Improving socio-scientific reasoning through field-trips

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Abstract. Perspective-taking is considered as a key competency for socio-scientific reasoning. Out-of-school education has multifaceted potentials for science education because of its authenticity and cross-disciplinary nature. In a comparative study it is examined to what extent and in which way the visit of an out-of-school-education site during a course with socio-scientific issues influences the socio-scientific reasoning of German high-school students. During the course students provided written statements and had semi-structured interviews both of which were qualitatively analyzed. The findings indicate that such a field-trip can foster the ability to perspective-taking.

Introduction

Socio-scientific issues (SSI) shape democratic societies, hence it is important that students learn how to argue and communicate their position. These competencies are summarized in the concept of socio-scientific reasoning (SSR) [1]. German national educational standards stipulate the promotion of SSR as an objective of science teaching. One possibility of implementing SSR is the use of out-of-school-education sites, because it is expected that these can foster SSR among students as they provide authentic contexts for learning [2, 3, 4]. However, there exist only few studies examining this relationship.

Theoretical framework

We define an out-of-school-education site as a topographically identifiable location outside the school grounds with learning potential for learning intended and planned by school [3].

Theoretical frameworks of SSR understand perspective-taking as a sub-competence of decision-making [5, 1]. The ability to take other perspectives was identified as a key-competency for the development of dimensions of SSR such as skepticism and inquiry [6]. Kahn and Zeidler (2019) described perspective-taking as a "gateway for more epistemologically sophisticated forms of reasoning" [7]. Kinslow et al. (2019) identified positive effects of field-based ecology classes on perspective-taking [4]. However, in their study there was no comparison between students in a field-based class and students in a school-based class. So it remains still unclear to what extent the positive effects can be traced back to the field-trips or to other factors such as regional relevance of the issue in question. This leads to the research questions:

1. To what extent and in which way do the decisions of students who participated in the out-of-school-based class distinguish from the decisions of students who participated in the school-based class?
2. Which aspects of the out-of-school education site lead to the potentially different decisions?

Methods

To answer the research questions, we conducted a comparative study in pre-post-design. Two groups of high-school students attend the same problem-based science course to the publicly heavily discussed issue, if the coal power plants in Lusatia (Germany) should be turned off in the year 2038 (as it is legally regulated today) or already in the year 2030. The only difference was

that one group (53 students) visited a nearby coal power plant during the course and talked to former employees of the power plant. The other group (75 students) stayed in the school for the whole time of the intervention. For them, information given on the power plant were provided via an explanatory video. Both groups had access to the same information. The intervention lasted for three 90-minute classes plus field trip resp. four 90-minute classes. At the end of the intervention the students were asked to argue their opinion to the controversial issue in a written statement. These statements were analysed through qualitative content analysis. To answer the second research question, we conducted semi-structured interviews with selected students at two points during the course. The interview guide was developed upon a supply-benefit model of out-of-school education [adapted 8, 9]. The interviews were analysed qualitatively based on this model.

First findings and conclusions

Students who visited the power plant formulated more arguments in their statements than students who took part in the school-based class. They were also more often not capable of making a clear decision to the issue: They formulated pro- and contra-arguments but did not weigh them resp. their corresponding values. They couldn't decide which argument or value was more important to them. This indicates that the students in the field-based class are more capable of taking other perspectives into account when building an own opinion to a SSI. These findings will be triangulated with the interviews and deeper analyses of the statements. Mainly they indicate that visiting an out-of-school-education site can foster the perspective-taking of high-school students when dealing with a SSI.

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