

Democracy and science: two sides of the same coin?

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Abstract

Democracy and science, according to a number of researchers, share several basic characteristics like critical thinking, public discourse, open debate, free flow of information, mutual respect, and the critical role of inquiry and evidence. The core curriculum for primary school in Norway, specifically states the importance of democracy in the natural sciences subject. In this paper, we explore the question: *Did pre-service teachers experience or learn about the connection between natural science and democracy during their compulsory education?*

The analysis builds on theory relating to thick and thin democracy, about the shared characteristics of natural science and democracy, and of democracy in the Norwegian curriculum. The informants are 18 pre-service teachers studying natural science didactics and who all studied science in their higher education. These students were influenced in their compulsory education. When we write about pupils being taught democracy, it is about our informants as pupils before attending teacher education. The data were collected by a questionnaire based on a template developed by the international Global Doing Democracy Research Project (GDDRP). Although this study includes only 18 pre-service teachers, the study indicates that students during the compulsory education in Norway acquire a rather thin understanding of democracy and without any connectedness between the natural science subject and the concept of democracy. The study concludes that science teachers in primary school and in teacher education have to put more emphasis on a thick understanding of democracy and the connectedness between natural science and democracy, for the science curriculum to be properly implemented in school.

Keywords: *Thin thick democracy; citizenship; coherence; didactic; curriculum*

Introduction

Norway and many other Western countries regard themselves as democratic societies and wish to convey knowledge about democracy to the next generations. We also want our children to understand that a democratic society is the best society for us to live in and that they therefore need to respect what many generations before them have lived and fought for. Consequently, democracy is an important element

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in school. There have been various studies on how school students' and teachers' understanding and conception of democracy vary depending on which country they live in (Busher, Wilkins, and Lawson, 2012; Cashman, 2007; Kennedy, 2012). In addition, a few studies have been done on what pre-service teachers believe about democracy (Zyngier, Traverso, and Muriello, 2015) but these studies are not subject-specific.

In terms of the natural sciences, it has been argued that democracy and science share some basic ideas and methods and that the subject of natural science therefore should or might improve students' conceptions and democratic skills (see f.ex. Kolstø, 2001, Brown, 2009). However, neither teachers' understanding of how natural science as a subject has contributed to their perception of democracy, nor teachers' perception of any interconnectedness between science and democracy, are areas that are well explored.

The Norwegian Education Act (NEA, 1998) and the National Curriculum for Knowledge Promotion in Primary and Secondary Education and Training (Udir, 2011a) constitute the framework for compulsory school in Norway, and in this framework democracy is mentioned a number of times. The National Curriculum states that 'the students shall participate in democratic processes, thus developing their democratic ideals and understanding of the importance of active and committed participation in a multicultural society' (Udir, 2011b, p. 3) and it also states that 'Upper secondary education shall contribute to... democratic ideals and scientific thought and method.' (Udir, 2011a, p. 2). The students are not only supposed to know about democracy, but they should be able to engage in and further develop democratic processes. The concepts *democracy*, *critical thinking*, and *social responsibility* are examples of how these goals are being operationalized, and the concepts are mentioned a number of times throughout the curriculum.

In this paper, we want to explore whether this coherence and connection between democracy and natural science is actually being communicated to the pupils in the Norwegian compulsory education system. We do this by investigating whether and in what ways pre-service teachers with a master's degree in natural science as an academic background express any coherence or connection between their understanding of *democracy* and the *subject of science*. We ask the research question: *Does compulsory education leave the students with an understanding of coherence between natural science and democracy?*

We first present some theoretical aspects on democracy and a discussion of thin and thick understandings of democracy. Thereafter, we discuss relations between natural science and democracy before we turn to democracy and natural science in the Norwegian curriculum. Thereafter, we present our research method, the empirical data, and the results. Finally, we discuss the results in light of the theories and draw some conclusions about development of the democratic aspect in natural science education for teacher students.

Theoretical perspectives

In this part, we introduce thick democracy as a holistic way of understanding democracy covering much more than democracy as merely a political, electoral system. A thick understanding of democracy embraces living together, participating in society, and acquiring knowledge and an understanding of facts in order to make decisions. These elements are important in developing a democratic country, and the educational system is one of the important tools for educating students in these democratic skills and concepts. In the article, we firstly discuss democracy, and thereafter we explore some theoretical relations between democracy and natural science. Thirdly, we look at natural science in the Norwegian curriculum and examine the topics, skills, and characteristics that the statutes and regulation mandate in the subject of natural science; we also ascertain whether these are in correspondence with our discussion of democracy. Thereafter, we present our survey in which we discuss our research and findings and ascertain whether our respondents in fact present any correlation between their experience of the subject of science and the concept of democracy in their own compulsory education.

