Climate Change in the Mathematics Classroom

Introduction and background

The aim with this poster is to present a theoretical framework which is under construction. The purpose with the framework is to study implementation of climate change as an important issue for students’ future, in the context of mathematics education. I see developing citizenship as a part of education, and as an interdisciplinary theme. By applying this framework, I look into how students can engage in climate change through mathematics education, in a critical citizenship. Qualitative research approach becomes important in exploring this topic. I will establish a partnership with lower secondary teachers. Through conversations and observation, I seek to gain insight into both how facilitation of mathematics teaching can take place as well as how such education can contribute to critical citizenship.

Education on Mathematics, Climate Change and Citizenship

My theoretical framework consist of three main perspectives reflecting the different views, Post-normal Science (PNS), Critical Citizenship Education (CCE) and Critical Mathematics Education (CME). The figure below visualizes these perspectives looking into mathematics education, climate change and citizenship. I consider the boundaries between the perspectives as overlapping. All are therefore included in a triangle, but with the possibilities for looking at the education from different angles. I choose to include mathematics education, citizenship and climate change into a circle to show their relationship. In the figure, I differentiate between CME as a theoretical perspective and ‘Mathematics Education’ as something that happens in school context (and likewise with CCE and ‘Citizenship’).
Critical Citizenship Education

A society needs engaged and involved citizens, and citizenship education have received increased interest (Biesta & Lawy, 2006). There are political, social, civil and cultural dimensions to citizenship, which are interrelated and overlapping (Banks, 2008). ‘Critical’ citizenship moves beyond the dimension of citizenship, in that “students and teachers are involved as proactive agents of change by connecting citizenship education with engagement in the public sphere” (Dejaeghere & Tudball, 2007). Kennedy (2005) refer to this as “teachers’ civic professionalism”. In climate change, the context is a pressing and global problem, and teachers need to be involved. Freire (1970) highlights “authentic dialogue between learners and educators as equally knowing subject” and “the real, concrete context of facts, the social reality in which men exist” as significant in process of knowing. Both contexts are important in CCE and mathematics education, citizenship and climate change.

Critical Mathematics Education

Through history, mathematics has played an important role in understanding the world. Modern mathematics education can been seen as a way of understanding nature, as a resource for technological development, or/and as pure rationality (Skovsmose, 2011). CME moves beyond this conception, and includes mathematical knowing, technological knowing, and especially reflective knowing (Skovsmose, 1994). Gutstein (2006) suggests that controversial issues are explored through mathematics to “investigate, make sense out of, and possible take action on”. I consider the issue of climate change to be such an issue. He also stresses that genuine views and differences are “solicited, accepted, and respected”. The reflective knowing can be on, with and through mathematics, and Skovsmose (2011) emphasizes the importance to question mathematical rationality with education for social responsibility. He uses the term response-ability linked to mathemacy, as “a capacity of making responses and as reading the world as being open to change”. I relate this to critical citizenship. Climate change is a complex issue with high degree of uncertainty, and involves mathematics in describing, predicting and communicating (Barwell, 2013). I consider climate change in mathematics classroom demands dialogue, different perspectives and critical mathematical competence.
Post-normal Science

The uncertainty and complexity of climate change makes it difficult to deal with. Funtowicz and Ravetz (2003) refer to issues where “facts are uncertain, values in dispute, stakes high and decisions urgent” as ‘post-normal science’. They argue that PNS must involve a wide range of participant, not only expert, but also those who in fact have to deal with the impacts. Barwell (2013) draws parallels between Skovsmoses ‘reflective knowing’ and PNS. They both involve dialogue and engagement with a wider community. Key elements in PNS is management of uncertainty, how plurality of perspectives is coped with, and involvement of peer community (Petersen, Cath, Hage, Kunseler, & van der Sluijs, 2010). Climate change is an issue that need participation not only from expert-regime. I consider PNS as a way of responding to the issue of climate change, with students as engaged and critical citizens.

Conclusion

In this text, I have started on a framework for my PhD-project on climate change in mathematics classroom. Connections has been drawn between the perspective of PNS, CME and CCE, in relation to mathematics education, climate change and citizenship.

Reference