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# Editorial: Science education for citizenship through Socio-Scientific Issues

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## Editorial on the Research Topic

### Science education for citizenship through socio-scientific issues

Recent educational reports around the world have called for science education that places emphasis on scientific literacy, and makes the connection between science and everyday life, focusing on the social aspects of science, with the aim of preparing young people for life beyond school (European Commission, 2015; Evagorou and Dillon, 2020). Many countries put emphasis on educating citizens, not only regarding knowledge but also in acquiring particular skills that will help them become active, engaged, informed and responsible citizens (Joris et al., 2022). In order to think as an informed citizen and apply this in everyday decision-making, students need to gain skills such as argumentation, critical thinking, problem-solving, media literacy, assessing the validity of information sources, thinking ethically and collaborating (Jiménez-Aleixandre and Puig, 2012; Puig et al., 2019).

The current situation we are all living in with the ongoing COVID-19 pandemic, wars and climate change, has made clear that to be able to deal with societal issues citizenship skills are more important than ever. Citizens' reactions to scientific and non-scientific information and the spread of misinformation on social media make citizens struggle to understand and accept information. This recent experience has provided informal evidence that as educators and researchers we have not been successful in preparing citizens to understand the processes of science, the uncertainty involved in science, and to become critical consumers of information (Bayram Jacobs et al., 2021; Puig et al., 2019). This is especially problematic for science education, which claims to be a field that supports students to understand the processes of science and helps them become responsible citizens (European Commission, 2015).

Despite several studies regarding Socio-Scientific-Issues (SSI) and related skills during the last decade, the public discussions on social media around COVID-19 and possible solutions illustrate that science education needs to pay more attention to developing the aforementioned skills of students (Bayram-Jacobs et al., 2019). The aim of this Special Issue focusing on the topic of Science Education for Citizenship through Socio-Scientific Issues is to provide an international platform for a wide range of science educators and researchers to discuss relevant issues. This special issue features eight contributions from 28 researchers from three continents focusing on studies with either secondary or primary school or college students, as well as in-service and pre-service teachers within the context of citizenship education and socio-scientific issues.

Researchers Puig et al. report on secondary school students' critical thinking and argumentation skills for dealing with coronavirus information and disinformation. They conclude that even though students were able to identify false headlines, very few students were able to use the criterion of scientific procedure to assess headlines. Wiyarsi et al. also explored secondary school students' scientific habits of mind and chemical literacy. They have identified that students developed their literacy more when they engaged with SSI topics that are linked to everyday life.

van der Leij et al. explore the nature of secondary school students' morality in the human-nature context. Findings from this study highlight that students experience both rational-based and emotion-based reasoning, and that compassion was one of the moral emotions appearing the most. Tasquier et al. found that presenting science education for action and engagement toward sustainability is a component missing from scientific literacy traditional definitions, but is vital in supporting students to become active citizens and take responsibility for their actions, especially the ones linked to climate change.

Pellaud et al. from Switzerland explored teachers' perceptions of the fundamental elements of education in sustainable development (ESD) advanced competencies, as well as how they value the development of these competencies in school. They found interesting strengths and weaknesses of the current school system with regard to the development of competencies in ESD. Their work led them to propose a typology that can be used to compare different competency frameworks proposed by various stakeholders to teachers' perceptions and open up opportunities for developing tools for assessing these competencies in schools.

Nida et al. focused on exploring the use of everyday life contexts and SSI by pre-service teachers during their practicum. The findings suggest that pre-service teachers use mostly environmental topics, which are used as a way to introduce the lesson and not as a way to provoke societal discussions.

Dauer et al. engaged college students in a structured decision-making process in the context of socioscientific issues and explored students' perceptions and responses, identifying that students' ideas about actions they could take to impact were limited, which suggests that SSI instructions should focus more on taking action.

Songer and Recalde in their paper discuss the design and evaluation of socioscientific curricula for pre-college students focusing on phenomenon-centric materials and placing an emphasis on offering solutions. Their findings suggest that such a curriculum can support students and teachers in engaging with environmental socioscientific issues. They also conclude that the local environmental issues that are interesting to students, teachers, and other stakeholders are essential to design principles to create a successful socioscientific curriculum.

Highlighting the implications of the studies presented in this special issue, it is evident that taking action or being accountable for your actions is something that is still missing from socioscientific curricula and practical citizenship education. On the other hand, engaging in SSI and linking school learning with the everyday life of students have the potential for developing citizenship skills of students and supporting teachers and teacher candidates to focus on skill development in science lessons. Studies in this special issue highlight that it is possible to support secondary school students and university students to take action in their local communities. Furthermore, morality is an important aspect of citizenship skills that is often neglected but can be supported by engaging in socioscientific issues.

## Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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