Thin and thick democracy

Democracy is a concept used worldwide, and notions of it differ according to context and culture. Democracy and democracy in relation to education have been discussed by several authors, f.ex. by Madsen & Biseth (2014), where they discuss what we really mean by *democracy* in Norwegian schools and how we implement this. Democracy is a socially constructed phenomenon, and the meaning of the concept has changed during history (Crick, 2008). Democracy covers different topics such as political participation, political representation, and the balancing of social and political power and conflict (Biesta, 2007). Democracy can be understood as a political lens through which to focus on each citizen's basic rights and self-preservation and protection against possible state tyranny (Held, 2006).

According to political scientist Larry Diamond (2004), democracy consists of four key elements: (a) A political system for choosing and replacing the government through free and fair elections; (b) The active participation of the people, as citizens, in politics and civic life; (c) Protection of the human rights of all citizens; and (d) A rule of law, in which the laws and procedures apply equally to all citizens. According to Gutmann (2003, in Biseth, 2014, p. 27), a basic trait of all modern democracies is that all citizens experience human rights related to basic principles of freedom, equality, and shared legal rights. Opposition and a plurality of perspectives are essential elements in a democratic society, and disagreements are not solved by violence, but through democratic means such as communication and debates within the legal system (Biseth, 2014, p. 27). Political decisions are based on knowledge, arguments, and negotiations in public and open debates. The ideal is an active, engaged, and involved citizenry. According to Biseth (2014), this understanding of democracy pertains to the electoral system as well as to how we live in society. To maintain and develop our

democratic society, we need to be responsible, interactive and engaged citizens, and an attitude reflecting this mind-set should be passed down from generation to generation. Teaching *about* democracy (Carr & Zyngier, 2012) as a political system is not sufficient in order to promote democracy as interaction between engaged citizens, and this is the reason why the Norwegian curriculum (Udir, 2011b) embraces different ways of promoting democracy and democratic participation.

The European Council defines democracy on three different levels: 1) as a way of political governance (legal system, electoral rules, governance institutions); 2) as a way of organizing society (how to live together in a modern pluralistic society by peaceful means); and 3) as a way of living (being an engaged citizen based on values like solidarity, justice, self-determinations) (Biseth, 2014, p. 29). The European Council thereby promotes a rather broad understanding of democracy, which seems to correspond with the understanding presented in the Norwegian curriculum described above. An understanding of democracy is described as a learning outcome in the Norwegian schools. The students are also expected to develop skills in taking action democratically and to acquire democratic values so as to prepare the students for democratic citizenship in a pluralistic society. The inculcation of democracy therefore includes respectful treatment of all students and training in critical thinking and public discourse and engagement (Biseth, 2014).

Biesta (2006) discusses the concept of democracy in school by introducing what he calls *education for democracy* and *education through democracy*. He claims that teaching *for* democracy prepares the students for a future participation in a democratic society; ideally, it will include three components: a knowledge component (about the parliamentary system), a skill component (critical thinking, training in public discourse, being informed), and a value component (human rights). But this is still not sufficient. There is also a need in the educational system to learn democracy *through* democratic participation in the “inner life” in the school, and democratic values should permeate all activities in school (Biesta, 2006).

This is further elaborated with the concepts *thin* and *thick* democracy (Zyngier, 2012; Gandin & Apple, 2002). The thin and thick concept of democracy on one hand describes a superficial understanding covering only an electoral, political system in contrast to a deep understanding that comprises conceptualization of a representative versus a participatory democracy.

Furman and Shields (in Zyngier, 2012, p. 4) state that:

Deep or thick democracy espouses a number of principles that champion individual rights and responsibility within diverse cultural communities in the interests of the common good. These include (among others): .. reverence for, and proactive facilitation of free inquiry and critique, .. responsibility of individuals to participate in free and open inquiry. .. re-affirmation of the necessity for collective choices and actions in the interest of the common good.

Accordingly, a deep understanding of democracy covers both rights and responsibilities of the citizens. Citizens with a deep understanding of democracy are engaged participators.

These concepts might also be characterized as *thin electoral processes* versus *thick critical engagement and social justice*. Zyngier and Carr (2012) differentiate between thick and thin democracy by stating:

Through the notion of thin as opposed to thick democracy we can conceptualize the visible tension between the superficial features often associated with teaching about democracy that focus on civics and citizenship as opposed to the fundamental scaffolding, which, on the other hand permits people to appropriate the deeper meaning of the term democracy so that students know that civic engagement is not an individual private endeavor (p. 4).

