *"I think ... it will increase science literacy"* (19). According to the teacher candidates' views, it can be said that socio-scientific issues will help students make decisions based on scientific knowledge and research.

Teacher candidates stated that socio-scientific issues used in Science and Technology education will gain students thinking, discussing, and problem solving skills. One of the teacher candidates stating his view on this issue said: *"Firstly, these issues are open for discussion and they are the suitable areas where students can share their own ideas. Students discuss by putting forth their own opinions."* (16). Teacher candidates pointed out the aspect of socio-scientific issues on which there is no agreement and stressed out that this situation can lay the foundation for students to explain their thoughts and discuss them. Other views regarding the fact that socio-scientific issues will gain students the thinking, discussing and problem solving skills is as follows:

"It provides them with the opportunity to think scientifically and creatively and express them. It develops a multi-dimensional thinking skill and the scientific thinking and problem solving skill develop. Besides curiosity and interest in socio-scientific issues, it contributes on the development of advanced thinking skills" (75).

Developments in science and technology make individuals to analyze complicated problems harder. Therefore, it becomes important that students gain good thinking skills. It can be said that socio-scientific issues cause students to think on the effects of science and technology on societal life and environment and develop their decision making and inquiry skills. Besides gaining students discussing and problem solving skills, another contribution that it can have on students appears to make students gain attitudes and values. Socio-scientific issues require the individuals to develop attitudes towards environmental protection and development, experiments on animals and human beings or such issues as well as generating values covering ethical issues. Regarding gaining attitudes and values on socio-scientific issues, a teacher candidate stated: "*They are raised as sensitive people. They are respectful to environment and society. They love nature and human beings and they protect them"* (56).

3.4 Teacher candidates view regarding the competencies of utilizing socio-scientific issues in science and technology education

In order to obtain the desired outcomes in Science and Technology lessons by using socio-scientific issues, generating an effective teaching and learning process, knowing what to consider in practice and how to reflect the things that are learnt on learning and teaching process, teacher candidates' perceptions about competency of using socio-scientific issues become important. Almost all of the teacher candidates participating in the study stated that their level of competency for utilizing socio-scientific issues in science and technology lessons is low. Some of the teacher candidates considering them incompetent express themselves as follow: *"I don't consider myself as competent as we didn't have any lessons on this issue in university."*(67); *"As a teacher candidate, I am not making use of the socio-scientific issues sufficiently. I don't consider myself competent enough in terms of teaching methods and techniques."* (75);*"I don't think I am competent. I am not doing many things to gain knowledge on this issue"* (29).

Teacher candidates who consider themselves as incompetent with regards to using socio-scientific issues stated the source of deficiency as the program and themselves. According to them, the fact that they weren't offered any lessons on this issue affects their competency perceptions in a negative way. Teacher candidates stated that they had deficiencies in terms of professional knowledge regarding teaching socio-scientific issues and they are not working on eliminating this deficiency. Teacher candidates considering them competent enough to utilize socio-scientific issues express their views as follow:

"I can provide a good teaching process by means of my previous and recent knowledge. Since I have interest in this issue, I may be competent enough in using socio-scientific issues." (15); *"As I am reading scientific books and watching movies it wouldn't be hard for me to associate them with lessons. I wouldn't have the problem to prepare and present activities in line with the information I obtained."* (46).

The basic reason why some teacher candidates assess themselves as competent in using socio-scientific issues in Science and Technology lessons is particularly related with interest. Teacher candidates stating that socio-scientific issues are among the issues in life indicated that they are not going to experience problems in making use of these issues in science and technology teaching.

4. Discussion and Conclusion

It was found out that teacher candidates conceptualize socio-scientific issue phenomenon in different ways. When the definitions are generally examined, it is seen that the features of socio-scientific issues are current events, having a scientific basis and an effect on individual and societal life. In her book where she inquires the properties the socio-scientific issues, Ratcliffe (2003) stated that these issues are within the scientific knowledge. According to her, socio-scientific issues are mainly composed of daily problems and affect the individual and societal life in a negative or positive way.

Teacher candidates chose the socio-scientific issues that they can use in science and technology lessons from the subjects that affect the societal life in the world and in Turkey and among the ones that are discussed in public. According to them, the socio-scientific issues that can be used in science and technology lessons can be issues like global warming, contagious diseases (swine flu, bird flu…etc.), cloning, environmental pollution and genetically modified products. Depending on the problems of the issues named, materials to be used in teaching these are stated as internet, news articles, TV, photos and posters.

According to the findings obtained from the research, socio-scientific issues have the functions as providing general culture, understanding science-technology- society- environment relationship, developing scientific process skills, thinking, discussing, problem – solving skills, gaining attitudes and morals. Moreover, the participants stated that socio-scientific issues enrich the learning environment and increase interest in science and technology. Pike maintains that using socio-scientific issues support the development scientific literacy and students' decision making and inquiry skills. Socio-scientific issues can be used as a way of preparing students for an active, informed participation in society (Reis and Galvão, 2009).

Teacher candidates state that they are incompetent in making use of socio-scientific issues in science and technology teaching. The basic reason why teacher candidates consider themselves as incompetent is the program. According to them, there is no education in the program they have been studying and there are no lessons towards teaching socio-scientific issues. On the other hand, teacher candidates considering themselves as competence do not associate this competence with the knowledge of field and teaching profession but the individual interest towards socio-scientific issues.

References

Driver, R., Newton, P., & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. Science Education, 84, 287–312.

Ekiz, D. (2003). Eğitimde araştırma yöntem ve metodlarına giriş. Ankara: Anı Yayıncılık.

Hughes, G. (2000). Marginalization of socioscientific material in science-technology-society science curricula: some implications for gender inclusivity and curriculum reform. Journal of Research in Science Teaching, 37, 426–440.

Klosterman, M. & Sadler. T. D. (2008). Information literacy for science education: Evaluating web-based materials for socioscientific issues. Science Scope, 31(8), 62-65.

Miles, M. B.& Huberman, A. M. (1994). An expanded sourcebook qualitative data analysis. (Second edition). California: Sage.

Nuangchalerm, P. (2010). Engaging students to perceive nature of science through Socioscientific issues-based instruction. European Journal of Social Sciences, 13, 34-37.

Pike, M. A. (2007). Values and visibility: the implementation and assesment of citizenship education in schools. Educational Review. 59(2), 215-229.

Ratcliffe, M. (2003). Science education for citizenship. Maidenhead, UK: Open University Press.

Reis, P.; & Galvão, C. (2009). Teaching controversial socio-scientific issues in biology and geology classes: a case study. Electronic Journal of Science Education, 13, Retrieved from http://ejse.southwestern.edu.

Sadler, T. D., & Zeidler, D. L. (2005). Patterns of informal reasoning in the context of socioscientific decision making. Journal of Research in Science Teaching, 42(1), 112–138.

Yıldırım A. & Şimşek, H. (2006). Sosyal bilimlerde nitel araştırma yöntemleri. Ankara: Seçkin Yayıncılık.

Zeidler, D. L., Walker, K. A., Ackett, W. A., & Simmons, M. L. (2002). Tangled up in views: beliefs in the nature of science and responses to socioscientific dilemmas. Science Education, 86, 343–367.