In summary, thin democracy corresponds to teaching *about* democracy and thick democracy to teaching *for* and *through* democracy (Zyngier, 2012). A school teaching *for* democracy empowers active, informed and supportive students and citizens. A school that implements and establishes democratic practices in classrooms by creating an open climate for discussing issues is most effective in promoting democracy through civic knowledge and engagement in a *thick* way (Kahne & Westheimer, 2003).

However, several international studies indicate that educators have only a superficial conceptualization of and thereby thin perception of democracy (Carr, 2010a; Carr & Zyngier, 2012; Zyngier, 2012; Westheimer, 2008). Kahne and Westheimer (2003) found that teachers mainly teach “thin” democracy and not “thick”, as desired from a critical pedagogical perspective (Denzin, 2009). According to Fischman and McLaren (2005, p. 425), it is ‘not enough to understand any educational reality, you also need to transform it with the goal of radically democratizing educational sites and societies.’ To participate actively as citizens we need democratic competence and a thick perception of democracy. According to Carr (2010b) and Zyngier (2013), the teachers should teach both ‘about’ and ‘for’ democracy in order to achieve a deep, democratic understanding, because the citizens need competence to reflect and participate as responsible, justice-oriented citizens.

In the next section, we focus on science, and explore the relations between the subject natural science and democracy and discuss whether natural science might contribute to such skills or attitudes which are part of this understanding of democracy.

Natural science and democracy

As indicated in the introduction, one can argue that natural science and democracy are based on some of the same principles. Branscomb and Rosenberg (2012, p. 2) stated that:

We must remember that at their root, science and democracy share the same values. Democratic societies are founded on open debate, free flow of information, mutual respect, and the critical role of inquiry and evidence. . . . These values are also fundamental to the scientific method.

Natural science is a field in which researchers, often through the use of quantitative methods, investigate and test theories and hypotheses, but it is also a field with long traditions for public arguments and discussions. Natural science research involves critical investigation and discussions on contrasting theories and observations. All observations, discussions and reflections are supposed to be considered and handled in a serious way in the search for a final conclusion. Such explorations bear similarities to democratic processes, and therefore these processes being part of science have been arguments for natural science education as an important arena for teaching, learning, and experiencing democracy in school (Sjøberg, 2009, p. 197; Madsen and Strande, 2014, p. 204; Kolstø, 2003, p. 60). Sjøberg (2001) argues that ‘Science competence is necessary for most people for a democracy to function. . . . In a functional democracy the participants are autonomous, independent actors that do not let themselves be cheated or manipulated’ (p.120, our translation). Science in general and natural science in school especially are linked to democracy because the subject is supposed to enhance the students with knowledge and skills that enable them to participate as active and concerned citizens in the democratic processes in the society (Siegel, 2010; Zyngier, 2012; Kahne & Westheimer, 2003).

According to Sjøberg (2001, p. 97), the critical component in science might also promote democratic thinking by being anti-authoritarian. He claims that science education with its active learning processes not only has an impact on the students’ knowledge, but also on their ability to ‘take a stand’ (Sjøberg, 2001, p. 121). Important topics relevant to society, such as sustainable development, climate change, and social health, offer students knowledge that helps them to establish informed attitudes and actions (Sjøberg, 2001). Also Madsen and Strande (2014, p. 205) claim that several elements in science education are relevant to democracy and citizenship, such as knowledge, communicative attitudes and skills, and active participation in decision-making processes.

As argued above, the basic ideas of democracy and the foundation of science complement each other and the overarching goals coincide. Both include elements such as active and critical human beings and engaged citizens in public discourse in closed groups or open societies, with a shared framework of aspirations for increased knowledge and understanding. The question is whether this is implemented and operationalized in the subject of science in schools. Therefore, we now turn to the subject of natural science in the Norwegian curriculum.

Democracy and natural science in the Norwegian curriculum

The Norwegian National Curriculum (Udir, 2011a) is a regulation of the National Education Act (NEA, 1998). The Education Act (1-1) states: ‘Education and training shall provide insight into cultural diversity and show respect for the individual’s convictions. They are to promote democracy, equality and scientific thinking’. Further on in the same section, the Act states: ‘The students and apprentices shall learn to think critically and act ethically and with environmental awareness. They shall have joint responsibility and the right to participate’. This is further elaborated

in the National Curriculum for primary and secondary school (Udir, 2011b), as defined by the Ministry of Education and Research and executed by the Norwegian Directorate for Education and Training (Utdanningsdirektoratet or Udir).

The Directorate for Education and Training underlines the schools' responsibility for educating students in democratic skills by stating that:

The school and apprenticeship-training enterprise shall prepare students for participation in democratic decision-making processes and stimulate social commitment, both nationally and internationally. In their education, the students shall develop knowledge on democratic principles and institutions (Udir, 2011b).

The connection between science and democracy is highlighted several places in the Core Curriculum. In the chapter titled *The Environmentally Aware Human Being* it is stated that:

The consequences of applied science - of human action based on research - have at once become more extensive and more interlaced.... It increases the need for more knowledge, more holistic knowledge, and for more conscious ecological, ethical and political decisions made by individuals, and by society as a whole. Understanding makes for insightful decisions, ethical appreciation that decisions can be made with discernment (Udir, 2011a, p. 36).

It is therefore a fundamental aim in Norwegian schools to educate the children for participating with discernment in political decisions, which is another way of saying that the students shall be educated for democratic participation. The curriculum also otherwise states the importance of natural science as a subject with the purpose of educating the students to be engaged citizens:

[Education] must spur the urge of the young to understand the processes of nature. Hence, immersion in the natural sciences is a crucial component of a well-balanced education.... Education must awaken their faith in the efficacy of joint efforts and collective action to solve the formidable global problems facing them (Udir, 2011a, p. 38).

The National Curriculum (Udir, 2011) thus highlights engagement and democratic competencies and skills both in the general part of the curriculum and in the natural science curriculum, which are in accordance with a thick understanding of democracy.

These aspects are elaborated in the description of the purpose of natural science:

Natural science shall also help children and young persons attain knowledge and form attitudes that will give them a considered view of the interaction between nature, individuals, technology, society and research. This is important for the possibilities the individual has to understand various types of natural science and technological information and shall give one the basis for participation in democratic processes in society (Udir, 2013, p. 1).¹

¹This version of the natural science curriculum was valid during the years 2010–2013, but also with minor changes from 1998 until 2016.

In this quotation, the word *democratic* is used leaving the teachers no opportunity to interpret in any other ways than to *participate*, but not stating exactly how to understand a *democratic process*.

In other parts of the science curriculum, the Directorate of Education mentions other aspects of democracy by stating, for example (Udir, 2013, p. 1):

Practical and theoretical work in laboratories and in the field using different theses and research questions is necessary to gain experience with and develop knowledge of the methods and approaches in natural science. This may contribute to developing creativity, the critical eye, openness and active participation in situations involving natural science knowledge and expertise.

And the Directorate continues by describing activities like:

The students should be able to investigate a global conflict of interest related to an environmental question and discuss and elaborate on the quality of arguments and conclusions in a forum for debate (Udir, 2013, p. 9), and observe and provide examples of how human activities have affected a nature area, identify the views of different interest groups on the effects and propose measures that might preserve nature for future generations (Udir, 2013, p. 8).

All these activities teach the students skills in being active and engaged democratic citizens with high democratic competence and a thick understanding of democracy. In this way, the curriculum clearly states the importance of combining the subject of natural science (including both the scientific method and scientific knowledge) with political debates and decisions, and describes natural science as a subject for gaining necessary knowledge about science, critical abilities and active participation in both social, political and, thus, democratic processes. The curriculum clearly expresses interconnectedness between natural science and democracy, and the activities described are in line with a thick understanding of democracy. We find that the Directorate uses terms and concepts that we share in our understanding of thick democracy and science: critical thinking, theses, public discourse, knowledge, arguments, participation and engagement.

Without going into many details and quotations from the science curriculum, we will refer to only a couple examples of how this is further operationalized in the Main Subject Areas and appurtenant Core Competencies²:

The Budding Researcher: (Udir, 2013, p. 8)

- explains the importance of looking for relationships between cause and effect and explains why argumentation, disagreement and publication are important in natural science
- plans and carries out experiments to test the validity of his or her own hypotheses and chooses the publication method Diversity in Nature

²The Science Curriculum consists of four parts: The Purpose, Main Subject Areas, Core Competencies and Basic Skills.

Sustainable development (Udir, 2013, p. 9):

- identifies the views of different interest groups on the effects and propose measures that might preserve nature for future generations
- selects and describes some global conflicts of interest and assesses the consequences these might have for the local population and the global community

Radiation and radioactivity (Udir, 2013, p. 9):

- explain what the greenhouse effect is and elaborate on and analyse how human activities are altering the energy balance of the atmosphere

And in the description of Basic Skills, the Directorate operationalizes the skills in the following manner: (Udir, 2013, p. 2):

Oral skill in natural science means listening, speaking and conversing to describe, share and develop knowledge with content about natural science related to observations and experiences. This involves using natural science concepts to communicate knowledge and to formulate questions, arguments and explanations... Being able to read: Reading in Natural science includes critical assessment of how information is presented and used in arguments, e.g. by being able to distinguish between data, assumptions, assertions, hypotheses and conclusions.

This shows that the curriculum encompasses many, if not all, aspects and dimensions of science, which is also part of democracy. The science curriculum names topics and skills like science and society, citizens, democracy, developing hypotheses, experiments, systematic observations, discussion, critical evaluation and critical assessment, arguing, state the reasons for conclusions, and publication....

All these concepts and basic skills are aspects of science and of democracy, and the concepts can all be understood as competences related to a thick understanding of democracy (Siegel, 2010; Zyngier, 2012; Kahne & Westheimer, 2003) described earlier in this paper.

In our understanding of the concept thick democracy, and of how the Ministry of Education, through the implementing Directorate of Education, describes and operationalizes the purpose, contents and skills to be acquired by students in the subject of science in primary and secondary school in Norway, there is a strong connectedness between democracy and science. One of the purposes of the science subject is clearly to inculcate in future citizens an understanding of the necessity of democratic participation in society and of public engagement and to acquire democratic skills in a thick understanding of democracy. However, one might ask whether students understand this aspect and see the connectedness in the science curriculum?

In order to find out whether Norwegian students experience and understand this relationship between science and democracy, we have analysed questionnaires from a group of students who are training to become science teachers. We anticipate

that these students are more than moderately interested in natural science as a subject and therefore devote above-average attentiveness and thought to the lessons. We therefore ask, do these students understand the connectedness between science and democracy after having been subjected to the science curriculum in the compulsory education system in Norway?

Research Method

This study is a part of the international Global Doing Democracy Research Project (GDDRP). Zyngier (2013) describes the main concepts of critical pedagogy (Freire, 1974) as ‘a framework of analysis’ in GDDRP. The focus of the project is on how education supports, cultivates and engages in, and with, democracy. The data in this survey were collected by means of a survey, originally constructed as an instrument in the *Global Doing Democracy Project* (GDDRP) (Zyngier, 2013).

The GDDRP questionnaire for use internationally was developed as a set of questions that can be used anywhere in the world. The original was constructed as an instrument in GDDRP for research with teachers in the USA, Canada, and Australia. It contains four sections: 1) an introductory section requesting demographic information; 2) questions on democracy and education; 3) questions on citizenship and education; and 4) a final section allowing respondents to add any additional comments on democracy and citizenship, or on the questionnaire itself (Zyngier, 2013). The developers are also aware that there are local differences in understanding democracy in various countries, and it is therefore possible for researchers in other countries to revise the questionnaire. In our survey, approximately 80% of the questions were found relevant for the Norwegian context and translated into Norwegian from the original version. Then the survey was adjusted for teacher educators and teacher students in Norway. Some items were added in the Norwegian questionnaire based on our interests.

Collection of data

In this study, questionnaires were distributed to two groups of pre-service teachers in teacher education, and this data is analysed from a perspective of exploring the relations between democracy and natural science.

The questionnaire was constructed with questions on topics eliciting the informants’ understanding of democracy, its role in education, and in what way and to what extent the educational system influenced their understanding of democracy. Some questions were factual and could be answered by one word, while most of the questions had to be answered freely in several sentences. The questions were related to thematics or the respondents’ opinion about democracy-related and political and ideological matters and not on what they learned about democracy in specific academic subjects. The questionnaire included no specific questions hinting that the object under study was science education or any other specific subjects in school or any interrelatedness between science and democracy.

Our group of informants is a specific, targeted group of 18 pre-service teachers in two different classes, studying the didactics of natural science to become teachers in lower or upper secondary school. These pre-service teachers are all highly educated (Ba, Ma and PhD) science professionals aged 30 to 50 and most of them with several years as scientists. All the pre-service teachers in this group answered the questionnaire. The online survey took place in the very beginning of their teacher education, and we can assume that their understanding of democracy is not influenced by teacher education but strongly influenced amongst others by earlier education.

Data Analysis

The questionnaires were analysed in two ways:

Firstly: The vocabulary used by the pre-service teachers when they answered the questionnaire was examined for patterns, missing words and repeated use of words (Miles, Huberman & Saldana, 2014). We looked for the words *Critical thinking*, *Participation*, *Arguments*, *Evidence*, *Public discourse*, *Environmental concern*, *Engaged citizen*, and *Action*. These words were selected because they appear in the curriculum of natural science in the Norwegian school, and they are at the same time connected to our understanding of democracy. We also looked for the use of other words related to democracy and/or natural science or to other relevant topics.

Secondly, the written answers in the questionnaire were systematically interpreted, coded and categorized in order to understand what the pre-service teachers are expressing.

The responses, codings and categorizations were done in accordance with the process of open coding described by Straus & Corbin (1998) in the method of constant comparative analysis. This data-reducing process resulted in two main analytical categories. The category *thin and thick understanding of democracy* appeared from the empirical data when the analysis was going on. The predetermined category *natural science as a mediator of democracy* appeared in advance of the analysis from the theory and the ministerial papers.

Criticism of the method

In this research, we have only two classes of science pre-service teachers in teacher education as informants. They represent a group of pre-service teachers with a special interest in the subject natural science, as they all want to be science teachers. Pupils with special interest are expected to have acquired the main ideas in the subject; therefore, these pre-service teachers are expected to understand the relations between science and democracy as described in the curriculum, if it has been part of the teaching in their compulsory education. At the same time, students with special interest for natural science might be focusing on the “hard core” part of the subject and for that reason do not see the coherence between science and democracy.

Empirical Data and Findings

We analysed the data using the categories described above (Straus & Corbin, 1998). By the end of the process of analysis, these categories were dominant: a) thin and thick understanding of democracy, and b) natural science as a mediator of democracy. The empirical findings within each of the categories will now be discussed. All the citations are translated from Norwegian to English by the authors.

Thin and thick understanding of democracy

Most of the informants in our study voiced a thin understanding of democracy, as defined by Zyngier (2012). When asked about democracy, they write about voting, political parties, freedom, and rights (Held, 2006; Gutmann, 2003). One informant writes:

Democracy is a system of governing where all the inhabitants, directly or indirectly, participate in deciding which party or person should run the country.

Another writes:

[Democracy is a] representative government.

She ranks Norway as “very democratic” (level 5 on a 1-5 scale) when, in question 12, she is asked whether Norway is a democratic country. In question 13, she argues that she thinks Norway is very democratic because

we regularly vote for Stortinget (the Norwegian Parliament) and vote for local politicians. We vote when important decisions are to be made and we have a government elected by the people.

The quotes are examples showing that these pre-service teachers focus their democratic understanding on the electoral system, and in this perspective they do have a thin understanding of democracy, as defined by Zyngier (2012). The same understanding of democracy becomes visible when the informants respond to whether Norway has become more or less democratic after the terror attack on the 22 July 2011³. The political system did not change after this episode, and with a thin understanding, the answer to the question will be: No. All the informants answered no. A person with a thick understanding could answer either yes or no depending on his/her experiences. As we see, the answer to this question does not tell us about the informants’ understanding of democracy. When analysing some of the other

³A Norwegian terrorist killed 87 people, mostly young people, in Norway as a political act against immigration and multiculturalism. The act aroused a huge public discussion about the reasons for terrorism and local democracy and engaged citizens, but the formal regulations regarding elections and democracy were not changed.

questions (no. 21 and no. 22), we meet the same problem, and thus these questions are not part of our analysis.

Questions 27-30 are about democracy as an element in school. The informants were asked, "How democratic do you think the compulsory school and the upper secondary school that you have attended have been?" Rank from 1-5. Most of the informants ranked the schools in the middle of the scale. In question 29 the informants were asked to explain their ranking.

Five of the students only referred democracy to the Pupils' Council, a school-version of an electoral and representative system, and in this way, they again express a thin understanding of democracy. The Pupils' Council is a legally mandated institution in school for the purpose of teaching and involving the students in the school democracy (Biseth, 2014). Each class elects a representative to the Pupils' Council. This council and sometimes the classes discuss various questions presented to them by the headmaster or raised by themselves. The students might discuss and argue about matters concerning their everyday life in school. The students might have an opinion and sometimes act on matters that might be important for them. The real influence from the Pupils' Council, however, will vary a lot from one school to another.

The informants seem to think that a school with a well-organized Pupils' Council is democratic, while a school not organizing the Council so well is not a democratic school. We consider this to be within the range of thin understanding of democracy (a formal electoral and voting system). These responses point to experiences of education *about* democracy (Biesta, 2006, 2007). This understanding of democracy makes it difficult for the informants to answer question no. 30: 'What can you do to facilitate democracy amongst the students?' With a thin understanding of democracy, we expect only different ways of expressing 'supporting pupils' council', which is also expressed by some of the informants. Therefore, it seems as if the informants did not experience schools teaching a thick understanding of democracy, but only as an 'electoral and voting system'.

Question 28 asks whether the school had any influence on the informants' thoughts about democracy. The overall impression of the explanations is that the impact was negligible or the impact was irrelevant. One informant put it this way: "My school had little impact on my understanding of democracy". This answer implies that the student experienced to have learned only a little in school about democracy. This does not imply that she was not taught about or through democracy, but she did not acquire an understanding of democracy while in school. This informant is not only concerned about democracy as voting for the Norwegian Parliament. She thinks that if the school intends to increase students' engagement in the political system, the students must experience a Pupils' Council making decisions and having influence on issues that are important to the students. When she was asked what she could do to promote democracy as a future teacher, she wrote, 'the school ought to let the students have influence on the everyday tasks in school and I will help the

students in their understanding of the purpose of democracy and how a democratic society works'. This will be very difficult if the teachers, as indicated in the theoretical part, have a superficial understanding of democracy (Carr, 2010a; Carr & Zyngier, 2012; Zyngier, 2012; Westheimer, 2008).

Another informant is critical because she did not experience having learnt much about democracy in school. When asked what she could do to improve democracy in school, she answered: 'A Pupils' Council that is in reality being listened to and taken seriously'. She still describes democracy as a political system and thereby seems to represent a thin understanding of democracy (Zyngier, 2012), but also thinks that by teaching the students how this system works, they also have to be taken seriously. Indirectly she seems to tell us that if we want to teach the children to get involved, the processes of decisions should be meaningful or serious for the students. Otherwise, one might eventually end up teaching them lack of engagement.

One informant felt that the Pupils' Council was the one and only initiative from the school related to democracy. She wrote, 'In my primary school, there was nothing related to democracy except the Pupils' Council, where we discussed and expressed opinions, which were listened to but our opinions were never implemented'. She indicates that Pupils' Council should be representative of a democratic society, but when nothing is implemented, this is not representative anyway; the system is instead a reign of "tyranny" (Held, 2006). The underlying message seems to be that the students do not learn democracy when the decisions made by the Pupils' Council are not implemented, quite the contrary. Some other respondents seem to stress a similar argument by mentioning that they were only involved in decisions on the amount of homework or the content in the lesson plan for the week.

Two respondents mention social science as a subject with impact on their understanding of democracy: 'I had a fantastic teacher in social science who taught me to discuss and be critical, and taught me about democracy'. This informant expresses a thicker understanding of democracy including "to discuss" and to "be critical" (Zyngier, 2012). The informant confirms this when, in question 30, she discusses what she can do to improve students' understanding of democracy by focusing on both the formal questions and the skills of 'discussing' and to 'engage the students'. The informant refers to a certain teacher and a certain subject (social science) maybe because knowledge about elections and the representative system are parts of this curriculum. This makes democracy visible as an important theme. Several informants mentioned democracy as a topic in school in connection with political elections. They did not explain exactly how the topic was raised, but when the topic is handled in connection with political elections, it seems likely that the students were taught *about* the formal democratic election system (Biesta, 2006; Biseth, 2014).

The responses point to a situation where students experienced democracy to a very limited degree as an important matter or topic in school. Democracy was

experienced as a topic or term in social science, and it was primarily related to elections where democracy was a system for voting, not a system of interest or to participate or become involved citizens. This is in accordance with the *thin* understanding of democracy where democracy is about formal political structures, about elections and voting systems (Biesta, 2006; Biseth, 2014). Instead of being involved in democratic activities in school, the respondents reflected a passive role where democracy was a formal elective system which had no connection to activities in their everyday life and teaching in school.

When asked about what they, as future teachers, can do to improve students' understanding of democracy, some of the students wrote, 'Teach the students that it is the majority that rules' and 'Change my teaching subject to social science... Teach the students to understand the idea of democracy and how a democracy works'. All these statements are relevant for teaching *about* democracy, but in no cases did the respondent's statement to this or other questions relate to science or reflect on teaching *through* democracy (Biesta, 2006).

Does this imply that their experience of democracy in school was an element mentioned in only one subject (social science) and then mostly as a formalistic matter? Some respondents mention the Pupils' Council, but as an institution. They also mentioned some teachers who 'engaged them in discussions' or told them 'to be critical', but the informants do not relate this to a school subject. A thick understanding of democracy includes the ability to reflect and participate as a responsible, justice-oriented citizen (Zyngier, 2012). Democratic competence or thick democracy might have been trained in lessons of natural science, but then it was not experienced by the informants as 'democracy' (Sjøberg, 2001).

All the informants are pre-service teachers becoming teachers, and all are studying natural science. Even though the science curriculum, as described above, mandates that the subject of science communicate and mediate democracy (Sjøberg, 2009; Madsen and Strande, 2014; Kolstø, 2003), this is not reflected in any of the respondents' answers, according to our analysis. The respondents reflect in general a thin understanding of democracy, and democracy as an element in natural science does not appear at all in their responses.

Natural Science as a mediator of democracy

As described in the section: Democracy and natural science in the Norwegian curriculum, the content and the didactics of natural science, according to the curriculum, could and should promote a thick understanding of democracy (Sjøberg, 2009; Madsen & Strande, 2014; Kolstø, 2003). These informants have been students in a school system committed to including democracy in natural science. Before collecting and analysing the data, we expected to be able to trace students' opinions and reflections about at least some aspects of thin and thick democracy in natural science. When collecting and analysing the data, we did not find this. No respondents mentioned natural science explicitly or vaguely as a subject with an impact on their

understanding of democracy. Natural science was never mentioned by any respondent anywhere in the questionnaire.

The fact that none of the informants mention natural science as having any impact on their democratic knowledge or skills does not mean that this did not happen. Natural science and democracy contains many similar elements (Branscomb and Rosenberg, 2012), but if this is not visualized for the students, they might not realize this. For this to be the case, a more transparent promotion of democracy might increase the students' awareness of the relation between natural science and democracy. This will only happen if the students appropriate a thicker understanding of democracy, because a thin understanding is not compatible with natural science as an arena for learning democracy (Madsen & Strande, 2014). The teachers could also increase the awareness of democracy in natural science by meta-communicating to the students when the named elements of democracy are relevant or actually being handled in the science teaching.

When asked how to improve students' understanding of democracy, one of the respondents stated, "Teach them to be critical and look up information, so that they might discuss". Another informant answered that the teacher should "increase the students' understanding that by being engaged they might have an impact on decisions". A third student wrote, "Give students the possibility to express and have their own opinion". All three answers, but specifically the first one, might be interpreted as expressing a thick understanding of democracy. However, none of them relate this to natural science, and all three reflect a passive student's role: they *might* have an impact; they *can have* their opinion. The informants do not present an engaged teacher arranging for active, participating students. They do not reflect any necessity or obligation to get involved in decision-making (thick democracy) (Biesta, 2006), and the responses do not correlate in any way to natural science.

The result of the analyses in this category suggests that the informants do not reflect an understanding of a connectedness between natural science in school and education in democracy. They neither mention natural science in relation to learning *about* or *through* democracy, nor do they relate any terms or activities relevant to democracy to their experience in the subject of science in school.

Conclusion

The analysis shows that the pre-service teachers have acquired a thin understanding of democracy: Most of them look at democracy as a question of elections and voting for decisions in a political system. None of the informants express democracy as a way of communicating and living together, as a value-based attitude. The informants do not express democracy as an attitude with alternative disputes of conflicts and inclusive perspectives on cultural diversity.

As mentioned earlier, the informants in this study are students with special interest in the subject. Therefore, we think they have picked up the main ideas from

their previous teachers, and we conclude that democracy, as prescribed in the curriculum, has probably not been presented as a main idea.

A thin understanding of democracy is rooted in understanding democracy as a political system with parties and elections, not as a way of living together. As the survey shows, this basic understanding does not support an understanding of coherence between natural science and democracy. We find a high level of inner logic in the answers, but for almost all the students, this is related to a thin democratic understanding with no coherence between natural science and democracy.

The results of this research tell us that democratic competence as part of the learning outcome in natural science is clearly described both in the curriculum for teacher education institutions and in the curriculum for basic education. The teachers in primary school and therefore also teachers in teacher education are obliged to make democracy a “natural part” of natural science. Teachers in compliance with the mandates of the national curriculum should communicate a thick understanding of democracy, preparing the students and the pre-service teachers for participating in meaningful decisions and actions as fellow citizens. However, it seems as though this does not happen.

If the politicians want democracy to be a natural, daily part of natural science in Norwegian schools, it should be communicated even more clearly and maybe followed up in some ways. We think that at a time when democratic values seem to be under pressure, this is important.

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